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ANNEX 5

ANNEX

to the

Commission Implementing Regulation

amending Commission Regulations: (EU) No 321/2013, No 1299/2014, No 1300/2014, No 1301/2014, No 1302/2014, No 1304/2014 and Commission Implementing Regulation (EU) 2019/777

ANNEX V

The Annex to Regulation (EU) No 1302/2014 is amended as follows:

(1) Unless indicated otherwise in points (2) to (165), the term “clause” or “Clause” is replaced by the term “point”;

(2) point 1 is replaced by the following:

“1. INTRODUCTION

A Technical Specification for Interoperability (TSI) is a specification that covers a subsystem, or part thereof, as defined in Article 2(11) of Directive (EU) 2016/797 of the European Parliament and of the Council*.

* Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union (OJ L 138, 26.5.2016, p. 44).”;

(3) point 1.2 is replaced by the following:

“1.2. Geographical scope

This TSI applies to the Union rail system.”;

(4) point 1.3 is replaced by the following:

“1.3. Content of the TSI

In accordance with Article 4(3) of Directive (EU) 2016/797, this TSI covers the ‘rolling stock - Locomotives and passenger rolling stock' subsystem.”;

(5) point 2.1 is replaced as follows:

“2.1. The rolling stock subsystem as part of the Union's rail system

The Union's rail system has been broken down into subsystems as set out in Annex II to Directive (EU) 2016/797.

The Locomotives and passenger rolling stock subsystem has interfaces with other subsystems of the Union rail system. Those interfaces are considered within the frame of an integrated system, compliant with all the relevant TSIs.

In addition to the rolling stock subsystem, other TSIs describe specific aspects of the railway system and concern several subsystems.

The requirements concerning the rolling stock subsystem expressed in the TSI PRM** and the TSI NOI*** are not repeated in this TSI. They apply to “Locomotives and passenger rolling stock” subsystem in accordance with their respective scope and implementation rules.

* Commission Regulation (EU) No 1300/2014 of 18 November 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 Text with EEA relevance (OJ L 356, 12.12.2014, p. 110).

** 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 Text with EEA relevance (OJ L 356, 12.12.2014, p. 421).”

(6) in point 2.2.1., point (g) is replaced by the following:

"(g) 'Multiple operation' is an operational formation consisting of more than one unit, including:

– trainsets designed in such a way that several of them (of the type under assessment) are capable of being coupled together to operate as a single train controlled from 1 driver's cab;

– locomotives designed in such a way that several of them (of the type under assessment) are capable of being included in a single train controlled from one driver's cab.";

(7) in point 2.2.2.(A)(2) the title is replaced by the following:

"Self-propelling thermal or electric trainsets"

(8) in point 2.2.2., points (B) and (C) are replaced by the following:

"(B) Freight wagons, including low-deck vehicles designed for the entire network and vehicles designed to carry lorries.

Such vehicles are out of the scope of this TSI. They are covered by Commission Regulation (EU) No 321/2013* ('TSI WAG').

(C) Special vehicles

Special vehicles, such as On-Track Machines (OTMs), are categorised in appendix 6 part 11[(1)] of the EVR Decision (EU) 2018/1614**. They can be grouped into the following subsets:

(i) On track Machines (OTMs) are vehicles specially designed for construction and maintenance of the track and infrastructure.

(ii) Infrastructure Inspection Vehicles (IIVs) are vehicles utilised to monitor the condition of the infrastructure.

(iii) Environment vehicles are vehicles designed for clearance of the track from environmental conditions such as snow clearance machines.

(iv) Emergency vehicles are vehicles designed for a specific emergency use such as evacuation, firefighting, and recovery of trains (including the breakdown cranes).

(v) Road-Rail vehicles are self-propelled machines able to move on rails and on the ground.

Special vehicles can be used in one or more of the following modes: working mode, travelling mode and running mode, as self-propelled or as hauled vehicles.

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* Commission Regulation (EU) No 321/2013 of 13 March 2013 concerning the technical specification for interoperability relating to the subsystem 'rolling stock — freight wagons' of the rail system in the European Union and repealing Decision 2006/861/EC (OJ L 104, 12.4.2013, p. 1).

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1 Assignment of EVN - Appendix 6 Part 11.pdf

** Commission Implementing Decision (EU) 2018/1614 of 25 October 2018 laying down specifications for the vehicle registers referred to in Article 47 of Directive (EU) 2016/797 of the European Parliament and of the Council and amending and repealing Commission Decision 2007/756/EC, C/2018/6929 (OJ L 268, 26.10.2018, p. 53–91)";

(9) letters (B) and (C) point 2.3.1 are replaced by the following:

"(B) Freight wagons, including low-deck vehicles designed for the entire network and vehicles designed to carry lorries are not in the scope of this TSI but covered by the TSI WAG even when they are included in a passenger train (the train composition is in this case an operational issue).

Vehicles intended to carry road motor vehicles even where persons are on on-board the carried road motor vehicles are not in the scope of this TSI.

(C) Special vehicle

Special Vehicles are in the scope of this TSI and shall demonstrate compliance with the requirement of this TSI when in running mode and when:

(1) running on its own rail wheels (in running mode self-propelled or hauled), and

(2) designed and intended to be detected by a track-based train detection system for traffic management.

Specific requirements laid down in chapter 4 and Appendix C for OTMs are also applicable to Infrastructure Inspection Vehicles unless they are designed to be integrated into a fixed passenger train formation; in this case they shall be considered as non-passenger carrying vehicles as defined in point (A) (3).

Excluded from the scope of this TSI are road-rail vehicles.";

(10) point 3.1 is replaced by the following:

"**3.1 Elements of the rolling stock subsystem corresponding to the essential requirements:**

The following table indicates the essential requirements, as set out and numbered in Annex III of Directive (EU) 2016/797, taken into account by the specifications set out in Chapter 4.

Rolling stock elements corresponding to essential requirements

Note: only those points in point 4.2, which contain requirements, are listed.

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.2.2.2	Inner coupling	1.1.3 2.4.1					
4.2.2.2.3	End coupling	1.1.3 2.4.1					
4.2.2.2.4	Rescue coupling		2.4.2			2.5.3	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.2.2.5	Staff access for coupling and uncoupling	1.1.5		2.5.1		2.5.3	
4.2.2.3	Gangways	1.1.5					
4.2.2.4	Strength of vehicle structure	1.1.3 2.4.1					
4.2.2.5	Passive safety	2.4.1					
4.2.2.6	Lifting and jacking					2.5.3	
4.2.2.7	Fixing of devices to carbody structure	1.1.3					
4.2.2.8	Staff and freight access doors	1.1.5 2.4.1					
4.2.2.9	Mechanical characteristics of glass	2.4.1					
4.2.2.10	Load conditions and weighted mass	1.1.3					
4.2.3.1	Gauging					2.4.3	
4.2.3.2.1	Axle load parameter					2.4.3	
4.2.3.2.2	Wheel load	1.1.3					

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.3.3.1	Rolling stock characteristics for compatibility with train detection systems	1.1.1				2.4.3 2.3.2	
4.2.3.3.2	Axle bearing condition monitoring	1.1.1	1.2				
4.2.3.4.1	Safety against derailment running on twisted track	1.1.1 1.1.2				2.4.3	
4.2.3.4.2	Running dynamic behaviour	1.1.1 1.1.2				2.4.3 2.3.2	
4.2.3.4.2.1	Limit values for running safety	1.1.1 1.1.2				2.4.3	
4.2.3.4.2.2	Track loading limit values					2.4.3	
4.2.3.4.3	Equivalent conicity	1.1.1 1.1.2				2.4.3	
4.2.3.4.3.1	Design values for new wheel profiles	1.1.1 1.1.2				2.4.3	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.3.4.3.2	In-service values of wheelset equivalent conicity	1.1.2	1.2			2.4.3	
4.2.3.5.1	Structural design of bogie frame	1.1.1 1.1.2					
4.2.3.5.2.1	Mechanical and geometrical characteristics of wheelsets	1.1.1 1.1.2				2.4.3	
4.2.3.5.2.2	Mechanical and geometrical characteristics of wheels	1.1.1 1.1.2					
4.2.3.5.3	Automatic variable gauge systems	1.1.1 1.1.2, 1.1.3	1.2			1.5	
4.2.3.6	Minimum curve radius	1.1.1 1.1.2				2.4.3	
4.2.3.7	Life guards	1.1.1					
4.2.4.2.1	Braking — Functional requirements	1.1.1 2.4.1	2.4.2			1.5	
4.2.4.2.2	Braking — Safety requirements	1.1.1	1.2 2.4.2				

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.4.3	Type of brake system					2.4.3 2.3.2	
4.2.4.4.1	Emergency braking command	2.4.1				2.4.3 2.3.2	
4.2.4.4.2	Service braking command					2.4.3 2.3.2	
4.2.4.4.3	Direct braking command					2.4.3	
4.2.4.4.4	Dynamic braking command	1.1.3				2.3.2	
4.2.4.4.5	Parking braking command					2.4.3	
4.2.4.5.1	Braking performance -General requirements	1.1.1 2.4.1	2.4.2			1.5	
4.2.4.5.2	Emergency braking	1.1.2 2.4.1				2.4.3 2.3.2	
4.2.4.5.3	Service braking					2.4.3 2.3.2	
4.2.4.5.4	Calculations related to thermal capacity	2.4.1				2.4.3	
4.2.4.5.5	Parking brake	2.4.1				2.4.3	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.4.6.1	Limit of wheel rail adhesion profile	2.4.1	1.2 2.4.2				
4.2.4.6.2	Wheel slide protection system	2.4.1	1.2 2.4.2				
4.2.4.7	Dynamic brake — Braking systems linked to traction system	2.4.1	1.2 2.4.2				
4.2.4.8.1.	Braking system independent of adhesion conditions – General	2.4.1	1.2 2.4.2				
4.2.4.8.2.	Magnetic track brake					2.4.3 2.3.2	
4.2.4.8.3	Eddy current track brake					2.4.3 2.3.2	
4.2.4.9	Brake state and fault indication	1.1.1	1.2 2.4.2				
4.2.4.10	Brake requirements for rescue purposes		2.4.2				
4.2.5.1	Sanitary systems				1.4.1		

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.5.2	Audible communication system	2.4.1					
4.2.5.3	Passenger alarm	2.4.1					
4.2.5.4	Communication devices for passengers	2.4.1					
4.2.5.5	Exterior doors: access to and egress from Rolling stock	2.4.1				2.3.2	
4.2.5.6	Exterior doors: system construction	1.1.3 2.4.1					
4.2.5.7	inter-unit doors	1.1.5					
4.2.5.8	Internal air quality			1.3.2			
4.2.5.9	body side windows	1.1.5					
4.2.6.1	Environmental conditions		2.4.2				
4.2.6.2.1	Slipstream effects on passengers on platform and on workers at track side	1.1.1		1.3.1			

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.6.2.2	Head pressure pulse					2.4.3	
4.2.6.2.3	Maximum pressure variations in tunnels					2.4.3	
4.2.6.2.4	Crosswind	1.1.1					
4.2.6.2.5	Aerodynamic effect on ballasted track	1.1.1				2.4.3	
4.2.7.1.1	Head lights					2.4.3 2.3.2	
4.2.7.1.2	Marker lights	1.1.1				2.4.3	
4.2.7.1.3	Tail lights	1.1.1				2.4.3	
4.2.7.1.4	Lamp controls					2.4.3	
4.2.7.2.1	Horn – General	1.1.1				2.4.3 2.6.3	
4.2.7.2.2	Warning horn sound pressure levels	1.1.1		1.3.1			
4.2.7.2.3	Protection					2.4.3	
4.2.7.2.4	Horn control	1.1.1				2.4.3	
4.2.8.1	Traction performance					2.4.3 2.6.3 2.3.2	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.8.2 4.2.8.2.1 to 4.2.8.2.9	Power supply					1.5 2.4.3 2.3.2	
4.2.8.2.10	Electrical protection of the train	2.4.1					
4.2.8.4	Protection against electrical hazards	2.4.1					
4.2.9.1.1	Driver's cab – General	—	—	—	—	—	
4.2.9.1.2	Access and egress	1.1.5				2.4.3	
4.2.9.1.3	External visibility	1.1.1				2.4.3 2.3.2	
4.2.9.1.4	Interior layout	1.1.5					
4.2.9.1.5	Driver's seat			1.3.1			
4.2.9.1.6	Driver's desk-Ergonomics	1.1.5		1.3.1		2.3.2	
4.2.9.1.7	Climate control and air quality			1.3.1			
4.2.9.1.8	Internal lighting					2.6.3	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.9.2.1	Windscreen — Mechanical characteristics	2.4.1					
4.2.9.2.2	Windscreen — Optical characteristics					2.4.3 2.3.2	
4.2.9.2.3	Windscreen – Equipment					2.4.3	
4.2.9.3.1	Driver's activity control function	1.1.1				2.6.3	
4.2.9.3.2	Speed indication	1.1.5					
4.2.9.3.3	Driver display unit and screens	1.1.5					
4.2.9.3.4	Controls and indicators	1.1.5					
4.2.9.3.5	Labelling					2.6.3	
4.2.9.3.6	Radio remote control function by staff for shunting operation	1.1.1				2.3.2	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.9.3.7	Derailment detection and prevention signal processing	1.1.1 1.1.2					
4.2.9.3.7a	On-board derailment detection and prevention function	1.1.1 1.1.2					
4.2.9.3.8	Requirements for management of ETCS modes	1.1.1				1.5 2.3.2	
4.2.9.3.9	Traction status					2.3.2	
4.2.9.4	On-board tools and portable equipment	2.4.1				2.4.3 2.6.3	
4.2.9.5	Storage facility for staff personal effects	—	—	—	—	—	
4.2.9.6	Recording device					2.4.4 2.3.2	
4.2.10.2	Fire safety – Measures to prevent fire	1.1.4		1.3.2	1.4.2		

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.10.3	Measures to detect/control fire	1.1.4					
4.2.10.4	Requirements related to emergency situations	2.4.1				2.3.2	
4.2.10.5	Requirements related to evacuation	2.4.1					
4.2.11.2	Train exterior cleaning					1.5	
4.2.11.3	Connection to toilet discharge system					1.5	
4.2.11.5	Interface for water refilling					1.5	
4.2.11.6	Special requirements for stabling of trains					1.5	
4.2.11.7	Refuelling equipment					1.5	
4.2.11.8	Train interior cleaning – power supply					2.5.3	

Ref. point	Element of the rolling stock sub-system	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility	Accessibility
4.2.12.2	General documentation					1.5	
4.2.12.3	Documentation related to maintenance	1.1.1				2.5.1 2.5.2 2.6.1 2.6.2	
4.2.12.4	Operating documentation	1.1.1				2.4.2 2.6.1 2.6.2	
4.2.12.5	Lifting diagram and instructions					2.5.3	
4.2.12.6	Rescue related descriptions		2.4.2			2.5.3	
4.2.13	Interface requirements with Automatic Train Operation					1.5 2.3.2 2.4.3	

(11) point 3.2 is replaced by the following:

"**3.2 Essential requirements not covered by this TSI**

Some of the essential requirements classified as 'general requirements' or 'specific to other subsystems' in Annex III to Directive (EU) 2016/797 that have an impact on the rolling stock subsystem are covered with limitations [in a limited way] by the scope of this TSI.";

(12) in point 4.1.1., point (4) is replaced by the following:

"(4) Some of the rolling stock characteristics that are mandated to be recorded in the 'European register of authorised types of vehicles' (according to the relevant Commission Decision) are described in point 7.1.2 (see Table 17a). Additionally,

those characteristics are required to be provided in the rolling stock technical documentation described in point 4.2.12.";

(13) in point 4.1.3., point (3), the last two indents are replaced by:

"- Special Vehicles (see point 2.2.2, letter C)";

(14) point 4.2.1.2. is replaced by the following:

"Open points in accordance with Article 4(6) of Directive (EU) 2016/797 are listed in Annex I.";

(15) in point 4.2.2.2.3, point (b), point (b-2), points (1) and (2) are replaced by the following:

"(1) The buffers and the screw coupling shall be installed according to the specification referenced in Appendix J-1, index [2].

(2) The dimensions and layout of brake pipes and hoses, couplings and cocks shall meet the requirements set out in the same specification.";

(16) In point 4.2.2.2.4, point(3)(a), the second indent is replaced by the following:

"- Lateral location of brake pipes and cocks according to the specification referenced in Appendix J-1, index [2],".;

(17) point 4.2.2.2.5 (2) is replaced as follows:

"To comply with this requirement, units fitted with manual coupling systems of UIC type as per point 4.2.2.2.3(b) shall comply with the following requirements (the 'Bern rectangle'):

– On units equipped with screw couplers and side buffers, the space for staff operation shall be in accordance to the specification referenced in Appendix J-1, index [2].

– Where a combined automatic and screw coupler is fitted it is permissible for the auto coupler head to infringe the Berne rectangle on the left-hand side when it is stowed and the screw coupler is in use.

There shall be a handrail under each buffer. The handrails shall withstand a force of 1,5 kN.";

(18) point 4.2.2.4., points (3), (4) and (5) are replaced by the following:

"(3) The static and dynamic strength (fatigue) of vehicle bodies is relevant to ensure the safety required for the occupants and the structural integrity of the vehicles in train and in shunting operations. Therefore, the structure of each vehicle shall comply with the requirements of the specification referenced in Appendix J-1, index [1] where the rolling stock categories to be taken into account shall correspond to category L for locomotives and power head units and to categories PI or PII for all other types of vehicle within the scope of this TSI.

(4) Proof of the strength of the vehicle body may be demonstrated by calculations and/or by testing, according to the conditions set up in the specification referenced in Appendix J-1, index [1].

(5) In case of a unit designed for higher compressive force than those of the categories (required in point (3) as a minimum) in the specification referenced in Appendix J-1, index [1], this specification does not cover the proposed

technical solution; it is then permissible to use for compressive force other normative documents that are publicly available.

In that case it shall be verified by the notified body that the alternative normative documents form part of a technically consistent set of rules applicable to the design, construction and testing of the vehicle structure.

The value of compressive force shall be recorded in the technical documentation defined in clause 4.2.12.";

(19) Point 4.2.2.5. is replaced by the following:

"4.2.2.5. Passive safety

(1) The requirements specified in this point apply to all units, except to units not intended to carry passengers or staff during operation and except to OTMs.

(2) For units designed to be operated on the 1520 mm system, the requirements on passive safety described in this point are of voluntary application. If the Applicant chooses to apply the requirements on passive safety described in this point, this shall be recognised by Member States. Member States may also require application of those requirements.

(3) For locomotives designed to be operated on the 1524 mm system, the requirements on passive safety described in this point are of voluntary application. If the Applicant chooses to apply the requirements on passive safety described in this point, this shall be recognised by Member States.

(4) Units which cannot operate up to the collision speeds specified under any of the collision scenarios below are exempted from the provisions related to that collision scenario.

(5) Passive safety is aimed at complementing active safety when all other measures have failed. For this purpose, the mechanical structure of vehicles shall provide protection of the occupants in the event of a collision by providing means of:

– limiting deceleration;

– maintaining survival space and structural integrity of the occupied areas;

– reducing the risk of overriding;

– reducing the risk of derailment;

– limiting the consequences of hitting a track obstruction.

To meet these functional requirements, units shall comply with the detailed requirements specified in the specification referenced in Appendix J-1, index [3] related to crashworthiness design category C-I.

The following four reference collision scenarios shall be considered:

– scenario 1: A front end impact between two identical units,

– scenario 2: A front end impact with a freight wagon,

– scenario 3: An impact of the unit with a large road vehicle on a level crossing,

– scenario 4: An impact of the unit into a low obstacle (e.g. car on a level crossing, animal, rock, etc.).

(6) The scenarios in point (5) are described in the specification referenced in Appendix J-1, index [3]

(7) The requirements of the specification referenced in Appendix J-1, index [3] shall be applied in relation to the above given reference collision scenarios.

(8) To limit the consequences of hitting a track obstruction, the leading ends of locomotives, power heads, driving coaches and trainsets shall be equipped with an obstacle deflector. The requirements with which obstacle deflectors shall comply are defined in the specification referenced in Appendix J-1, index [3].";

(20) in point 4.2.2.6, points (7), (8) and (9) are replaced by the following:

"(7) The geometry of jacking/lifting points shall be compliant with the specification referenced in Appendix J-1, index [4].

(8) Marking of lifting points shall be made by signs compliant with the specification referenced in Appendix J-1, index [5].

(9) The structure shall be designed with consideration of the loads specified in the specification referenced in Appendix J-1, index [1]; proof of the strength of the vehicle body may be demonstrated by calculations or by testing, according to the conditions set up in the same specification.

Alternative normative documents that are publicly available may be used under the same conditions as defined in clause 4.2.2.4 above.";

(21) in point 4.2.2.7.(3), "index 12" is replaced by "index [1]";

(22) point 4.2.2.10 is amended as follows:

(a) point (1) is replaced by the following:

"(1) The following load conditions defined in the specification referenced in Appendix J-1, index [6], shall be determined:

(i) design mass under exceptional payload;

(ii) design mass under normal payload;

(iii) design mass in working order;

(iv) operational mass under normal payload;

(v) operational mass in working order.";

(b) in point (2), "index 13" is replaced by "index [6]";

(23) point 4.2.3.1. is replaced by the following:

"4.2.3.1. *Gauging*

(1) This point concerns the rules for calculation and verification intended for sizing the rolling stock to run on one or several infrastructures without interference risk.

For units designed to be operated on other track gauge(s) than 1520 mm system:

(2) The applicant shall select the intended reference profile including the reference profile for the lower parts. This reference profile shall be recorded in the technical documentation defined in point 4.2.12.

(3) The compliance of a unit with this intended reference profile shall be established by one of the methods set out in the specification referenced in Appendix J-1, index [7].

(4) In case the unit is declared as compliant with one or several of the reference profiles G1, GA, GB, GC or DE3, including those related to the lower part GI1, GI2 or GI3, as set out in the specification referenced in Appendix J-1, index [7], compliance shall be established by the kinematic method as set out in the specification referenced in Appendix J-1, index [7].

The compliance to those reference profile(s) shall be recorded in the technical documentation defined in point 4.2.12.

(5) For electric units, the pantograph gauge shall be verified by calculation according to the specification referenced in Appendix J-1, index [7] to ensure that the pantograph envelope complies with the mechanical kinematic pantograph gauge which in itself is determined according to Appendix D to Commission Regulation (EU) No. 1301/2014* ('TSI ENE'), and depends on the choice made for the pantograph head geometry: the two permitted possibilities are defined in point 4.2.8.2.9.2.

The voltage of the power supply is considered in the infrastructure gauge in order to ensure the proper insulation distances between the pantograph and fixed installations.

(6) The pantograph sway as specified in point 4.2.10 of TSI ENE and used for the mechanical kinematic gauge calculation shall be justified by calculations or measurements as set out in the specification referenced in Appendix J-1, index [7].

For units designed to be operated on track gauge of 1520 mm system:

(7) The static profile of the vehicle shall be within the 'T' uniform vehicle gauge; the reference profile for infrastructure is the 'S' gauge. This profile is specified in Appendix B .

(8) For electric units the pantograph gauge shall be verified by calculation to ensure that the pantograph envelope complies with the mechanical static pantograph gauge which is defined in Appendix D of TSI ENE; the choice made for the pantograph head geometry shall be taken into account: the permitted possibilities are defined in point 4.2.8.2.9.2.

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* Commission Regulation (EU) No 1301/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'energy' subsystem of the rail system in the Union (OJ L 356, 12.12.2014, p. 179).";

(24) point 4.2.3.2.1. is replaced by the following:

"4.2.3.2.1. Axle load parameter

(1) The axle load in combination with the axle spacing, with the length of the unit and with the maximum allowed speed for the unit on the considered line is an interface parameter between the unit and the infrastructure.

For the infrastructure target system specified in point 4.2.1 of the Commission Regulation (EU) No 1299/2014* ('TSI INF'), the axle load is a performance parameter and depends on the traffic code of the line.

(2) The following characteristics to be used as an interface to the infrastructure shall be part of the general documentation produced when the unit is assessed and described in point 4.2.12.2:

– the mass per axle (for each axle) for all load conditions (as defined and required to be part of the documentation in point 4.2.2.10);

– the position of the axles along the unit (axle spacing);

– the length of the unit;

– the maximum design speed (as required to be part of the documentation in point 4.2.8.1.2);

– The EN line category as the result of a categorisation of the unit according to the specification referenced in Appendix J-1, index [10].

(2a) For self-propelling thermal or electric passenger trains and for passenger coaches and other related cars, the EN line category shall always be documented, indicating the standard value of payload in standing areas in kg per m^2, as defined in the specification referenced in Appendix J-1, index [10].

(2b) If a particular value of payload in standing areas is used to determine the load condition "design mass under exceptional payload", in accordance with points 4.2.2.10 (1) and (2), a second EN line category shall be documented using this particular value of payload in standing areas.

(2c) For all of these units, any EN line category shall be documented indicating the payload used in standing areas, as described in the specification referenced in Appendix J-1, index [10].

(3) Use of the axle load information at operational level for compatibility check between rolling stock and infrastructure (outside the scope of this TSI):

The axle load of each individual axle of the unit to be used as interface parameter to the infrastructure must be defined by the railway undertaking as required in point 4.2.2.5 of the TSI OPE**, considering the expected load for the intended service (not defined when the unit is assessed). The axle load in load condition 'design mass under exceptional payload' represents the maximum possible value of the axle load mentioned above. The maximum load considered for the design of the brake system defined in point 4.2.4.5.2 has also to be considered.

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* Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union (OJ L 356, 12.12.2014, p. 1).

** Commission Implementing Regulation (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision (OJ L 139I , 27.5.2019, p. 5).";

(25) point 4.2.3.3.1. is replaced by the following:

"4.2.3.3.1 Rolling Stock characteristics for the compatibility with train detection systems

(1) The set of rolling stock characteristics for compatibility with train detection target systems are given in points 4.2.3.3.1.1, 4.2.3.3.1.2 and 4.2.3.3.1.3.

Reference is made to points of the specification referenced in Appendix J-2, index [A] (also referenced in Appendix A, Table A.2, index 77 of TSI CCS*). The related specific cases are defined in point 7.7 of TSI CCS.

(2) The set of characteristics the rolling stock is compatible with shall be recorded in the technical documentation described in point 4.2.12.

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* [PO please *complete inserting the appropriate references to Commission Implementing Regulation which will be adopted on the same day as the current one replacing the current Regulation (EU) 2016/919*] Commission Implementing Regulation (EU) [*xxxx/xxxx*] of [*xxxx*] on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union and repealing Regulation (EU) 2016/919 (OJ [*xxxx*]).";

(26) point 4.2.3.3.1.1. is replaced by the following:

"4.2.3.3.1.1. Rolling stock characteristics for compatibility with train detection system based on track circuits

The specification referenced in Appendix J-2 index [A] specifies the characteristics relative to:

(i) Vehicle geometry

(1) The maximum distance between following axles;

(2) The maximum distance between front/ rear end of train and first/last axle;

(3) The minimum distance between first and last axle;

(ii) Vehicle design

(4) The minimum axle load in all load conditions;

(5) The electrical resistance between the running surfaces of the opposite wheels of a wheelset and the method to measure it;

(6) For electric units equipped with a pantograph, the minimum vehicle impedance;

(7) The use of shunting assisting devices;

(iii) Isolating emissions

(8) The use of sanding equipment;

In case where an automatic sanding function is provided, it shall be possible for the driver to suspend its use on particular points of the track identified in operating rules as non-compatible with sanding;

(9) The use of composite brake blocks;

(10) If the vehicle is equipped, the requirements applicable to flange lubricators;

(iv) EMC

(11) The requirements related to conducted interference.";

(27) point 4.2.3.3.1.2. is replaced by the following:

"4.2.3.3.1.2 Rolling stock characteristics for compatibility with train detection system based on axle counters

The specification referenced in Appendix J-2 index [A] specifies the characteristics relative to:

(i) Vehicle geometry

(1) The maximum distance between following axles;

(2) The minimum distance between following axles ;

(3) At the end of a unit intended to be coupled, the minimum distance between front/ rear end of train and first/last axle (equal to half of the value specified)

(4) The maximum distance between front/ rear end of train and first/last axle;

(ii) Wheel geometry

(5) Wheel geometry;

(iii) Vehicle design

(6) Metal and inductive-components-free space between wheels;

(7) The characteristics of the wheel material;

(iv) EMC

(8) The requirements related to electromagnetic fields;

(9) The use of magnetic or eddy current track brakes.";

(28) point 4.2.3.3.1.3 is replaced by the following:

"4.2.3.3.1.3. Rolling stock characteristics for compatibility with loop equipment

The specification referenced in Appendix J-2 index [A] specifies the characteristics relative to:

Vehicle design

(1) The vehicle metal construction.";

(29) in point 4.2.3.3.2.1., points (3) and (4) are replaced by the following:

"(3) The detection system shall be located entirely on board the unit and diagnosis messages shall be made available on board.

(4) The diagnosis messages delivered shall be described and taken into account in the operating documentation described in point 4.2.12.4 and in the maintenance documentation described in point 4.2.12.3.";

(30) in point 4.2.3.3.2.2., in points (1) and (2a), "index 15" is replaced by "index [8].";

(31) in point 4.2.3.4.1., the second paragraph is replaced by the following:

"This conformity assessment procedure is applicable for axle loads in the range of those mentioned in the point 4.2.1 of TSI INF and in the specification referenced in Appendix J-1, index [9].";

(32) point 4.2.3.4.2 is amended as follows:

(a) point (a) is replaced by the following:

"**(a) Technical requirements**

(1) The unit shall run safely and produce an acceptable level of track loading when operated within the limits defined by the combination(s) of speed and cant deficiency under the conditions set out in the specification referenced in Appendix J-1, index [9].

This shall be assessed by verifying that limit values specified below in points 4.2.3.4.2.1 and 4.2.3.4.2.2 are respected; the conformity assessment procedure is described in point 6.2.3.4.

(2) The limit values and conformity assessment mentioned in point 3 are applicable for axle loads in the range of those mentioned in the point 4.2.1 of the TSI INF and in the specification referenced in Appendix J-1, index [9].

They are not applicable to vehicles designed for higher axle load, as harmonised track loading limit values are not defined; such cases may be covered by national rules or by the procedure for innovative solution described in article 10 and Chapter 6.

(3) The running dynamic behaviour test report (including limits of use and track loading parameters) shall be stated in the technical documentation described in point 4.2.12.

Track loading parameters (including the additional ones Ymax, Bmax and the Bqst where relevant) to be recorded are defined in the specification referenced in Appendix J-1, index [9].";

(b) in point (b) (6) 2, the word "contour" is replaced by "profile";

(c) point (d) is inserted as follows:

"**(d) Additional requirements regarding interface with ETCS onboard**

(8) Requirements applicable to units with regards to their interface with ETCS onboard and related to train interface function 'status of the tilting system' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].";

(33) in point 4.2.3.4.2.1 (1) "index 17" is replaced by "index [9]";

(34) in point 4.2.3.4.2.2. (1) "index 19" is replaced by "index [9]";

(35) in point 4.2.3.4.3.2., point (1) is replaced by the following:

"(1) The combined equivalent conicities the vehicle is designed for, as verified by the demonstration of conformity of the running dynamic behaviour specified in point 6.2.3.4, shall be specified for in-service conditions in the maintenance documentation as set out in point 4.2.12.3.2, taking into account the contributions of wheel and rail profiles.";

(36) in points 4.2.3.5.1 (1) and (3) “index 20” is replaced by “index [11]”;

(37) in point 4.2.3.5.1. (2) “index 21” is replaced by “index [1]”;

(38) in point 4.2.3.5.2.1, point (3) is replaced by the following:

“(3) The characteristics of the end of axle (interface between wheel and running gear) shall ensure the transmission of forces and torque.

The conformity assessment procedure shall be in accordance with point 6.2.3.7 (7).”;

(39) in point 4.2.3.5.2.1, in Table 1, “Back to back” is replaced by “Back-to-back”;

(40) point 4.2.3.7 is replaced by the following:

“4.2.3.7 Life guards

(1) This requirement applies to units fitted with a driving cab.

(2) The wheels shall be protected against damages caused by minor items on the rails by lifeguards in front of the wheels of the leading axle.

(3) Life guards shall comply with the requirements of the specification referenced in Appendix J-1, index [3].”;

(41) point 4.2.4.3 is replaced by the following:

“**4.2.4.3 Type of brake system**

(1) Units designed and assessed to be operated in general operation (various formations of vehicles from different origins; train formation not defined at design stage) on other track gauge systems than the 1520 mm system shall be fitted with a brake system with a brake pipe compatible with the UIC brake system. To this end, the specification referenced in Appendix J-1, index [12] specifies the principles to be applied.

This requirement is set to ensure technical compatibility of the brake function between vehicles of various origins in a train.

(2) There is no requirement on the type of brake system for units (trainsets or vehicles) assessed in fixed or predefined formation.

(3) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function ‘brake pressure’ when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

(4) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function ‘Special brake status Electro Pneumatic (EP) brake’ when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].”;

(42) point 4.2.4.4.1 (3) is replaced by the following:

“(3) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function ‘emergency brake command’ when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].”;

(43) in Point 4.2.4.4.2 the following point (5) is added:

"(5) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'service brake command' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].";

(44) in point 4.2.4.4.4 the following points (4) and (5) are added after the note in point (3):

"(4) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibition area – Trackside orders: regenerative brake' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of regenerative brake inhibition by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.

(5) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibit – STM Orders: regenerative brake' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of regenerative brake inhibition by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.";

(45) in point 4.2.4.5.1, points (1) and (2) are replaced by the following:

"(1) The unit (trainset or vehicle) braking performance (deceleration = F(speed) and equivalent response time) shall be determined by calculation as defined in the specification referenced in Appendix J-1, either index [13] or index [14], considering a level track.

Each calculation shall be performed for wheel diameters corresponding to new, half-worn and worn wheels, and shall include the calculation of the required wheel/rail adhesion level (see point 4.2.4.6.1).

(2) The friction coefficients used by friction brake equipment and considered in the calculation shall be justified (see the specification referenced in Appendix J-1, index [13]).";

(46) point 4.2.4.5.2 is replaced as follows:

"**4.2.4.5.2. Emergency braking**

Response time:

(1) For units assessed in fixed formation(s) or predefined formation(s), the equivalent response time and the delay time evaluated on the total emergency braking force developed in case of the emergency brake command shall be lower than the following values:

– Equivalent response time:

– 3 seconds for units of maximum design speed higher or equal to 250 km/h

– 5 seconds for other units

– Delay time: 2 seconds

'Equivalent response time' and 'Delay time' shall be evaluated based on the total brake force, or based on pressure in brake cylinders in case of pneumatic brake system, according to the definition of the specification referenced in Appendix J-1, index [13].

(2) For units designed and assessed for general operation, the response time shall be as specified for the UIC brake system (see also point 4.2.4.3: the brake system shall be compatible with the UIC brake system).

Calculation of the deceleration:

(3) For all units, the emergency braking performance calculation shall be performed in accordance with the specification referenced in Appendix J-1, either index [13] or index [14]; the deceleration profile and stopping distances at the following initial speeds (if lower than the maximum design speed of the unit) shall be determined: 30 km/h; 100 km/h; 120 km/h; 140 km/h; 160 km/h; 200 km/h; 230 km/h; 300 km/h; maximum design speed of the unit.

(4) For units designed and assessed for general operation, the brake weight percentage (lambda) shall also be determined.

The specification referenced in Appendix J-1, index [65], specifies how other parameters (brake weight percentage (lambda), braked mass) can be derived from the calculation of the deceleration or from the stopping distance of the unit.

(5) The emergency braking performance calculation shall be performed with a brake system in two different modes, and considering degraded conditions:

– *Normal mode*: no failure in the brake system and nominal value of the friction coefficients (corresponding to dry conditions) used by friction brake equipment. This calculation provides the braking performance normal mode.

– *Degraded mode*: corresponding to the failures of brake systems considered in point 4.2.4.2.2, hazard no. 3, and nominal value of the friction coefficients used by friction brake equipment. The degraded mode shall consider possible single failures; for this purpose, the emergency braking performance shall be determined for the case of single point(s) failure(s) leading to the longest stopping distance, and the associated single failure shall be clearly identified (component involved and failure mode, failure rate if available).

– *Degraded conditions*: in addition, the emergency braking performance calculation shall be performed with reduced values of the friction coefficient, with consideration of limit environmental (external influence) values for temperature and humidity (see the specification referenced in Appendix J-1, index [67] or index [68]).

Note: these different modes and conditions have to be considered particularly when advanced Control Command and Signalling systems (such as ETCS) are implemented, aiming at optimising the railway system.

(6) The emergency braking performance calculation shall be performed for the three following load conditions:

– Minimum load: ‘design mass in working order’ (as described in point 4.2.2.10).

– Normal load: ‘design mass under normal payload’ (as described in point 4.2.2.10)

– Maximum braking load: load condition lower or equal to ‘design mass under exceptional payload’ (as described in point 4.2.2.10).

– In case this load condition is lower than ‘design mass under exceptional payload’, it shall be justified and documented in the general documentation described in point 4.2.12.2.

(7) Tests shall be performed to validate the emergency braking calculation, according to the conformity assessment procedure specified in point 6.2.3.8.

(8) For each load condition, the lowest result (i.e. leading to longest stopping distance) of the ‘emergency braking performance in normal mode’ calculations at the design maximum speed (revised according to the results of tests required above) shall be recorded in the technical documentation defined in point 4.2.12.2.

(9) Additionally, for units assessed in fixed or predefined formation of design maximum speed higher than or equal to 250 km/h, the stopping distance in case of ‘emergency braking performance in normal mode’ shall not exceed the following values for the load condition ‘normal load’:

– 5360 m from the speed of 350 km/h (if ≤ design maximum speed).

– 3650 m from the speed 300 km/h (if ≤ design maximum speed).

– 2430 m from the speed 250 km/h.

– 1500 m from the speed 200 km/h.”;

(47) in point 4.2.4.5.3 points (1) and (2) are replaced by the following:

“(1) For all units, the maximum service braking performance calculation shall be performed in accordance with the specification referenced in Appendix J-1, either index [13] or index [14] with a brake system in normal mode, with nominal value of the friction coefficients used by friction brake equipment for the load condition ‘design mass under normal payload’ at the design maximum speed.

(2) Tests shall be performed to validate the maximum service braking calculation, according to the conformity assessment procedure specified in point 6.2.3.9.”;

(48) in point 4.2.4.5.5. point (3) “index 29” is replaced by “index [13]”;

(49) point 4.2.4.6.1. is replaced by the following:

“**4.2.4.6.1 Limit of wheel rail adhesion profile**

(1) The braking system of a unit shall be designed so that emergency brake performance (dynamic brake included if it contributes to the performance) and the service brake performance (without dynamic brake) do not assume a calculated wheel/rail adhesion for each wheelset in the speed range > 30 km/h and < 250 km/h higher than 0,15 with the following exceptions:

– for units assessed in fixed or predefined formation(s) having 7 axles or less, the calculated wheel/rail adhesion shall not be higher than 0,13,

– for units assessed in fixed or predefined formation(s) having 20 axles or more the calculated wheel/rail adhesion for the load case ‘minimum load’ is permitted to be higher than 0,15, but shall not be higher than 0,17.

Note: for the load case ‘normal load’, there is no exception; the limit value of 0,15 applies.

This minimum number of axles may be reduced to 16 axles if the test required in point 4.2.4.6.2 related to the efficiency of the WSP system is performed for the load case ‘minimum load’, and provides positive result.

In the speed range > 250 km/h and < = 350 km/h, the three limit values above shall decline linearly in order to be reduced by 0,05 at 350 km/h.

(2) The above requirement shall also apply for a direct brake command described in point 4.2.4.4.3.

(3) The design of a unit shall not assume wheel/rail adhesion higher than 0,12 when calculating the parking brake performance.

(4) These limits of wheel rail adhesion shall be verified by calculation with the smallest wheel diameter, and with the 3 load conditions considered in point 4.2.4.5.2.

All values of adhesion shall be rounded to two decimal places.”.;

(50) point 4.2.4.6.2 is replaced by the following:

“**4.2.4.6.2. Wheel slide protection system**

(1) A wheel slide protection system (WSP) is a system designed to make the best use of available adhesion by a controlled reduction and restoration of the brake force to prevent wheelsets from locking and uncontrolled sliding, thereby minimising the extension of stopping distances and possible wheel damage.

Requirements on the presence and use of a WSP system on the unit:

(2) Units designed for maximum service speed higher than 150 km/h shall be fitted with a wheel slide protection system.

(3) Units equipped with brake blocks on wheel running surface with a brake performance which assumes in the speed range > 30 km/h a calculated wheel/rail adhesion higher than 0.12 shall be fitted with a wheel slide protection system.

Units not equipped with brake blocks on wheel running surface with a brake performance which assumes in the speed range > 30 km/h a calculated wheel/rail adhesion higher than 0. 11 shall be fitted with a wheel slide protection system.

(4) The requirement on the wheel slide protection system above shall apply to the two brake modes: emergency brake and service brake.

It shall also apply to the dynamic brake system, which is part of the service brake, and can be part of the emergency brake (see point 4.2.4.7).

Requirements on the WSP system performance:

(5) For units equipped with a dynamic braking system, a WSP system (if present according to the point above) shall control the dynamic brake force; when this

WSP system is not available, the dynamic brake force shall be inhibited, or limited in order not to lead a wheel/rail adhesion demand higher than 0.15.

(6) The wheel slide protection system shall be designed according to the specification referenced in Appendix J-1, index [15]; the conformity assessment procedure is specified in point 6.1.3.2.

(7) Requirements on performance at unit level:

If a unit is equipped with a WSP, a test shall be done to verify the efficiency of the WSP system (maximum extension of the stopping distance compared to stopping distance on dry rail) when integrated in the unit; the conformity assessment procedure is specified in point 6.2.3.10.

The relevant components of the wheel slide protection system shall be considered in the safety analysis of the emergency brake function required in point 4.2.4.2.2.

(8) Wheel rotation monitoring system (WRM):

Units of design maximum speed higher or equal to 250 km/h shall be equipped with a wheel rotation monitoring system to advise the driver that an axle has seized; the wheel rotation monitoring system shall be designed according to the specification referenced in Appendix J-1, index [15].";

(51) point 4.2.4.7 is replaced by the following:

"**4.2.4.7 Dynamic brake — Braking system linked to traction system**

Where the braking performance of the dynamic brake or of braking system linked to the traction system is included in the performance of the emergency braking in normal mode defined in point 4.2.4.5.2, the dynamic brake or the braking system linked to traction:

(1) must be commanded by the main brake system control line (see point 4.2.4.2.1);

(2) must be subject to a safety analysis covering the hazard 'after activation of an emergency command, complete loss of the dynamic brake force'.

This safety analysis shall be considered in the safety analysis required by the safety requirement N° 3 set out in point 4.2.4.2.2 for the emergency brake function.

For electric units, in case the presence on-board the unit of the voltage delivered by the external power supply is a condition for the dynamic brake application, the safety analysis shall cover failures leading to absence on-board the unit of that voltage.

In case the hazard above is not controlled at the level of the rolling stock (failure of the external power supply system), the braking performance of the dynamic brake or of braking system linked to the traction system shall not be included in the performance of the emergency braking in normal mode defined in point 4.2.4.5.2.";

(52) point 4.2.4.8.1 is replaced by the following:

"**4.2.4.8.1. General**

(1) Brake systems able to develop a brake force applied on the rail, independent of the wheel/rail adhesion condition, are a means of providing additional braking performance when the requested performance is higher than the performance

corresponding to the limit of the available wheel rail adhesion (see point 4.2.4.6).

(2) It is permissible to include the contribution of brakes independent of wheel/rail adhesion in the braking performance in normal mode defined in point 4.2.4.5 for the emergency brake; in such a case, the brake system independent of adhesion condition:

(a) Shall be commanded by the main brake system control line (see point 4.2.4.2.1).

(b) Shall be subject of a safety analysis covering the hazard 'after activation of an emergency command, complete loss of the brake force independent of the wheel/rail adhesion'.

This safety analysis shall be considered in the safety analysis required by the safety requirement No 3 set out in point 4.2.4.2.2 for the emergency brake function.";

(53) point 4.2.4.8.2 is replaced by the following:

"4.2.4.8.2. Magnetic track brake

(1) Requirements on magnetic brakes specified for compatibility with train detection system based on axle counters are referenced in point 4.2.3.3.1.2(10).

(2) A magnetic track brake is allowed to be used as an emergency brake, as mentioned in the TSI INF, point 4.2.6.2.2.

(3) The geometrical characteristics of the end elements of the magnet in contact with the rail shall be as specified for one of the types described in the specification referenced in Appendix J-1, index [16]. It is permissible to use geometries of end elements of the magnet that are not listed in Appendix J-1, index [16] provided that the compatibility with switches and crossings is demonstrated in accordance with the procedure referred to in Appendix K.

(4) Magnetic track brake shall not be used at speed higher than 280 km/h.

(5) The braking performance of the unit specified in points 4.2.4.5.2 shall be determined with and without the use of magnetic track brakes.

(6) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibition area – Trackside orders: magnetic track brake' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of inhibition of magnetic track brake by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.

(7) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibit – STM Orders: magnetic track brake' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of inhibition of magnetic track brake by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.";

(54) point 4.2.4.8.3. is replaced by the following:

"**4.2.4.8.3 Eddy current track brake**

(1) This point covers only eddy current track brake developing a brake force between the unit and the rail.

(2) Requirements on eddy current track brake specified for compatibility with train detection system based on axle counters, track circuits, wheel detectors and vehicle detectors based on inductive loops are referenced in point 4.2.3.3.1.2(10).

(3) If the eddy current track brake requires a displacement of its magnets when the brake is applied, the unobstructed movement of such magnets between the 'brake released' and 'brake applied' positions shall be demonstrated by calculation in accordance with the specification referenced in Appendix J-1, index [7].

(4) The maximum distance between the eddy current track brake and the track corresponding to 'brake released' position will be recorded in the technical documentation described in point 4.2.12.

(5) The eddy current track brake shall not operate below a fixed speed threshold.

(6) The conditions for use of eddy current track brake for technical compatibility with the track are not harmonised (regarding in particular their effect on rail heating and vertical force) and are an open point.

(7) The Register of Infrastructure indicates per track section if their use is allowed, and provides in such case their conditions for use.

– The maximum distance between the eddy current track brake and the track corresponding to 'brake released' referred to in point (4) above,

– Fixed speed threshold referred to in point (5) above,

– Vertical force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking),

– Braking force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking).

(8) The braking performance of the unit specified in points 4.2.4.5.2 and 4.2.4.5.3 shall be determined with and without the use of eddy current track brakes.

(9) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibition area – Trackside orders: Eddy current track brake' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of inhibition of eddy current track brake by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.

(10) Requirements applicable to units with regards to their interface with ETCS on-board and related to train interface function 'Special brake inhibit – STM Orders: eddy current track brake' when ETCS is installed are defined in the

specification referenced in Appendix J-2, index [B]. The subsequent commands of inhibition of eddy current track brake by the unit can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.";

(55) point 4.2.4.9 is amended as follows:

(a) point (1) is replaced by the following:

"(1) Information available to train staff shall allow the identification of the status of the brake system. To that end, it shall be possible at certain phases during operation for the train staff to identify the status (applied or released or isolated) of the main (emergency and service) and parking brake systems, and the status of each part (including one or several actuators) of these systems that can be controlled and/or isolated independently.";

(b) point (6) is replaced by the following:

"(6) The function providing the information described above to the train staff is a function essential to safety, as it is used for the train staff to evaluate the braking performance of the train.

Where local information is provided by indicators, the use of harmonised indicators ensures the required safety level.

Where a centralised control system allowing the train staff to perform all checks from one location (i.e. inside the drivers cab) is provided, it shall be subject to a reliability study, considering the failure mode of components, redundancies, periodic checks and other provisions; based on this study, operating conditions of the centralised control system shall be defined and provided in the operating documentation described in point 4.2.12.4 .";

(56) in point 4.2.4.10, points (4) and (5) are replaced by the following:

"(4) The braking performance developed by the rescued train in this particular operating mode shall be evaluated by a calculation, but is not required to be the same as the braking performance described in point 4.2.4.5.2. The calculated braking performance and rescue operating conditions shall be part of the technical documentation described in point 4.2.12.

(5) The requirement in 4.2.4.10 (4) does not apply to units which are operated in a train formation of less than 200 tons (load condition 'design mass in working order').";

(57) point 4.2.5.1 is replaced by the following:

"**4.2.5.1 Sanitary systems**

(1) The materials used for the on-board storage and distribution of water to sanitary systems (e.g. tank, pump, piping, water tap and sealing material and quality) shall comply with the requirements applicable to water intended for human consumption in accordance with Directive (EU) 2020/2184 of the European Parliament and of the Council*.

(2) Sanitary systems (toilets, washrooms, bar/restaurant facilities) shall prevent the release of sewage that may be detrimental to the health of people or to the

environment. Released materials (i.e. treated water) shall be conformant to the following Directives (water with soap directly released from sink excluded):

– The bacterial content of sewage discharged from sanitary systems shall not at any time exceed the bacterial content value for Intestinal enterococci and *Escherichia coli* bacteria specified as 'good' for Inland waters in Directive 2006/7/EC of the European Parliament and of the Council** concerning the management of bathing water quality.

– The treatment processes shall not introduce substances that are identified in Annex I of Directive 2006/11/EC of the European Parliament and of the Council*** on pollution caused by certain dangerous substances discharged into the aquatic environment of the Union.

(3) To limit the dispersion of released liquid on the trackside, discharge from any source shall take place downwards only, under the body frame of the vehicle in a distance not greater than 0,7 metres from the longitudinal centre line of the vehicle.

(4) The following shall be provided in the technical documentation described in point 4.2.12:

– The presence and type of toilets in a unit,

– The characteristics of the flushing medium, if it is not clean water,

– The nature of the treatment system for released water and the standards against which conformity has been assessed.

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* Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (OJ L 435, 23.12.2020, p. 1).

** Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (OJ L 64, 4.3.2006, p. 37).

*** 32006L0011: Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (OJ L 64, 4.3.2006, p. 52).";

(58) point 4.2.5.2 (5) is replaced by the following:

"(5) Provisions for passengers to contact train crew are prescribed in point 4.2.5.3 (passenger alarm) and in point 4.2.5.4 (communication devices for passengers).";

(59) in point 4.2.5.3.2. point (4a) is inserted as follows:

"(4a) In case of multiple activations, the driver's acknowledgement of the passenger alarm for the first activated passenger alarm device shall initiate the automatic acknowledgement for all further activated devices, until all activated devices have been reset.";

(60) point 4.2.5.4. is amended as follows:

(a) point (3) is replaced by the following:

"(3) The requirements to the location of the 'communication device' are the ones applicable for the passenger alarm as defined in point 4.2.5.3.";

(b) point (7) is added as follows:

"(7) The existence or not of communication devices shall be recorded in the technical documentation described in point 4.2.12.2.";

(61) in point 4.2.5.5.3, points (4) and (5) are replaced by the following:

"(4) The doors shall be kept closed and locked until they are released in accordance with point 4.2.5.5.6. In the event of loss of power to the door controls, the doors shall be kept locked by the locking mechanism.

Note: see point 4.2.2.3.2 of TSI PRM for alert signal when closing a door.

Door obstacle detection:

(5) External passenger access doors shall incorporate devices that detect if they close on an obstacle (e.g. a passenger). Where an obstacle is detected the doors shall automatically stop, and remain free for a limited period of time or reopen. The sensitivity of the system shall be such as to detect an obstacle according to the specification referenced in Appendix J-1, index [17], with a maximum force on the obstacle according to the specification referenced in Appendix J-1, index [17].";

(62) in point 4.2.5.5.6, point (2) is replaced by the following:

"(2) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'Station platform', when ETCS is installed, are defined in the specification referenced in Appendix J-2, index [B].";

(63) in point 4.2.5.5.9.(6) "index 33" is replaced by "index [17]";

(64) in point 4.2.6.1.1 (1), "index 34" is replaced by "index[18]";

(65) in point 4.2.6.1.2 (1), "index 35" is replaced by "index[18]";

(66) in point 4.2.6.1.2.(4), the first two paragraphs of the first indent are replaced by the following:

– " — Obstacle deflector as defined in point 4.2.2.5: additionally, capability to remove snow in front of the train.

– Snow shall be considered as an obstacle to be removed by the obstacle deflector; the following requirements are defined in point 4.2.2.5 (by reference to the specification referenced in Appendix J-1, index [3]):";

(67) point 4.2.6.2., point (1) is replaced by the following:

"(1) The requirements in this point apply to all rolling stock. For rolling stock operated on the 1520 mm and 1600 mm track gauge systems, in case of a maximum speed higher than the limits specified in points 4.2.6.2.1 to 4.2.6.2.5, the procedure for innovative solution shall apply.";

(68) in point 4.2.6.2.1., point (1), the introductory wording of point (2) and point (3) are replaced by the following:

"(1) Units of maximum design speed $v_{tr,\ max} > 160$ km/h, running in the open air at a reference speed $v_{tr,\ ref}$ shall not cause the air speed to exceed, at each measurement point defined in the specification referenced in Appendix J-1 index [49], the value u95 %,max as indicated in that specification.

(2) For units intended to be operated on the networks with track gauges of 1524 mm and 1668 mm, the corresponding values in Table 4 below referring to the parameters of the specification referenced in Appendix J-1, index [49] shall be applied:"

"(3) The specification referenced in Appendix J-1, index [49] specifies:

– the reference train to be tested for fixed/predefined formations and units assessed for use in general operation;

– the formation to be tested for single units fitted with a driver cab.";

(69) in point 4.2.6.2.2., point (2) and the introductory wording of point (3) are replaced by the following:

"(2) Units with a maximum design speed higher than 160 km/h running in the open air at their reference speed $V_{tr,ref}$ on 1435 mm track gauge shall not cause the maximum peak-to-peak pressure to exceed the maximum permissible pressure change defined in specification referenced in Appendix J-1, index [49] assessed over the measurement positions defined in the same specification.

(3) For units intended to be operated on the networks with track gauges of 1524 mm and 1668 mm, the corresponding values in Table 4a below referring to the parameters of the specification referenced in Appendix J-1, index [49] shall be applied:";

(70) point 4.2.6.2.3. is replaced by the following:

"4.2.6.2.3. Maximum pressure variations in tunnels

(1) Units of maximum design speed higher than or equal to 200 km/h shall be aerodynamically designed so that for a given combination (reference case) of train speed and tunnel cross section in case of a solo run in a simple, non-inclined tube-like tunnel (without any shafts etc.) the requirements for the characteristic pressure variation shall be met as defined in Appendix J-1, index [50].

(2) The reference train to be verified by a test is specified as follows for different types of rolling stock:

(i) unit assessed in fixed or predefined formation: assessment shall be made according to the specification referenced to in Appendix J-1, Index [50];

(ii) unit assessed for general operation (train formation not defined at design stage) and fitted with a driver's cab: assessment shall be made according to the specification referenced to in Appendix J-1, Index [50];

(iii) other units (coaches for general operation): assessment shall be made according to the specification referenced to in Appendix J-1, Index [50];

(3) The conformity assessment procedure is described in point 6.2.3.15 .";

(71) point 4.2.6.2.4. is replaced by the following:

"**4.2.6.2.4. Crosswind**

(1) This requirement applies to units of maximum design speed higher than 140 km/h.

(2) For units of maximum design speed lower than 250 km/h the characteristic wind curve (CWC) of the most sensitive vehicle shall be determined in accordance with the specification referenced in Appendix J-1, index [19].

(3) For units of maximum design speed equal or higher than 250 km/h the crosswind effect shall be determined and complying with the specification referenced in Appendix J-1, index [19].

(4) The resulting characteristic wind curve of the most sensitive vehicle of the unit under assessment shall be recorded in the technical documentation as per point 4.2.12 .";

(72) in point 4.2.7.1.1., points (4), (5) and (6) are replaced by the following:

"(4) The colour of head lamps shall be in accordance with the values specified in the specification referenced in Appendix J-1, index [20].

(5) Headlamps shall provide 2 luminous intensity levels: 'dimmed headlamp' and 'full-beam headlamp'.

For each level, the luminous intensity of headlamps measured along the optical axis of the head lamp shall be in accordance with the values specified in the specification referenced in Appendix J-1, index [20].

(6) The installation of head lamps on the unit shall provide a means of alignment adjustment of their optical axis when installed on the unit according to the specification referenced in Appendix J-1, index [20].";

(73) point 4.2.7.1.2. is amended as follows:

(a) point (6) is replaced by the following:

"(6) The specification referenced in Appendix J-1, index [20] specifies the characteristics of:

(a) the colour of marker lamps;

(b) the spectral radiation distribution of light from the marker lamps;

(c) the luminous intensity of marker lamps."

(b) point (7) is replaced as follows:

"(7) The installation of marker lamps on the unit shall provide a means of alignment adjustment of their optical axis when installed on the unit according to the specification referenced in Appendix J-1, index [20].*";*

(c) point (8) is deleted;

(74) in point 4.2.7.1.3., point (4) is replaced by the following:

"(4) The specification referenced in Appendix J-1, index [20] specifies the characteristics of:

(a) the colour of tail lamps;

(b) the luminous intensity of tail lamps.";

(75) point 4.2.7.1.4. is replaced by the following:

"**4.2.7.1.4 Lamp controls**

(1) This point applies to units fitted with a driver's cab.

(2) It shall be possible for the driver to control:

– the head, marker lamps of the unit from the normal driving position;

– the tail lamps of the unit from the cab.

This control may use independent command or combination of commands.

(3) On units intended to operate on one or more of the networks listed in point 7.3.2.8.a , it shall be possible for the driver to use the head lamps in automatic flashing/blinking mode and to inhibit the function. The characteristics of the flashing/blinking mode shall not be a condition for accessing a network.

(4) The fitment of the controls to activate and to inhibit the flashing/blinking mode of head lamps shall be recorded in the technical documentation defined in point 4.2.12.2 .";

(76) in point 4.2.7.2.1., point (4), "point 4.2.7.2.2." is replaced by "point 4.2.7.2.2. ".

(77) point 4.2.7.2.2. is replaced by the following:

"**4.2.7.2.2. Warning horn sound pressure levels**

(1) The C weighted sound pressure level produced by each horn sounded separately (or in a group if designed to sound simultaneously as a chord) when integrated on the unit shall be as defined in the specification referenced in Appendix J-1, index [21].

(2) The conformity assessment procedure is specified in point 6.2.3.17 .";

(78) point 4.2.8.1.2. is replaced by the following:

"**4.2.8.1.2. Requirements on performance**

(1) This point applies to units fitted with traction equipment.

(2) Unit traction force profiles (force at wheel rim =F(speed)) shall be determined by calculation; the unit running resistance shall be determined by a calculation for the load case 'design mass under normal payload', as defined in point 4.2.2.10 .

(3) Unit traction force profiles and running resistance shall be recorded in the technical documentation (see point 4.2.12.2).

(4) The design maximum speed shall be defined from the data above for the load case 'design mass under normal payload' on a level track; design maximum speed higher than 60 km/h shall be a multiple of 5 km/h.

(5) For units assessed in fixed or predefined formation, at the maximum service speed and on a level track, the unit shall still be capable of an acceleration of at least 0,05 m/s^2 for the load case 'design mass under normal payload'. This requirement may be verified by calculation or by testing (acceleration measurement) and applies for maximum design speed up to 350 km/h.

(6) Requirements regarding the traction cut-off required in case of braking are defined in the point 4.2.4 .

(7) Requirements regarding availability of the traction function in case of fire on board are defined in the point 4.2.10.4.4 .

(8) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'traction cut off' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

Additional requirements for units assessed in fixed or predefined formation of maximum design speed higher than or equal to 250 km/h:

(9) The mean acceleration on a level track, for the load case 'design mass under normal payload', shall be of at least of:

– 0,40 m/s2 from 0 to 40 km/h

– 0,32 m/s2 from 0 to 120 km/h

– 0,17 m/s2 from 0 to 160 km/h.

This requirement may be verified by calculation only or by testing (acceleration measurement) combined with calculation.

(10) The design of the traction system shall assume a calculated wheel/rail adhesion not higher than:

– 0,30 at start up and very low speed

– 0,275 at 100 km/h

– 0,19 at 200 km/h

– 0,10 at 300 km/h.

(11) A single failure of power equipment affecting the traction capability shall not deprive the unit of more than 50 % of its traction force.";

(79) in point 4.2.8.2.2., point (1) is replaced by the following:

"(1) Electric units shall be able to operate within the range of at least one of the systems 'voltage and frequency' defined in TSI ENE, point 4.2.3 and in appendix J-1 index [69].";

(80) points 4.2.8.2.3. to 4.2.8.2.8.4. are replaced by the following:

"**4.2.8.2.3 Regenerative brake with energy to the overhead contact line**

(1) Electric units which return electrical energy to the overhead contact line in regenerative braking mode shall comply with the specification referenced in Appendix J-1, index [22].

4.2.8.2.4 Maximum power and current from the overhead contact line

(1) Electric units including fixed and predefined formations with power higher than 2 MW shall be equipped with power or current limitation function. For units intended to be used in multiple operation the requirement shall apply when the single train - with the maximum number of units intended to be coupled - has a total power higher than 2 MW.

(2) Electric units shall be equipped with automatic regulation as a function of voltage to limit the current or power to the 'maximum current or power against voltage' specified in the specification referenced in Appendix J-1, index [22].

A less restrictive limitation (lower value of coefficient 'a') may be used at operational level on a particular network or line if agreed by the Infrastructure Manager.

(3) The maximum current assessed here above (rated current) shall be recorded in the technical documentation defined in point 4.2.12.2 .

(4) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function ‘change of allowed current consumption’ when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. When receiving the information on allowed current consumption:

– If the unit is equipped with power or current limitation function, the device automatically adapts the level of the power consumption.

– If the unit is not equipped with power or current limitation function, the “allowed current consumption” shall be displayed on-board for the intervention of the driver.

The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2 .

4.2.8.2.5 Maximum current at standstill

(1) The maximum current per pantograph for AC and DC systems when a train is at standstill shall be as defined in the specification referenced in Appendix J-1, index [24].

(2) For DC systems, the maximum current at standstill per pantograph shall be calculated and verified by measurement in accordance with point 6.1.3.7 . For AC systems, the check for current at standstill is not necessary as the current is lower and not critical to causing heating of the contact wire.

(3) For trains equipped with electric energy storage for traction purposes:

– The maximum current per pantograph at vehicle standstill in DC systems can be exceeded only for charging electric energy storage for traction, in allowed locations and under the specific conditions defined in the register of infrastructure. Only in that case, it shall be possible for a unit to enable the capacity to exceed the maximum current at standstill for DC systems.

– The assessment method including the measurement conditions is an open point.

(4) For DC systems, the measured value and measurement conditions regarding the material of the contact wire and, for trains equipped with electric energy storage for traction purposes, the documentation for the operation of electric energy storage shall be recorded in the technical documentation defined in point 4.2.12.2 .

4.2.8.2.6 Power factor

(1) The power factor design data of the train (including multiple operation of several units as defined in point 2.2) shall be subject to a calculation to verify acceptance criteria set out in the specification referenced in Appendix J-1, index [22].

4.2.8.2.7 Harmonics and dynamic effects for AC systems

(1) An Electric unit shall comply with the requirements described in the specification referenced in Appendix J-1, index [22].

(2) All hypothesis and data considered shall be recorded in the technical documentation (see point 4.2.12.2).

4.2.8.2.8 On-board energy measurement system

4.2.8.2.8.1 General

(1) The on-board energy measurement system (EMS) is the system for measurement of all active and reactive electric energy taken from or returned (during regenerative braking) to the overhead contact line (OCL) by the electric unit.

(2) The EMS shall include at least the following functions: Energy measurement function (EMF) as set out in point 4.2.8.2.8.2 and data handling system (DHS) as set out in point 4.2.8.2.8.3 .

(3) A suitable communication system will send the compiled energy billing data sets (CEBD) to an on-ground data collecting system (DCS). The interface protocols and transferred data format between EMS and DCS shall fulfil the requirements set out in point 4.2.8.2.8.4 .

(4) The on-board energy measurement system is suitable for billing purposes; the data sets defined in point 4.2.8.2.8.3(4) provided by this system shall be accepted for billing in all Member States.

(5) The EMS rated current and voltage shall be matched to the electric unit rated current and voltage; it shall continue to function correctly when changing between several traction energy supply systems.

(6) Data stored in the EMS shall be protected against loss of the power supply and the EMS shall be protected from non-authorised access.

(7) An on-board location function providing location data originated from an external source to the DHS shall be provided in networks where such function is necessary for billing purposes. In any case, the EMS system shall be able to accommodate a compatible location function. If the location function is provided, it shall fulfil the requirements set out in specification referenced in Appendix J-1, index [55].

(8) The fitment of an EMS, its on-board location function, the description of on-board to ground communication and the metrological control including the accuracy class of the EMF shall be recorded in the technical documentation described in point 4.2.12.2 .

(9) The maintenance documentation described in point 4.2.12.3 shall include any periodic verification procedure to ensure the required accuracy level of the EMS during its lifetime.

4.2.8.2.8.2 Energy measurement function (EMF)

(1) The EMF shall ensure the measurement of the voltage and current, calculation of the energy and production of energy data.

(2) The energy data produced by EMF shall have a time reference period of 5 minutes defined by the Universal Time Coordinated (UTC) clock time at the end of each time reference period; originating from the time stamp 00:00:00. It is permitted to use a shorter measuring period if the data can be aggregated on-board into 5 minutes time reference period.

(3) The accuracy of EMF for active energy measurement shall comply with the specification referenced in Appendix J-1, index [56].

(4) Each device containing one or more functions of EMF shall indicate: metrological control, and its accuracy class, according to the class designations specified in the specification referenced in Appendix J-1, index [56].

(5) The conformity assessment of the accuracy is set out in point 6.2.3.19a .

(6) In cases where:

– an EMS is intended to be installed on an existing vehicle, or

– an existing EMS (or parts of it) is upgraded,

and where existing components of a vehicle are used as part of the EMF, requirements (1) to (5) apply to current and voltage measurements considering the temperature influence factor at rated temperature only and may be verified only for the range of 20% to 120% of rated current. The technical documentation described in point 4.2.12.2 shall record:

– the characteristic of the compliance of components of the on-board energy measurement system with this limited set of requirements, and

– the conditions for use of these components.

4.2.8.2.8.3 Data handling system (DHS)

(1) The DHS shall ensure the production of compiled energy billing data sets for energy billing purposes, by merging data from the EMF with time data and, when required, geographical position, and storing it ready to be sent to an on-ground data collecting system (DCS) by a communication system.

(2) The DHS shall compile the data without corrupting them and shall incorporate data storage with a memory capacity sufficient to store the compiled data of at least 60 days continuous operation. The time reference used shall be the same as in the EMF.

(3) The DHS shall have a capability to be interrogated locally on-board for audit and data recovery purposes.

(4) The DHS shall produce compiled energy billing data sets, (CEBD), by merging the following data for each time reference period:

– unique EMS consumption point identification (CPID) as defined in the specification referenced in Appendix J-1, index [57],

– end time of each period, defined as year, month, day, hour, minute and second,

– location data at the end of each period,

– consumed/regenerated active and reactive (if appropriate) energy in each period, in units of watt-hour (active energy) and var-hour (reactive energy) or their decimal-multiples.

(5) The conformity assessment of compilation and handling of data produced by DHS is set out in point 6.2.3.19a .

4.2.8.2.8.4 Interface protocols and transferred data format between EMS and DCS

The data exchange between EMS and DCS shall fulfil the requirements specified in the specification referenced in Appendix J-1, index [58] with regards to the following characteristics:

(1) The application services (service layer) of the EMS,

(2) The user access rights for these application services,

(3) The structure (data layer) for these application services, which shall comply with the defined XML schema,

(4) The message mechanism (message layer) for supporting these application services, which shall comply with the defined methods and the XML schema,

(5) The application protocols for supporting the message mechanism.

(6) The EMS shall use at least one of the defined communication architectures.";

(81) in point 4.2.8.2.9.1.1., point (5) shall be modified as follows "4190 mm and 5700 mm above rail level for electric units designed to be operated on the 1500 V DC system in accordance with the IRL gauge (track gauge system 1600mm).";

(82) in point 4.2.8.2.9.1.2., point (2) "index 46" is replaced by "index [23].";

(83) in point 4.2.8.2.9.2., point (2) is replaced by the following:

"(2) For electric units designed to be operated solely on the 1520 mm system, at least one of the pantograph(s) to be installed shall have a head geometry type compliant with one of the three specifications given in the points 4.2.8.2.9.2.1, 2 and 3 below.";

(84) in point 4.2.8.2.9.2, point (5) "index 47" is replaced by "index [24]";

(85) in point 4.2.8.2.9.2.1, point (1) "index 48" is replaced by "index [24]";

(86) in point 4.2.8.2.9.2.2, point (1) "index 49" is replaced by "index [24]";

(87) point 4.2.8.2.9.3a is replaced by the following:

"**4.2.8.2.9.3a Pantograph current capacity (IC level)**

(1) Pantographs shall be designed for the rated current (as defined in point 4.2.8.2.4) to be transmitted to the Electric unit.

(2) An analysis shall demonstrate that the pantograph is able to carry the rated current; this analysis shall include the verification of the requirements of the specification referenced in Appendix J-1, index [23].

(3) Pantographs shall be designed for a current at standstill with a maximum as defined in point 4.2.8.2.5 .";

(88) in point 4.2.8.2.9.4.2., point (3) "(see clause 6.1.3.8)" is replaced by "(see point 6.1.3.8).";

(89) points 4.2.8.2.9.6 to 4.2.8.2.10 are replaced by the following:

"**4.2.8.2.9.6 Pantograph contact force and dynamic behaviour**

(1) The mean contact force F_m is the statistical mean value of the pantograph contact force and is formed by the static and aerodynamic components of the contact force with dynamic correction.

(2) The factors which influence the mean contact force are the pantograph itself, its position in the train consist, its vertical extension, and the rolling stock on which the pantograph is mounted.

(3) Rolling stock and pantographs fitted on rolling stock shall be designed to exert a mean contact force F_m on the contact wire in a range specified in point 4.2.11 of the TSI ENE, in order to ensure current collection quality without undue arcing and to limit wear and hazards to contact strips. Adjustment of the contact force is made when dynamic tests are performed.

(3a) Rolling stock and pantographs fitted on rolling stock shall not exceed the limit values for uplift S_0 and either standard deviation σ_{max} or percentage of arcing as defined in point 4.2.12 of the TSI ENE.

(4) The verification at interoperability constituent level shall validate the dynamic behaviour of the pantograph itself, and its capability to collect current from a TSI compliant overhead contact line; the conformity assessment procedure specified in point 6.1.3.7.

(5) The verification at rolling stock subsystem level (integration in a particular vehicle) shall allow to adjust the contact force, taking into account aerodynamic effects due to the rolling stock and the position of the pantograph in the unit or train fixed or predefined formation(s); the conformity assessment procedure specified in point 6.2.3.20 .

4.2.8.2.9.7 Arrangement of pantographs (RST level)

(1) It is permissible for more than one pantograph to be simultaneously in contact with the overhead contact line equipment.

(2) The number of pantographs and their spacing shall be designed taking into consideration the requirements of current collection performance, as defined in point 4.2.8.2.9.6 above.

(3) Where the spacing of 2 consecutive pantographs in fixed or predefined formations of the assessed unit is less than the spacing shown in point 4.2.13 of the TSI ENE for the selected OCL design distance type, or where more than 2 pantographs are simultaneously in contact with the overhead contact line equipment, it shall be demonstrated by testing that the dynamic behaviour as defined in point 4.2.8.2.9.6 above is met.

(4) The distances between consecutive pantographs for which the rolling stock has been verified shall be recorded in the technical documentation (see point 4.2.12.2).

4.2.8.2.9.8 Running through phase or system separation sections (RST level)

(1) Trains shall be designed to be able to move from one power supply system and from one phase section to an adjacent one (as described in points 4.2.15 and 4.2.16 of the TSI ENE) without bridging either system or phase separation sections.

(2) Electric units designed for several power supply systems shall, when running through system separation sections, recognise automatically the voltage of the power supply system at the pantograph.

(3) When running through phase or system separation sections, it shall be possible to bring the power exchange between the OCL and the unit to zero. The

infrastructure register gives information on the permitted pantographs position: lowered or raised (with permitted pantograph arrangements) when running through systems or phase separation sections.

(4) Electric units of maximum design speed higher than or equal to 250 km/h shall be able to receive from the ground the information related to the location of the separation section, and the subsequent commands to the control of the pantograph and main circuit breaker shall be triggered automatically the unit, without intervention of the driver.

(5) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface functions 'Change of traction system, Powerless section with pantograph to be lowered – Trackside orders, Powerless section with main power switch to be switched off – Trackside orders,' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B], for units of maximum design speed lower than 250 km/h, the subsequent commands are not required to be automatic. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2 .

(6) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface functions 'Main Power Switch – STM orders', 'Pantograph – STM orders' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. For units of maximum design speed lower than 250 km/h, the subsequent commands are not required to be automatic. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2 .

4.2.8.2.9.9 Insulation of pantograph from the vehicle (RST level)

(1) The pantographs shall be assembled on an electric unit in a way that ensures the current path from collector head to vehicle equipment is insulated. The insulation shall be adequate for all system voltages the unit is designed for.

4.2.8.2.9.10 Pantograph lowering (RST level)

(1) Electric units shall be designed to lower the pantograph in a period (3 seconds) meeting the requirements of the specification referenced in Appendix J-1, index [23] and to the dynamic insulating distance according to the specification referenced in Appendix J-1, index [26] either by initiation by the driver or by a train control function (including CCS functions).

(2) The pantograph shall lower to the stowed position in less than 10 seconds.

When lowering the pantograph, the main circuit breaker shall previously be opened automatically.

(3) If an electric unit is equipped with an automatic dropping device (ADD) that lowers the pantograph in case of a collector head failure, the ADD shall meet the requirements of the specification referenced in Appendix J-1, index [23].

(4) Electric units of maximum design speed higher than 160 km/h shall be equipped with an ADD.

(5) Electric units that require more than one pantograph raised in operation and of maximum design speed higher than 120 km/h shall be equipped with an ADD.

(6) Other electric units are permitted to be equipped with an ADD.

4.2.8.2.10 Electrical protection of the train

(1) Electric units shall be protected against internal short – circuits (from inside the unit).

(2) The location of the main circuit breaker shall be such as to protect the on-board high voltage circuits, including any high voltage connections between vehicles. The pantograph, the main circuit breaker, and the high voltage connection between them shall be located on the same vehicle.

(3) Electric units shall protect themselves against short overvoltages, temporary overvoltages and maximum fault current. To meet this requirement, electrical protection coordination design of the unit shall comply with the requirements defined in the specification referenced in Appendix J-1, index [22].";

(90) point 4.2.8.3. is replaced by "Intentionally blank";

(91) in point 4.2.8.4., point (1), "index 54" is replaced by "index [27]";

(92) in point 4.2.9.1.4., point (5), "(see clause 4.2.9.1.5)" is replaced by "(see point 4.2.9.1.5)";

(93) in point 4.2.9.1.5, point (2) is replaced by the following:

"(2) It shall be possible for the driver to adjust the seat position in order to meet the reference position of eyes for external visibility, as defined in point 4.2.9.1.3.1 .";

(94) in point 4.2.9.1.6. the following points (5) and (6) are added:

"(5) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'direction controller' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

(6) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'cab status information' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].";

(95) in point 4.2.9.1.7., point (2), "(as defined in the clause 4.2.9.1.3.)" is replaced by "(as defined in the point 4.2.9.1.3.).";point 4.2.9.2. is replaced by the following:

"**4.2.9.2. Windscreen**

4.2.9.2.1. Mechanical characteristics

(1) The dimension, location, shape and finishes (including those for maintenance purpose) of the windows shall not inhibit the drivers external view (as defined in point 4.2.9.1.3.1) and shall support the driving task.

(2) The driver's cab windscreens shall be able to resist impacts from projectiles and spalling as specified in the specification referenced in Appendix J-1, index [28].

4.2.9.2.2. Optical characteristics

(1) The driver's cab windscreens shall be of an optical quality that does not alter the visibility of signs (shape and colour) in any operating condition (including as example when the windscreen is heated to prevent misting and frost).

(2) The windscreen shall fulfil the requirements specified in the specification referenced in Appendix J-1, index [28] with regards to the following characteristics:

(a) The angle between primary and secondary images in the installed position

(b) Permissible optical distortions of vision

(c) Haze

(d) Light transmittance

(e) Chromaticity";

(96) Points from 4.2.9.3.6. to 4.2.9.6 are replaced by the following:

"**4.2.9.3.6. Radio Remote control function by staff for shunting operation**

(1) If a radio remote control function is provided for a staff member to control the unit during shunting operations, it shall be designed to allow him to control the train movement safely, and to avoid any mistake when used.

(2) It is assumed that the staff member using the remote control function can visually detect train movement when using the remote control device.

(3) The design of the remote control function, including safety aspects, shall be assessed according to recognised standards.

(4) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'remote shunting' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

4.2.9.3.7 Derailment detection and prevention signal processing

(1) This point is applicable to locomotives intended to process signals emitted by freight wagons, if provided with derailment prevention function (DPF) or derailment detection function (DDF) as defined in point 4.2.3.5.3 of TSI WAG.

(2) These locomotives shall be equipped with means to receive a signal from the freight wagons forming a train which are equipped with the DPF and DDF informing of:

- a precursor of a derailment, in case of the DPF in accordance with point 4.2.3.5.3.2 of TSI WAG and
- a derailment, in case of the DDF in accordance with point 4.2.3.5.3.3 of the TSI WAG.

(3) At the reception of the signal above, both visual and acoustic alarms shall indicate in the driver's cab that the train is:

- In risk of derailment, in case the alarm is sent by a DPF or
- Just derailed, in case the alarm is sent from a DDF.

(4) A device in the driver's cab shall allow the acknowledgment of the alarm above.

(5) If the alarm is not acknowledged from the driver's cab in 10 +/-1 seconds, a full service brake or an emergency brake application shall be automatically applied.

(6) It shall be possible to override the automatic brake application set out in point 4.2.9.3.6 (5) above from the driver's cab.

(7) It shall be possible to deactivate the automatic brake application set out in point 4.2.9.3.6 (5) above from the driver's cab.

(8) The presence of the derailment detection signal processing function in the locomotive as well as the conditions of use at train level shall be recorded in the technical documentation defined in point 4.2.12 .

4.2.9.3.7a On-board derailment detection and prevention function

(1) This point is applicable to locomotives which are intended to detect derailments or precursors to derailments in freight wagons hauled by the locomotive.

(2) The equipment fulfilling this function shall be located entirely on board the locomotive

(3) At the detection of a derailment or precursor to derailment, both visual and acoustic alarms shall be triggered in the driver's cab.

(4) A device in the driver's cab shall allow the acknowledgment of the alarm above.

(5) If the alarm is not acknowledged from the driver's cab in 10 +/-1 seconds, a full service brake or an emergency brake application shall be automatically applied.

(6) It shall be possible to override the automatic brake application set out in point 4.2.9.3.7a (5) above from the driver's cab.

(7) It shall be possible to deactivate the automatic brake application set out in point 4.2.9.3.7a (5) above from the driver's cab.

(8) The presence of the on-board derailment detection function in the locomotive as well as the conditions of use at train level shall be recorded in the technical documentation defined in point 4.2.12 .

4.2.9.3.8 Requirements for management of ETCS modes

4.2.9.3.8.1 Sleeping mode

(1) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'Sleeping' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

4.2.9.3.8.2 Passive shunting

(1) Requirements applicable to Locomotive and Trainset with regards to their interface with ETCS on-board and related to the train interface function 'Passive shunting' are defined in the specification referenced in Appendix J-2, index [B].

4.2.9.3.8.3 Non leading

(1) Requirements applicable to Locomotive and Trainset with regards to their interface with ETCS on-board and related to the train interface function 'Non leading' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

4.2.9.3.9 Traction status

(1) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'traction status' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B].

4.2.9.4 On-board tools and portable equipment

(1) A space shall be available in or near the driver's cab to store the following equipment, in case they are needed by the driver in emergency situation:

- Hand-lamp with red and white light
- Short circuiting equipment for track-circuits
- Scotches, if the parking brake performance is not sufficient depending on track gradient (see point 4.2.4.5.5).
- A fire extinguisher (to be located in the cab; see also point 4.2.10.3.1).
- On manned traction units of freight trains: a self-rescue device, as specified in the TSI SRT* (see TSI SRT point 4.7.1).

4.2.9.5. Storage facility for staff personal effects

(1) Each driver's cab shall be equipped with:

- Two hooks for clothing or a niche with a clothes beam.
- A free space for storing a suitcase or bag of size 300 mm × 400 mm × 400 mm.

4.2.9.6. Recording device

(1) The list of information to be recorded is defined in point 4.2.3.5 of the TSI OPE.

(2) The unit shall be equipped with a means to record this information, complying with the following requirements specified in the specification referenced in Appendix J-1, index [29]:

(a) Functional requirements shall be met.

(b) Recording performance shall be according to class R1.

(c) The integrity (consistency; correctness) of the recorded and extracted data shall be met.

(d) Data integrity shall be safeguarded.

(e) The level of protection that applies to the protected storage medium shall be 'A'.

(f) The time of day and date.

(3) The tests of the requirements in clause 4.2.9.6(2) shall be carried out in accordance with the requirements of the specification referenced in Appendix J-1, index [72].

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* 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 (OJ L 356, 12.12.2014, p. 394).";

(97) point 4.2.10.2.1. is replaced by the following:

"**4.2.10.2.1. Material requirements**

(1) The selection of materials and components shall take into account their fire behaviour properties, such as flammability, smoke opacity and toxicity.

(2) Materials used to construct the rolling stock unit shall comply with the requirements of the specification referenced in Appendix J-1, index [30] for the 'Operation Category' as defined below:

– 'Operation Category 2' for Category A passenger rolling stock (including passenger locomotive).

– 'Operation Category 3' for Category B passenger rolling stock (including passenger locomotive).

– 'Operation Category 2' for freight locomotives, and self-propelling units designed to carry other payload (mail, freight, etc.).

– 'Operation Category 1' for OTMs, with requirements limited to areas which are accessible to staff when the unit is in transport running configuration (see Point 2.3).

(3) In order to ensure constant product characteristics and manufacturing process, it is required that:

– the test reports to prove compliance of a material with the standard, which shall be issued immediately after testing of this material, shall be renewed every 5 years,

– in case there is no change in the product characteristics and manufacturing process, and no change in the related requirements (TSI), it is not required to perform new testing of this material; expired test reports shall be accepted provided they are accompanied with a statement delivered at the placing on the market of the product from the original equipment manufacturer, and stating that there has been no change in the product characteristics and in the manufacturing process, covering the complete supply chain involved, since the fire behaviour properties of the product were tested. This statement shall not be delivered later than 6 months after the initial test report is expired. This statement shall be renewed every 5 years.";

(98) in point 4.2.10.2.2., point (2), "index 59" is replaced by "index [30].";

(99) point 4.2.10.3.4. is amended as follows:

(a) in point (3), third indent, "index 60" is replaced by "index [31].".

(b) point (5) and the last paragraph are replaced by the following:

"(5) If other FCCS are used and rely on reliability and availability of systems, components, or functions, they shall be subject to a reliability study considering the failure mode of components, redundancies, software, periodic checks and other provisions, and the estimated failure rate of the function (lack of control of the spread of heat and fire effluents) shall be provided in the technical documentation described in point 4.2.12 .

Based on this study, operating and maintenance conditions of the FCCS shall be defined and provided in the maintenance and operating documentation described in points 4.2.12.3 and 4.2.12.4 .";

(100) in point 4.2.10.3.5., point (3), "index 61" is replaced by "index [31]";

(101) in point 4.2.10.4.1., point (5), "index 62 is replaced by "index [32]";

(102) in point 4.2.10.4.2. points (5) is replaced and point (6) is inserted as follows:

"(5) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'Air tightness area – Trackside orders' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of close all means of external ventilation can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2 .

(6) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'Air tightness – STM orders' when ETCS is installed are defined in the specification referenced in Appendix J-2, index [B]. The subsequent commands of close all means of external ventilation can be automatic or manual through intervention of the driver. The rolling stock configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2 .";

(103) in point 4.2.10.4.4., point (3), "index 63" is replaced by "index [33]";

(104) point 4.2.10.5.1. is amended as follows:

(a) point (8) is replaced by the following:

"(8) All external passenger doors shall be equipped with emergency opening devices allowing them to be used as emergency exits (see point 4.2.5.5.9).";

(b) point (12) is replaced by the following:

"(12) The number of the doors and their dimensions shall allow the complete evacuation within three minutes by passengers without their baggage. It is permitted to consider that passengers with reduced mobility are to be assisted by other passengers or staff, and that wheelchair users are evacuated without their wheelchair.

Verification of this requirement shall be made either by a physical test under normal operating conditions or by numerical simulation.

In case the requirement is verified by numerical simulation, the simulation report shall include:

– A summary of the verification and validation of the simulation (tool and models)

– The hypothesis and parameters used for the simulation

– The results of an appropriate number of simulation runs allowing a statistically sound statement.";

(105) point 4.2.11.3 is replaced by the following:

"**4.2.11.3 Connection to Toilet discharge system**

(1) This point is applicable to units equipped with sealed retention systems (using clear or recycled water) that have to be emptied at sufficient intervals on a scheduled basis at designated depots.

(2) The following connections of the unit to the toilet discharge system shall comply with the following specifications:

(i) The 3 inch Evacuation nozzle (Inner part): see Appendix G Figure G-1 .

(ii) The flushing connection for the toilet tank (Inner part), the use of which is optional: see Appendix G Figure G-2 .";

(106) point 4.2.11.4 is replaced by "Not used";

(107) point 4.2.11.5 is replaced by the following:

"**4.2.11.5 Interface for water refilling**

(1) This point is applicable to units equipped with a water tank supplying water to sanitary systems covered by the point 4.2.5.1 .

(2) The inlet connection for water tanks shall comply with the specification referenced in Appendix J-1, index [34].";

(108) point 4.2.11.6 is replaced as follows:

"**4.2.11.6 Special requirements for stabling of trains**

(1) This point is applicable to units intended to be powered while stabled,

(2) The unit shall be compatible with at least one of the following external power supply systems, and shall be equipped (where relevant) with the corresponding interface for electrical connection to that external power supply (plug):

– power supply contact line (see point 4.2.8.2 'Power supply')

– 'Single pole' power supply line (AC 1 kV, AC/DC 1,5 kV, DC 3 kV), in accordance with the specification referenced in Appendix J-1, index [52]

– Local external auxiliary power supply 400 V that can be connected to socket type '3P+ground' according to the specification referenced in Appendix J-1, index [35].";

(109) point 4.2.12.2. is replaced by the following:

"**4.2.12.2 General documentation**

The following documentation describing the rolling stock shall be provided; the point of this TSI where the documentation is required is referenced:

(1) General drawings.

(2) Electrical, pneumatic and hydraulic diagrams, Control-circuit diagrams necessary to explain the function and operation of the concerned systems.

(3) Description of computerised on-board systems including description of functionality, specification of interfaces and data processing and protocols.

(3a) For units designed and assessed for general operation, this shall include a description of the electric interfaces between units and of communication protocols, with the reference to the standards or other normative documents that have been applied.

(4) Reference profile, and compliance to interoperable reference profile G1, GA, GB, GC or DE3, as required in point 4.2.3.1.

(5) Weight balance with hypothesis on load conditions considered, as required in point 4.2.2.10.

(6) Axle load, spacing of axles and any EN line category, as required in point 4.2.3.2.1.

(7) Test report concerning running dynamic behaviour, including the test track quality recording and the track loading parameters including possible limitations of use if testing of the vehicle only covers a part of the test conditions, as required in point 4.2.3.4.2.

(8) The hypothesis taken to evaluate the loads due to bogie running, as required in points 4.2.3.5.1 and in point 6.2.3.7 for wheelsets.

(9) Braking performance, including failure mode analysis (degraded mode) as required in point 4.2.4.5

(9a) Maximum distance between the eddy current track brake and the track corresponding to 'brake released', fixed speed threshold, vertical force and braking force as a function of the train speed, for the case of full application of eddy current track brake (emergency braking) and limited application of eddy current brake (service braking), as required in point 4.2.4.8.3.

(10) The presence and type of toilets in a unit, the characteristics of the flushing medium, if it is not clean water, the nature of the treatment system for released water and the standards against which conformity has been assessed, as required in point 4.2.5.1.

(11) Provisions taken in relation with the selected range of environmental parameters if different than the nominal one, as required in point 4.2.6.1.

(12) Characteristic wind curve (CWC) as required in point 4.2.6.2.4.

(13) Traction performance, as required in point 4.2.8.1.1.

(14) Fitment of an on-board energy measurement system, and of its on-board location function (optional), as required in point 4.2.8.2.8. Description of on-board to ground communication and the metrological control including functions related to the accuracy classes of the voltage measurement, current measurement and energy calculation.

When point 4.2.8.2.8.2 (6) applies, the characteristics of the compliance of components of the on-board energy measurement system with the limited set of requirements, and the conditions for use of these components.

(15) Hypothesis and data considered as required in point 4.2.8.2.7.

(16) The number of pantographs simultaneously in contact with the overhead contact line equipment (OCL), their spacing and the OCL design distance type (A, B or C) used for assessment tests, as required in point 4.2.8.2.9.7.

(17) Existence of communication devices as required in point 4.2.5.4 for units designed for operation without staff on-board (other than driver).

(18) The presence of one or several of the functions described in points 4.2.9.3.7 and 4.2.9.3.7a and their conditions of use at train level.

(19) The type(s) of pantograph head geometry that an Electric unit is equipped with, as required in point 4.2.8.2.9.2.

(20) The maximum current assessed (rated current), as required in point 4.2.8.2.4.

(21) For DC systems: the documentation for operation of electric energy storage, the measured value of maximum current at standstill and measurement conditions regarding the material of the contact wire, as required in point 4.2.8.2.5.

(22) Fitment of the controls to activate and to inhibit the flashing/blinking mode of head lamps as defined in point 4.2.7.1.4.

(23) Description of train interface functions implemented including specification of interfaces and protocols of communication, general drawings, control-circuit diagrams necessary to explain the function and operation of the interface.

(24) Documentation related to:

- space envelope available for installation of ETCS on-board equipment's defined in TSI CCS (e.g ETCS cabinet, DMI, antenna, odometry etc.) and,
- conditions for ETCS equipment's installation (e.g. mechanical, electrical etc.).

(25) The rolling stock configuration on automatic or manual execution of commands as referred in points: 4.2.4.4.4, 4.2.4.8.2, 4.2.4.8.3, 4.2.8.2.4, 4.2.8.2.9.8 and 4.2.10.4.2 . This information shall be made available upon request when ETCS is installed.

(26) For units applying the conditions specified in point 7.1.1.5 , the following characteristics shall be provided:

(i) Applicable "single pole" power supply line voltages in accordance with point 4.2.11.6(2) ;

(ii) Maximum "single pole" power supply line current consumption of the unit at standstill (A) for each applicable "single pole" power supply line voltages;

(iii) For each band of the frequency management defined in the specification referenced in Appendix J-2 index [A] and in the specific cases or technical documents referred to in Article 13 of TSI CCS when they are available:

(1) Maximum interference current (A), and applicable summation rule;

(2) Maximum magnetic field (dBµA/m) both radiated field and field due to the return current, and applicable summation rule;

(3) Minimum vehicle impedance (Ohm).

(iv) Comparable parameters specified in the specific cases or in the technical documents referred to in Article 13 of CCS TSI when they are available.

(27) For units applying the conditions specified in point 7.1.1.5.1, the compliance/non-compliance of the unit with the requirements of points (19) to (22) of point 7.1.1.5.1 shall be provided.";

(110) the following point 4.2.13 is inserted:

"**4.2.13 Interface requirements with Automatic Train Operation on-board**

(1) This basic parameter describes the interface requirements applicable to units equipped with ETCS on-board and intended to be fitted with Automatic Train Operation on-board up to Grade of Automation 2. The requirements relate to the functionality needed to operate a train up to Grade of Automation 2 as defined in TSI CCS.

(2) Requirements applicable to units with regards to their interface with ETCS on-board and related to the train interface function 'Automatic Driving', when ATO is installed, are defined in the specification referenced in Appendix J-2, index [B].

(3) Where ATO on-board GoA1/2 functionality is implemented in newly developed vehicle designs, the index [84] and index [88] of Appendix A of TSI CCS shall be applied.

(4) Where ATO onboard GoA1/2 functionality is implemented in existing vehicle types and rolling stock in operation, the index [84] shall be applied, whereas index [88] may be used on a voluntary basis.";

(111) point 4.3 is replaced by the following:

"**4.3 Functional and technical specification of the interfaces**

4.3.1. Interface with Energy subsystem

Table 6

Interface with the Energy subsystem

Reference LOC & PAS TSI		Reference Energy TSI	
Parameter	Point	Parameter	Point
Gauging	4.2.3.1	Pantograph gauge	4.2.10
Pantograph head geometry	4.2.8.2.9.2		Appendix D
Operation within range of voltages and frequencies	4.2.8.2.2	Voltage and frequency	4.2.3
— Max current from OCL	4.2.8.2.4	Traction power supply performance	4.2.4
— Power factor	4.2.8.2.6	Traction power supply performance	4.2.4
— Maximum current at	4.2.8.2.5	— Current at standstill	4.2.5

standstill			
Regenerative brake with energy to OCL	4.2.8.2.3	Regenerative braking	4.2.6
Energy consumption measuring function	4.2.8.2.8	On-ground energy data collecting system	4.2.17
— Height of pantograph	4.2.8.2.9.1	Geometry of the overhead contact line	4.2.9
— Pantograph head geometry	4.2.8.2.9.2		
Contact strip material	4.2.8.2.9.4	Contact wire material	4.2.14
Pantograph static contact force	4.2.8.2.9.5	Mean contact force	4.2.11
Pantograph contact force and dynamic behaviour	4.2.8.2.9.6	Dynamic behaviour and quality of current collection	4.2.12
Arrangements of pantographs	4.2.8.2.9.7	Pantograph spacing	4.2.13
Running through phase or system separation section	4.2.8.2.9.8	Separation sections:	
		— phase	4.2.15
		— system	4.2.16
Electrical protection of the train	4.2.8.2.10	Electrical Protection Coordination Arrangements	4.2.7
Harmonics and dynamic effects for AC systems	4.2.8.2.7	Harmonics and Dynamic Effects for AC traction power supply systems	4.2.8

4.3.2. Interface with Infrastructure subsystem

Table 7

Interface with the Infrastructure subsystem

Reference LOC & PAS TSI		Reference Infrastructure TSI	
Parameter	Point	Parameter	Point
Rolling stock kinematic gauge	4.2.3.1.	Structure gauge	4.2.3.1
		Distance between track centres	4.2.3.2

		Minimum radius of vertical curve	4.2.3.5
Axle load parameter	4.2.3.2.1	Track resistance to vertical loads	4.2.6.1
		Lateral track resistance	4.2.6.3
		Resistance of new bridges to traffic loads	4.2.7.1
		Equivalent vertical loading for new earthworks and earth pressure effects	4.2.7.2
		Resistance of existing bridges and earthworks to traffic loads	4.2.7.4
Running dynamic behaviour	4.2.3.4.2.	Cant deficiency	4.2.4.3
Running dynamic limit values for track loading	4.2.3.4.2.2	Track resistance to vertical loads	4.2.6.1
		Lateral track resistance	4.2.6.3
Equivalent conicity	4.2.3.4.3	Equivalent conicity	4.2.4.5
Geometrical characteristics of wheelset	4.2.3.5.2.1	Nominal track gauge	4.2.4.1
Geometrical characteristics of wheels	4.2.3.5.2.2	Rail head profile for plain line	4.2.4.6
Automatic variable gauge systems	4.2.3.5.3	In service geometry of switches and crossings	4.2.5.3
Minimum curve radius	4.2.3.6	Minimum radius of horizontal curve	4.2.3.4
Maximum average deceleration	4.2.4.5.1	Longitudinal track resistance	4.2.6.2
		Actions due to traction and braking	4.2.7.1.5
Slipstream effects	4.2.6.2.1	Resistance of new structures over or adjacent to tracks	4.2.7.3
Head pressure pulse	4.2.6.2.2	Maximum pressure variations in tunnels	4.2.10.1
Maximum pressure variations in tunnels	4.2.6.2.3	Distance between track centres	4.2.3.2
Crosswind	4.2.6.2.4	Effect of crosswinds	4.2.10.2
Aerodynamic effect on ballasted track	4.2.6.2.5	Ballast pick-up	4.2.10.3

Toilet discharge system	4.2.11.3	Toilet discharge	4.2.12.2
Exterior cleaning through a washing plant	4.2.11.2.2	Train external cleaning facilities	4.2.12.3
Interface for water refilling	4.2.11.5	Water restocking	4.2.12.4
Refuelling equipment	4.2.11.7	Refuelling	4.2.12.5
Special requirements for stabling of trains	4.2.11.6	Electric shore supply	4.2.12.6

4.3.3. Interface with Operation subsystem

Table 8			
Interface with the Operation subsystem			
Reference LOC & PAS TSI		Reference Operation TSI	
Parameter	Point	Parameter	Point
Rescue coupling	4.2.2.2.4	Contingency arrangements	4.2.3.6.3
Axle load parameter	4.2.3.2	Train composition	4.2.2.5
Braking performance	4.2.4.5	Train braking	4.2.2.6
External front and rear lights	4.2.7.1	Train visibility	4.2.2.1
Horn	4.2.7.2	Train audibility	4.2.2.2
External visibility	4.2.9.1.3	Requirements for lineside signal and marker sighting	4.2.2.8
Optical characteristics of the windscreen	4.2.9.2.2		
Internal lighting	4.2.9.1.8		
Driver's activity control function	4.2.9.3.1	Driver vigilance	4.2.2.9
Recording device	4.2.9.6	Recording of monitoring data on-board the train	4.2.3.5 Appendix I

4.3.4. Interface with the Control, command and signalling subsystem

Table 9

Interface with the Control, command and signalling subsystem			
Reference TSI LOC & PAS		Reference TSI CCS	
Parameter	Point	Parameter	Point
Gauging	4.2.3.1	Position of Control-Command and Signalling on-board antennas	4.2.2
Rolling stock characteristics compatible with train detection system based on track circuits	4.2.3.3.1.1	Compatibility with trackside train detection systems: vehicle design Electromagnetic compatibility between rolling stock and Control-Command and Signalling trackside equipment	 4.2.10 4.2.11
Rolling stock characteristics compatible with train detection system based on axle counters	4.2.3.3.1.2	Compatibility with trackside train detection systems: vehicle design Electromagnetic compatibility between rolling stock and Control-Command and Signalling trackside equipment	4.2.10 4.2.11
Rolling stock characteristics compatible with loop equipment	4.2.3.3.1.3	Compatibility with trackside train detection systems: vehicle design	4.2.10
Running dynamic behaviour	4.2.3.4.2	ETCS onboard: Forwarding information/orders and receiving state information from rolling stock	4.2.2
Type of brake system	4.2.4.3		
Emergency braking command	4.2.4.4.1		
Service braking command	4.2.4.4.2		
Dynamic braking command	4.2.4.4.4		

Magnetic track brake	4.2.4.8.2		
Eddy current track brake	4.2.4.8.3		
Door opening	4.2.5.5.6		
Requirements on performance	4.2.8.1.2		
Maximum power and current from the overhead contact line	4.2.8.2.4		
Separation sections	4.2.8.2.9. 8		
Driver's desk — Ergonomics	4.2.9.1.6		
Radio Remote control function by staff for shunting operation	4.2.9.3.6		
Requirements for management of ETCS modes	4.2.9.3.8		
Traction status	4.2.9.3.9		
Smoke control	4.2.10.4.2		
Emergency braking performance	4.2.4.5.2	Guaranteed train braking performance and characteristics	4.2.2
Service braking performance	4.2.4.5.3.		
Head lights	4.2.7.1.1	Trackside Control-Command and Signalling objects	4.2.15
External visibility	4.2.9.1.3	Visibility of track-side Control-command Signalling objects	4.2.15
Optical characteristics	4.2.9.2.2		
Recording device	4.2.9.6	Interface to data recording for regulatory purposes	4.2.14
Dynamic braking command (Regenerative brake command)	4.2.4.4.4	ETCS DMI configuration	4.2.12
Magnetic track brake (command)	4.2.4.8.2		

Eddy current track brake (command)	4.2.4.8.3		
Separation sections	4.2.8.2.9.8		
Smoke control	4.2.10.4.2		
Interface requirements with Automatic Train Operation	4.2.13	On-Board ATO functionality	4.2.18
		System Requirements Specification	Specification referenced in Appendix A, Table A.2, index 84 of TSI CCS
		ATO-OB / ROLLING STOCK FFFIS	Specification referenced in Appendix A, Table A.2, index 88 of TSI CCS
		ETCS onboard: Forwarding information/orders and receiving state information from rolling stock	4.2.2

4.3.5 Interface with the Telematic application for passengers subsystem

Table 10			
Interface with the Telematic application for passengers subsystem			
Reference LOC & PAS TSI		Reference Telematic application for passengers TSI	
Parameter	Point	Parameter	Point
Customer information (PRM)	4.2.5	On board device display	4.2.13.1
Public address system	4.2.5.2	Automatic voice and announcement	4.2.13.2
Customer information (PRM)	4.2.5		

”;

(112) in point 4.4, point (4), “clause 4.2.12.4” is replaced by “point 4.2.12.4 ”;

(113) in point 4.5, point (1), “Section 3” is replaced by “Chapter 3”;

(114) in point 4.5, point (2), “section 4.2” is replaced by “point 4.2”;

(115) in point 4.8, point (2), “in the clause 4.2.12” is replaced by “in point 4.2.12 ”;

(116) point 4.9 is replaced by the following:

“**4.9 Route compatibility checks before the use of authorised vehicles**

The parameters of the subsystem ‘rolling stock — locomotives and passenger rolling stock’ to be used by the railway undertaking, for the purpose of route compatibility check, are described in Appendix D1 of the TSI OPE.”;

(117) in point 5.1, point (3), the third indent, “in Section 6.1” is replaced by “in point 6.1 ”;

(118) in point 5.2, point (1), “clause 6.1.5” is replaced by “point 6.1.5 ”;

(119) in point 5.3.1., point (1), “index 66” is replaced by “index [36] and the text of the note is replaced by the following:

“*Note:* types of automatic couplers other than type 10 are not considered as an IC (specification not publicly available).”;

(120) in point 5.3.2., point (1), all references to “index 67” are replaced by “index [37]” and all references to “index 68” are replaced by “index [38]”;

(121) in point 5.3.3., point (1), “index 69” is replaced by “index [39].”;

(122) in point 5.3.4., point (4), “clause 4.2.3.5.2.2.” is replaced by “point 4.2.3.5.2.2. .”;

(123) in point 5.3.4a, point (2) is replaced by the following:

“An automatic variable gauge system shall comply with the requirements set out in point 4.2.3.5.3 ; these requirements shall be assessed at IC level as set out in point 6.1.3.1a .”;

(124) points 5.3.6 to 5.3.15 are replaced by the following:

“*5.3.6 Head lamps*

(1) A head lamp is designed and assessed without any limitation concerning its area of use.

(2) A head lamp shall comply with requirements concerning the colour and the luminous intensity defined in point 4.2.7.1.1 . These requirements shall be assessed at IC level.

5.3.7. Marker lamps

(1) A marker lamp is designed and assessed without any limitation concerning its area of use.

(2) A marker lamp shall comply with requirements concerning the colour and the luminous intensity defined in point 4.2.7.1.2 . These requirements shall be assessed at IC level.

5.3.8. Tail lamps

(1) A tail lamp shall be designed and assessed for an area of use: fixed lamp or portable lamp.

(2) A tail lamp shall comply with the requirements concerning the colour and the luminous intensity defined in point 4.2.7.1.3 . These requirements shall be assessed at IC level.

(3) For portable tail lamps, the interface for attachment on the vehicle shall be in accordance with the Appendix E of the TSI WAG.

5.3.9. Horns

(1) A horn shall be designed and assessed for an area of use defined by its sound pressure level on a reference vehicle (or reference integration); this characteristic may be affected by the integration of the horn in a particular vehicle.

(2) A horn shall comply with the requirements concerning the soundings of signals defined in point 4.2.7.2.1 . These requirements shall be assessed at IC level.

5.3.10 Pantograph

A pantograph shall be designed and assessed for an area of use defined by:

(1) The type of voltage system(s), as defined in point 4.2.8.2.1 .

In case it is designed for different voltage systems, the various sets of requirements shall be taken into account.

(2) One of the 3 pantograph head geometries specified in point 4.2.8.2.9.2 .

(3) The current capacity, as defined in point 4.2.8.2.4 .

(4) The maximum current at standstill for AC and DC systems as defined in point 4.2.8.2.5 . For DC 1,5 kV supply systems, the material of the contact wire shall be considered.

(5) The maximum operating speed: assessment of the maximum operating speed shall be performed as defined in point 4.2.8.2.9.6 .

(6) Range of height for dynamic behaviour: standard, and/or for 1520 mm or 1524 mm track gauge systems.

(7) The requirements listed above shall be assessed at IC level.

(8) The working range in height of pantograph specified in point 4.2.8.2.9.1.2, the pantograph head geometry specified in point 4.2.8.2.9.2, the pantograph current capacity specified in point 4.2.8.2.9.3, the pantograph static contact force specified in point 4.2.8.2.9.5 and the dynamic behaviour of the pantograph itself specified in point 4.2.8.2.9.6 shall also be assessed at IC level.

5.3.11. Contact strips

(1) The contact strips are the replaceable parts of the pantograph head which are in contact with the contact wire.

Contact strips shall be designed and assessed for an area of use defined by:

(2) Their geometry, as defined in point 4.2.8.2.9.4.1 .

(3) The material of the contact strips, as defined in point 4.2.8.2.9.4.2 .

(4) The type of voltage system(s), as defined in point 4.2.8.2.1 .

(5) The current capacity, as defined in point 4.2.8.2.4 .

(6) The maximum current at standstill, as defined in point 4.2.8.2.5 .

(7) The requirements listed above shall be assessed at IC level.

5.3.12 Main circuit breaker

A main circuit breaker shall be designed and assessed for an area of use defined by:

(1) The type of voltage system(s), as defined in point 4.2.8.2.1 .

(2) The current capacity, as defined in point 4.2.8.2.4 (maximum current).

(3) The requirements listed above shall be assessed at IC level.

(4) The tripping shall be as specified in the specification referenced in Appendix J-1, index [22] (see point 4.2.8.2.10); it shall be assessed at the IC level.

5.3.13. Driver's seat

(1) A driver's seat shall be is designed and assessed for an area of use defined by the range of possible adjustments in height and longitudinal position.

(2) A driver's seat shall comply to the requirements specified at component level in the point 4.2.9.1.5 . These requirements shall be assessed at IC level.

5.3.14 Toilet discharge connection

(1) A toilet discharge connection is designed and assessed without any limitation concerning its area of use.

(2) A toilet discharge connection shall comply with requirements concerning the dimensions as defined in point 4.2.11.3 . These requirements shall be assessed at IC level.

5.3.15 Inlet connection for water tanks

(1) A inlet connection for water tanks is designed and assessed without any limitation concerning its area of use.

(2) A inlet connection for water tanks shall comply with requirements concerning the dimensions as defined in point 4.2.11.5 . These requirements shall be assessed at IC level.";

(125) in point 6.1.1., point (3), the first paragraph is replaced by the following:

"In case of a specific case applicable to a component defined as interoperability constituent in section 5.3 , the corresponding requirement can be part of the verification at interoperability constituent level only in the case where the component remains compliant to the chapters 4 and 5 , and where the specific case does not refer to a national rule.";

(126) point 6.1.2. is replaced as follows:

"6.1.2 Application of modules

Modules for EC certification of conformity of interoperability constituents:

Module CA	Internal production control
Module CA1	Internal production control plus product verification by individual examination
Module CA2	Internal production control plus product verification at random intervals
Module CB	EC-Type examination

Module CC	Conformity to type based on internal production control
Module CD	Conformity to type based on quality management system of the production process
Module CF	Conformity to type based on product verification
Module CH	Conformity based on full quality management system
Module CH1	Conformity based on full quality management system plus design examination
Module CV	Type validation by in service experience (Suitability for use)

(1) The manufacturer or his authorised representative established within the European Union shall choose one of the modules or module combinations indicated in the following table for the constituent to be assessed:

Point	**Constitu-ents to be assessed**	**Module CA**	**Module CA1 or CA2**	**Module CB + CC**	**Module CB + CD**	**Module CB + CF**	**Module CH**	**Module CH1**
5.3.1	Automatic centre buffer coupler		X ([1])		X	X	X ([1])	X
5.3.2	Manual end coupling		X ([1])		X	X	X ([1])	X
5.3.3	Towing coupler for rescue		X ([1])		X	X	X ([1])	X
5.3.4	Wheel		X ([1])		X	X	X ([1])	X
5.3.4a	Automatic variable gauge systems		X ([1])		X	X	X ([1])	X
5.3.5	Wheel slide protection system		X ([1])		X	X	X ([1])	X
5.3.6	Head lamp		X ([1])	X	X		X ([1])	X
5.3.7	Marker lamp		X ([1])	X	X		X ([1])	X

5.3.8	Tail lamp		X ([1])	X	X		X ([1])	X
5.3.9	Horns		X ([1])	X	X		X ([1])	X
5.3.10	Panto-graph		X ([1])		X	X	X ([1])	X
5.3.11	Panto-graph contact strips		X ([1])		X	X	X ([1])	X
5.3.12	Main circuit breaker		X ([1])		X	X	X ([1])	X
5.3.13	Driver's seat		X ([1])		X	X	X ([1])	X
5.3.14	Toilet discharge connection	X		X			X	
5.3.15	Inlet connection for water tanks	X		X			X	

([1]) Modules CA1, CA2 or CH may be used only in the case of products manufactured according to a design developed and already used to place products on the market before the entry into force of relevant TSIs applicable to those products, provided that the manufacturer demonstrates to the notified body that design review and type examination were performed for previous applications under comparable conditions, and are in conformity with the requirements of this TSI; this demonstration shall be documented, and is considered as providing the same level of proof as module CB or design examination according to module CH1.

(2) Where a particular procedure shall be used for the assessment, in addition to the requirements expressed in the point 4.2 , this is specified in the point 6.1.3 below.";

(127) point 6.1.3 is replaced by the following:

*"**6.1.3. Particular assessment procedures for interoperability constituents***

6.1.3.1. Wheels (point 5.3.4)

(1) The mechanical characteristics of the wheel shall be proven by mechanical strength calculations, taking into account three load cases: straight track (centred wheelset), curve (flange pressed against the rail), and negotiating of points and crossings (inside surface of flange applied to the rail), as specified in the specification referenced in Appendix J-1, index [40].

(2) For forged and rolled wheels, the decision criteria are defined in the specification referenced in Appendix J-1, index [40]; where the calculation

show values beyond the decision criteria, a bench test according to the same specification is required to be performed to demonstrate compliance.

(3) Other types of wheels are permitted for vehicles restricted to national use. In that case the decision criteria and the fatigue stress criteria shall be specified in national rules. Those national rules shall be notified by Member States.

(4) The assumption of the load conditions for the maximum vertical static force shall be explicitly stated in the technical documentation as set out in point 4.2.12 .

Thermo-mechanical behaviour:

(5) If the wheel is used to brake a unit with blocks acting on the wheel running surface, the wheel shall be thermo-mechanically proven by taking into account the maximum braking energy foreseen. The wheel shall be subject to a conformity assessment in accordance with the specification referenced in Appendix J-1, index [40], in order to check that the lateral displacement of the rim during braking and the residual stress are within tolerance limits specified utilising the decision criteria specified.

Verification of the wheels:

(6) A verification procedure shall exist to ensure at the production phase that no defects may detrimentally affect safety due to any change in the mechanical characteristics of the wheels.

The tensile strength of the material in the wheel, the hardness of the running surface, the fracture toughness, the resistance to impact, the material characteristics and the material cleanliness shall be verified.

The verification procedure shall specify the batch sampling used for each characteristic to be verified.

(7) Other conformity assessment method for wheels is allowed under the same conditions as for wheelsets; these conditions are described in point 6.2.3.7 .

(8) In case of innovative design for which the manufacturer has no sufficient return of experience, the wheel should be subject to an assessment of suitability for use (module CV; see also point 6.1.6).";

(128) point 6.1.3.1a is replaced by the following:

"**6.1.3.1a Automatic variable gauge system (point 5.3.4a)**

(1) The assessment procedure shall be based on a validation plan covering all aspects mentioned in points 4.2.3.5.3 and 5.3.4a .

(2) The validation plan shall be consistent with the safety analysis required in point 4.2.3.5.3 and shall define the assessment needed in all the following different phases:

– Design review;

– Static tests (bench tests and integration in the running gear/unit tests);

– Test on track gauge changeover facilities, representative of in-service conditions;

– On-track tests, representative of in-service conditions.

(3) Regarding the demonstration of compliance to point 4.2.3.5.3 (5) , the assumptions considered for the safety analysis related to the vehicle the system is intended to be integrated in, and related to the mission profile of that vehicle, shall be clearly documented.

(4) The automatic variable gauge system may be subject to an assessment of suitability for use (module CV; see also point 6.1.6).

(5) The certificate delivered by the Notified Body in charge of the conformity assessment shall include both the conditions for use as per point 5.3.4a (1) and the type(s) and operating conditions of the track gauge changeover facility(ies) the automatic variable gauge system has been assessed for.";

(129) points 6.1.3.2 to 6.1.3.8. are replaced by the following:

"**6.1.3.2. Wheel slide protection system (point 5.3.5)**

(1) The wheel slide protection system shall be verified according to the methodology defined in the specification referenced in Appendix J-1, index [15].

(2) In case of innovative design for which the manufacturer has no sufficient return of experience, the wheel slide protection system should be subject to an assessment of suitability for use (module CV; see also point 6.1.6).

6.1.3.3. Headlamps (point 5.3.6)

(1) The colour and luminous intensity of headlamps shall be tested in accordance with the specification referenced in Appendix J-1, index [20].

6.1.3.4. Marker lamps (point 5.3.7)

(1) The colour and luminous intensity of marker lamps and the spectral radiation distribution of light from marker lamps shall be tested in accordance with the specification referenced in Appendix J-1, index [20].

6.1.3.5. Tail lamps (point 5.3.8)

(1) The colour and luminous intensity of tail lamps shall be tested in accordance with the specification referenced in Appendix J-1, index [20]

6.1.3.6. Horn (point 5.3.9)

(1) Soundings and sound pressure levels of the warning horn shall be measured and verified in accordance with the specification referenced in Appendix J-1, index [21].

6.1.3.7.Pantograph (point 5.3.10)

(1) For pantographs for DC systems, the maximum current at standstill up to the limit values defined in 4.2.8.2.5 shall be verified in the following conditions:

– the pantograph shall be in contact with 2 plain copper contact wires or 2 copper alloyed with silver contact wires with a cross section of 100 mm^2 each for a 1,5 kV supply system,

– the pantograph shall be in contact with 1 copper contact wire with a cross section of 100 mm^2 for a 3 kV supply system.

(1a) For pantographs for DC systems the temperature of the contact wire with current at standstill shall be assessed by measurements according to the specification referenced in Appendix J-1, index [24].

(2) For all pantographs, the static contact force shall be verified in accordance with the specification referenced in Appendix J-1, index [23].

(3) The dynamic behaviour of the pantograph regarding current collection shall be assessed by simulation according to the specification referenced in Appendix J–1, index [41].

The simulations shall be made using at least two different types of overhead contact line; data for simulation shall correspond to sections of lines recorded as TSI compliant in the register of infrastructure (EC declaration of conformity, or declaration according to Commission Recommendation 2014/881/EU[2]) for the appropriate speed and supply system, up to the maximum design speed of the proposed Interoperability Constituent pantograph.

It is permitted to perform the simulation using types of overhead contact line that are under the process of IC certification or declaration according to Recommendation 2011/622/EU, provided that they fulfil the other requirements of Commission Regulation (EU) No 1301/2014 ('TSI ENE'). The simulated current collection quality shall be in accordance with point 4.2.8.2.9.6 for uplift, mean contact force and standard deviation for each of the overhead contact lines.

If the simulation results are acceptable, a site dynamic test shall be made using a representative section of one of the two types of overhead contact line used in the simulation.

The interaction characteristics shall be measured in accordance with the specification referenced in Appendix J-1, index [42]. Regarding the uplift measurement the uplift of at least two steady arms shall be measured.

The tested pantograph shall be mounted on a rolling stock producing a mean contact force within the upper and lower limits as required by point 4.2.8.2.9.6 up to the design speed of the pantograph. The tests shall be conducted in both directions of travel.

For pantographs intended to be operated on the 1435 mm and 1668 mm track gauge systems, the tests shall include track sections with low contact wire height (defined as between 5,0 to 5,3 m) and track sections with high contact wire height (defined as between 5,5 to 5,75 m).

For pantographs intended to be operated on the 1520 mm and 1524 mm track gauge systems, the tests shall include track sections with contact wire height between 6,0 to 6,3 m.

The tests shall be performed for a minimum of 3 speed increments up to and including the design speed of the tested pantograph.

[2] Commission Recommendation of 18 November 2014 on the procedure demonstrating the level of compliance of existing railway lines with the basic parameters of the technical specifications for interoperability (OJ L 356, 12.12.2014, p. 520).

The interval between successive tests shall be no greater than 50 km/h.

The measured current collection quality shall be in accordance with point 4.2.8.2.9.6 for uplift, and either mean contact force and standard deviation or percentage of arcing.

If all the assessments above are passed successfully, the tested pantograph design shall be considered as compliant to the TSI regarding quality of current collection.

For the use of a pantograph holding an EC declaration of verification on various designs of rolling stock, additional tests required at rolling stock level regarding quality of current collection are specified in point 6.2.3.20 .

6.1.3.8. Contact strips (point 5.3.11)

(1) Contact strips shall be verified as specified in the specification referenced in Appendix J-1, index [43].

(2) Contact strips, being replaceable parts of the pantograph head, shall be verified once at the same time as a pantograph (see point 6.1.3.7) regarding the quality of current collection.

(3) In case of use of a material for which the manufacturer as no sufficient return of experience, the contact strip should be subject to an assessment of suitability for use (module CV; see also point 6.1.6).";

(130) point 6.1.4. is replaced by the following:

"**6.1.4. Project phases where assessment is required**

(1) It is detailed in Appendix H in which phases of the project an assessment shall be done for the requirements applicable to the interoperability constituents:

(a) design and development phase:

(i) design review and/or design examination.

(ii) type test: test to verify the design, if and as defined in the Point 4.2;

(b) production phase: routine test to verify the conformity of production.

The entity in charge of the assessment of the routine tests is determined according to the assessment module chosen.

(2) Appendix H is structured according to point 4.2 ; the requirements and their assessment applicable to the interoperability constituents are identified in point 5.3 by reference to certain points of section 4.2; where relevant, a reference to a sub-point of point 6.1.3 above is also given.";

(131) point 6.1.6. is replaced by the following:

"**6.1.6. Assessment of suitability for use**

(1) Assessment of suitability for use according to the type validation of in service experience procedure (module CV) may be part of the assessment procedure for the following interoperability constituents:

– wheels (see point 6.1.3.1);

– automatic variable gauge system (see point 6.1.3.1a);

– wheel slide protection system (see point 6.1.3.2);

– contact strips (see point 6.1.3.8);

(2) Prior to commencing in service tests, a suitable module (CB or CH1) shall be used to certify the design of the constituent;

(3) The in service tests shall be organised on proposal from the manufacturer, who has to obtain an agreement with a railway undertaking for its contribution to such assessment.";

(132) in point 6.2.2. point (4), "the clause 4.2" is replaced by "point 4.2";

(133) point 6.2.3.1. is replaced by the following:

"**6.2.3.1 Load conditions and weighed mass (point 4.2.2.10)**

(1) Weighed mass shall be measured, for a load condition corresponding to 'design mass in working order' with the exception of consumables for which there is no imposition (for example 'dead mass' is acceptable).

(2) It is permissible to derive the other load conditions by calculation.

(3) Where a vehicle is declared as conformant to a type (in accordance with points 6.2.2 and 7.1.3):

– the weighed total vehicle mass in the load condition 'design mass in working order' shall not exceed by more than 3 % the declared total vehicle mass for that type which is reported in the type or design examination certificate of 'EC' verification and in the technical documentation described in point 4.2.12 .

– additionally, for unit of maximum design speed higher than or equal to 250 km/h the mass per axle for the load conditions 'design mass under normal payload' and 'operational mass under normal payload' shall not exceed by more than 4 % the declared mass per axle for the same load condition.";

(134) in point 6.2.3.3., point (1), "index 83" is replaced by "index [9]";

(135) point 6.2.3.4. is replaced by the following:

"**6.2.3.4. Running dynamic behaviour – technical requirements (Point 4.2.3.4.2a)**

(1) For units designed to be operated on 1435 mm or 1524 mm or 1668 mm system, the demonstration of conformity shall be carried out in accordance with the specification referenced in Appendix J-1, index [9].

The parameters described in points 4.2.3.4.2.1 and 4.2.3.4.2.2 shall be assessed using criteria defined in the specification referenced in Appendix J-1, index [9].";

(136) Point 6.2.3.5. is replaced by the following:

"**6.2.3.5. Conformity assessment for safety requirements**

The demonstration of compliance with the safety requirements expressed in the point 4.2 shall be performed as follows:

(1) The scope of this assessment shall be strictly limited to the rolling stock design, considering that operation, test and maintenance are performed according to the rules defined by the applicant (as described in the technical file).

Notes:

– When defining the test and maintenance requirements, the safety level to be met has to be taken into account by the applicant (consistency); the demonstration of compliance covers also test and maintenance requirements.

– Other sub-systems and human factors (errors) shall not be considered.

(2) All assumptions considered for the mission profile shall be clearly documented in the demonstration

(3) The compliance with the safety requirements that are specified in points 4.2.3.4.2, 4.2.3.5.3, 4.2.4.2.2, 4.2.5.3.5, 4.2.5.5.8 and 4.2.5.5.9 in terms of level of severity/consequences associated to hazardous failure scenarios shall be demonstrated by one of the two following methods:

1. Application of a harmonised risk acceptance criterion associated to the severity specified in point 4.2 (e.g. 'fatalities' for emergency braking.).

   The applicant may choose to use this method, provided that there is an available harmonized risk acceptance criterion defined in the CSM on Risk Assessment.

   The applicant shall demonstrate compliance with the harmonised criterion by applying Annex I-3 of the CSM on RA. The following principles (and their combinations) may be used for the demonstration: similarity with reference system(s); application of codes of practice; application of explicit risk estimation (e.g. probabilistic approach).

   The applicant shall designate the body for the assessment of the demonstration he will provide: the notified body selected for the RST subsystem or an assessment body as defined in the CSM on RA.

   The demonstration shall be recognized in all Member States; or

2. Application of a risk evaluation and assessment in accordance with the CSM on RA, in order to define the risk acceptance criterion to be used, and demonstrate compliance to this criterion.

   The applicant may choose to use this method in any case.

   The applicant shall designate the assessment body for the assessment of the demonstration he will provide, as defined in the CSM on RA.

   A safety assessment report shall be provided in compliance with the requirements defined in the CSM on RA and its amendments.

   The safety assessment report shall be taken into account by the Authorising Entity, in accordance with point 2.5.6 of Annex I and Article 15(2) of the CSM on RA.

(4) For each TSI point listed in point (3) above, the relevant documents accompanying the EC declaration of verification (e.g. EC certificate issued by the notified body or safety assessment report) shall explicitly mention the 'used method' ('1' or '2'); in case of method '2', they shall also mention the 'used risk acceptance criterion'.";

(137) point 6.2.3.6. is amended as follows:

(a) point (1) is amended as follows:

(i) in the first subparagraph, “(Dimension SR in Figure 1 , § 4.2.3.5.2.1)” is replaced by “(Dimension SR in Figure 1, point 4.2.3.5.2.1);

(ii) in the second subparagraph, “index 107” is replaced by “index [9]”;

(iii) in Table 12, “index 85” is replaced by “index [44]”;

(iv) in the third subparagraph, “index 86” is replaced by “index [45]”;

(b) point (2) is amended as follows:

(i) in Table 14, “index 85” is replaced by “index [44]”;

(ii) in the second subparagraph, “index 86” is replaced by “index [45]”;

(c) point (3) is amended as follows:

(i) in Table 14, “index 85” is replaced by “index [44]”;

(ii) in the second subparagraph, “index 86” is replaced by “index [45]”;

(138) point 6.2.3.7. is amended as follows:

(a) in point (1) “index 87” is replaced by “index [46]”;

(b) point (2) is replaced by the following:

“(2) The demonstration of compliance for mechanical resistance and fatigue characteristics of the axle shall be in accordance with the specification referenced in Appendix J-1, index [47].

The decision criteria for the permissible stress is specified in the specification referenced in Appendix J-1, index [47].”;

(c) in point (6), “index 90” is replaced by “index [48]”;

(139) point 6.2.3.8 is amended as follows:

(a) in point (1) “index 91” is replaced by “index [66]”;

(b) in point (3), the first paragraph is replaced by the following:

“(3) Tests shall be carried out for the load conditions of the unit ‘design mass in working order’, ‘design mass under normal payload’, and ‘maximum braking load’ (as defined in points 4.2.2.10 and 4.2.4.5.2).”;

(140) point 6.2.3.9. is replaced:

“**6.2.3.9. Service braking (point 4.2.4.5.3)**

(1) The maximum service braking performance which is subject to a test is the stopping distance as defined in the specification referenced in Appendix J-1, index [66]. The deceleration is evaluated from the stopping distance.

(2) Tests shall be carried out on dry rail at the initial speed equal to the maximum design speed of the unit, the load condition of the unit being one of those defined in the point 4.2.4.5.2 .

(3) Test results shall be evaluated by a methodology that takes into account the following aspects:

– correction of the raw data,

– repeatability of the test: in order to validate a test result, the test is repeated several times; the absolute difference between results and the standard deviation are evaluated.";

(141) in point 6.2.3.10, point (1) "index 93" is replaced by "index [15]";

(142) point 6.2.3.13 is replaced by the following:

"**6.2.3.13 Slipstream effects on passengers on platform and on workers trackside (point 4.2.6.2.1)**

(1) Demonstration of conformity with the limit value of trackside maximum permissible air speed set out in point 4.2.6.2.1 shall be demonstrated on the basis of full-scale tests on straight track performed in accordance with the specification referenced in Appendix J-1, index [49].

(2) Instead of the full assessment described above, it is permitted to carry out a simplified assessment for rolling stock of a similar design to rolling stock for which the full assessment defined in this TSI has been carried out. In such cases, the simplified conformity assessment defined the specification referenced in Appendix J-1, index [49], can be applied as long as the differences in the design remain within the limits defined in the same specification.";

(143) point 6.2.3.14 is replaced by the following:

"**Head pressure pulse (point 4.2.6.2.2)**

(1) Conformity shall be assessed on the basis of full-scale tests under conditions specified in the specification referenced in Appendix J-1, index [49]. Alternatively conformity may be assessed by means of either validated Computational Fluid Dynamics (CFD) simulations or by moving model tests as specified in the same specification.

(2) Instead of the full assessment described above, it is permitted to carry out a simplified assessment for rolling stock of a similar design to rolling stock for which the full assessment defined in this TSI has been carried out. In such cases, the simplified conformity assessment defined in the specification referenced in Appendix J-1, index [49], can be applied as long as the differences in the design remain within the limits defined in the same specification.";

(144) point 6.2.3.15 is replaced by the following:

"6.2.3.15. Maximum pressure variations in tunnels (point 4.2.6.2.3)

The conformity assessment procedure is described in specification referenced to in Appendix J-1, Index [50].";

(145) points 6.2.3.16 to 6.2.3.19 are replaced by the following:

"**6.2.3.16 Crosswind (point 4.2.6.2.4)**

(1) Conformity assessment is fully specified in point 4.2.6.2.4

6.2.3.17 Warning Horn sound pressure levels (point 4.2.7.2.2)

(1) Sound pressure levels of the warning horn shall be measured and verified in accordance with the specification referenced in Appendix J-1, index [21].

6.2.3.18 Maximum power and current from the overhead contact line (point 4.2.8.2.4)

(1) Conformity assessment shall be carried out in accordance with the specification referenced in Appendix J-1, index [22].

6.2.3.19 Power factor (point 4.2.8.2.6)

(1) Conformity assessment shall be carried out according to the specification referenced in Appendix J-1, index [22].";

(146) point 6.2.3.19a is replaced by the following:

"**6.2.3.19a On-board energy measurement system (point 4.2.8.2.8)**

(1) Energy measurement function (EMF)

The accuracy of each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions, using the relevant method as described in the specification referenced in Appendix J-1, index [56]. The input quantity and power factor range when testing shall correspond to the values set out in the same specification.

The effects of temperature on accuracy of each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions (except for temperature), using the relevant method as described in the specification referenced in Appendix J-1, index [56].

The mean temperature coefficient of each device containing one or more functions of EMF shall be assessed by testing each function, under reference conditions (except for temperature), using the relevant method as described in the specification referenced in Appendix J-1, index [56].

In cases where point 4.2.8.2.8.2 (6) applies, the conformity of the existing components to that point may be assessed according to another standard than the specification referenced in Appendix J-1, index [56] or according to a previous version of that specification.

(2) Data handling system (DHS)

The compiling and handling of data within the DHS shall be assessed by testing using the method as described in the specification referenced in Appendix J-1, index [55].

(3) On-board energy measurement system (EMS)

The EMS shall be assessed by testing as described in the specification referenced in the specification referenced in Appendix J-1, index [59].";

(147) point 6.2.3.20 is replaced by the following:

"**6.2.3.20 Current collection dynamic behaviour (point 4.2.8.2.9.6)**

(1) When pantographs, holding an EC declaration of conformity or suitability for use as IC, are integrated in a rolling stock unit which is assessed according to point 4.2.8.2.9.6 , dynamic tests shall be carried out in order to measure the uplift, and either mean contact force and standard deviation or the percentage of arcing, in accordance with the specification referenced in Appendix J-1, index [42] up to the design speed for the unit.

(2) For a unit designed to be operated on the 1435 mm and 1668 mm track gauge systems, the tests, for each installed pantograph, shall be conducted in both directions of travel and shall include track sections with low contact wire height (defined as between 5,0 to 5,3 m) and track sections with high contact wire height (defined as between 5,5 to 5,75 m).

For units designed to be operated on the 1520 mm and 1524 mm track gauge systems, the tests shall include track sections with contact wire height between 6,0 to 6,3 m.

(3) The tests shall be performed for a minimum of 3 speed increments up to and including the maximum design speed of the unit. The interval between successive tests shall be no greater than 50 km/h.

(4) During the test, the static contact force shall be adjusted for each particular power supply system within the range, as specified in point 4.2.8.2.9.5).

(5) The measured results shall be in accordance with point 4.2.8.2.9.6 for uplift and either mean contact force and standard deviation or percentage of arcing. Regarding the uplift measurement, the uplift of at least two steady arms shall be measured.";

(148) point 6.2.3.21 is replaced by following:

"**6.2.3.21 Arrangement of pantographs (point 4.2.8.2.9.7)**

(1) The characteristics related to the dynamic behaviour of the current collection shall be verified as specified in point 6.2.3.20 above.

(2) Tests are required for the poorest performing pantographs regarding maximum uplift and regarding maximum standard deviation or arcing. The arrangements containing poorest performing pantographs shall be identified by simulation or measurement referenced in Appendix J-1, indexes [41] and [42].";

(149) in point 6.2.3.22, point (1), "index 101" is replaced by "index [28]";

(150) in point 6.2.3.23, point (1), "requirement 4.2.10.3.2(1)" is replaced by "requirement 4.2.10.3.2(1) ";

(151) in point 6.2.4., point (2), "Section 4.2" is replaced by "point 4.2 ".

(152) point 6.2.5 is replaced by the following :

"6.2.5. Innovative solutions

(1) If an innovative solution (as defined article 10), is proposed for the rolling stock subsystem, the applicant shall apply the procedure described in article 10";

(153) point 6.2.6 is replaced by the following:

"6.2.6 Assessment of documentation requested for operation and maintenance

Pursuant to Article 15(4) of Directive (EU) 2016/797, the applicant is responsible for compiling the technical file, containing the documentation requested for operation and maintenance.";

(154) point 6.2.7. is replaced by the following:

"6.2.7. Assessment of units intended to be used in general operation

(1) Where a new, upgraded or renewed unit to be used in general operation is subject to assessment against this TSI (in accordance with point 4.1.2), some of the TSI requirements require a reference train for their assessment. This is mentioned in the relevant provisions of point 4.2 . Similarly, some of the TSI requirements at train level cannot be assessed at unit level; such cases are described for the relevant requirements in Point 4.2 .

(2) The area of use in terms of rolling stock type which, coupled with the unit to be assessed, ensures that the train is compliant with the TSI is not verified by the Notified Body.

(3) After such a unit has received the authorisation to be placed in service, its use in a train formation (whether TSI compliant or not) shall be dealt with under the responsibility of the Railway Undertaking, according to the rules defined in point 4.2.2.5 of the TSI OPE (train composition).";

(155) point 6.2.7a is deleted;

(156) point 6.2.8. is replaced by the following:

"6.2.8 Assessment of units intended to be used in predefined formation(s)

(1) Where a new, upgraded or renewed unit to be included in predefined formation(s) is subject to assessment (in accordance with point 4.1.2), the EC certificate of verification shall identify the formation(s) for which the assessment is valid: the rolling stock type coupled with the unit to be assessed, number of vehicles in the formation(s), arrangement of the vehicles in the formation(s) that will ensure that the train formation will be compliant with this TSI.

(2) TSI requirements at train level shall be assessed with use of a reference train formation when and as specified in this TSI.

(3) After such a unit has received the authorisation to be placed in service, it may be coupled with other units to constitute the formations mentioned in the EC certificate of verification.";

(157) in point 6.2.9.2, point (1), "(see also clause 7.1.2.2.)" is replaced by "(see also point 7.1.2.2.).";

(158) the following points 6.2.10 and 6.2.11 are inserted:

"6.2.10 *EC verification when ETCS is installed on-board a rolling stock/rolling stock type*

(1) This case applies when ETCS on-board is installed into:

– newly developed vehicle designs requiring a first authorisation as defined in Article 14 of Commission Implementing Regulation 2018/545*,

– all other vehicle types and rolling stock in operation.

Compliance of the rolling stock with train interface functions requirements of each basic parameter that refers to Appendix A, Table A.2, index 7 of TSI CCS (see column 1 and 2 of Table 9) can be assessed only when ETCS is installed.

(2) The assessment of the interface functions for installation of ETCS in the vehicle is part of the EC verification for the CCS on-board subsystem in accordance with point 6.3.3 of TSI CCS.

Note: Other requirements defined in this TSI applicable to Rolling stock are part of EC verification for the rolling stock subsystem.

6.2.11 *EC verification for rolling stock/rolling stock type when ATO on-board is installed*

(1) This point applies to units equipped with ETCS on-board and intended to be fitted with Automatic Train Operation on-board up to Grade of Automation 2.

(2) The compliance of the rolling stock with interface requirements specified in Appendix A, Table A.2, indexes 84 and 88 of TSI CCS can be assessed only when ATO is installed.

(3) The assessment of the interface requirements for integration of the ATO on-board in the vehicle is part of the EC verification for the CCS on-board subsystem in accordance with point 6.3.3 of TSI CCS.

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* Commission Implementing Regulation (EU) 2018/545 of 4 April 2018 establishing practical arrangements for the railway vehicle authorisation and railway vehicle type authorisation process pursuant to Directive (EU) 2016/797 of the European Parliament and of the Council (OJ L 90, 6.4.2018, p. 66).";

(159) point 6.3 is replaced by the following:

"6.3 Maintenance of subsystems containing Interoperability constituents not holding an EC declaration

(1) For subsystems holding an EC certificate of verification and incorporating interoperability constituents not covered by an EC declaration of conformity or suitability for use, interoperability constituents which do not hold an EC declaration of conformity or suitability for use and of the same type are permitted to be used as components for maintenance related replacements (spare parts) for the subsystem, under the responsibility of the ECM.

(2) In any case the ECM must ensure that the components for maintenance related replacements are suitable for their applications, are used within their area of use, and enable interoperability to be achieved within the rail system while at the same time meeting the essential requirements. Such components must be traceable and certified in accordance with any national or international rule, or any code of practice widely acknowledged in the railway domain.

(3) Points (1) and (2) above are applicable until the components in question are part of an upgrade or renewal of the subsystem according to point 7.1.2 .";

(160) point 7.1 is replaced by the following:

"**7.1 General rules for implementation**

7.1.1. ***General***

7.1.1.1. Application to newly built rolling stock

(1) This TSI is applicable to all units of rolling stock in its scope which are placed on the market after the date of application set out in Article 12, except where

point 7.1.1.2 'Application to ongoing projects' or point 7.1.1.3 'Application to special vehicles, such as on-track machines' below apply.

(2) Compliance with this Annex in its version applicable before [Publications Office: please insert the date of entry into force of this amending act] is deemed equivalent to compliance with this TSI, except for changes listed in Appendix L.

7.1.1.2. Application to ongoing projects

(1) The application of the version of this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]* is not mandatory for projects that, on that date, are in phase A or phase B as defined in point 7.1.3.1 of the 'previous TSI' (i.e. this Regulation, as amended by Commission Implementing Regulation (EU) 2020/387[3]).

(2) Without prejudice to Appendix L, Table L.2 , the application of the requirements of Chapters 4, 5, 6 to projects referred in point (1) is possible on a voluntary basis.

(3) If the applicant chooses not to apply this TSI version to an ongoing project, the version of this TSI applicable at the beginning of phase A as referred to in point (1) remains applicable.

7.1.1.3. Application to special vehicles

(1) The application of this TSI and TSI NOI to special vehicles in running mode (as defined in points 2.2 and 2.3) is mandatory if the area of use covers more than one Member State.

(2) The application of this TSI and TSI NOI to special vehicles in running mode other than the ones referred in to point (1) is not mandatory.

(a) If national rules different to this TSI or TSI NOI do not exist, the applicant shall use the conformity assessment process as described in the point 6.2.1 to establish an EC declaration of verification against this TSI; this EC declaration of verification shall be recognised as such by Member States.

(b) In case national rules different to this TSI or TSI NOI exist and the applicant chooses not to apply the respective TSIs as regards the relevant basic parameters of these TSIs, the special vehicle may be authorised in accordance with Article 21 of Directive (EU) 2016/797 against national rules as regards the selected basic parameters.

(3) When applying point 2 (b), the assessment of the driver's cab interior noise level (see point 4.2.4 of the TSI NOI) is mandatory for all special vehicles.

[3] Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem 'rolling stock — locomotives and passenger rolling stock' (OJ L 356 12.12.2014, p. 228).

7.1.1.4. Transitional measure for fire safety requirement

During a transitional period ending on 1st January 2026, it is permitted, as an alternative to material requirements specified in point 4.2.10.2.1, to apply the verification of conformity to the material fire safety requirements using the appropriate operation category from EN 45545-2:2013+A1:2015.

7.1.1.5. Conditions for having a vehicle type authorisation and/or an authorisation for placing on the market of passenger coaches not limited to a particular area of use.

(1) This point applies to passenger coaches and other related cars as defined in point 2.2.2(A)(3), excluding those equipped with a driving cab.

(2) The conditions for having a vehicle type authorisation and/or an authorisation for placing on the market not limited to a particular area of use are specified in points 7.1.1.5.1 and 7.1.1.5.2 as additional requirements to be covered in the EC verification of the subsystem rolling stock. These conditions shall be seen as complementary to the requirements of this TSI, the TSI PRM and the TSI NOI and shall be fulfilled in their entirety.

(3) The compliance with the set of conditions specified in point 7.1.1.5.1 is mandatory. It lists the conditions applicable to coaches intended to be used in predefined formation.

(4) The compliance with the set of conditions specified in point 7.1.1.5.2 is optional. That point lists additional conditions that are applicable to coaches intended to be used in general operation.

7.1.1.5.1 Conditions applicable to coaches intended to be used in predefined formations

(1) The vehicle shall correspond to a unit (as defined in this TSI) composed of a rolling stock subsystem only without CCS on-board installed.

(2) The unit is without traction.

(3) The unit shall be designed for operation on at least one of the following track gauges:

(a) 1435 mm,

(b) 1668 mm.

(4) The unit shall be equipped with forged and rolled wheels assessed in accordance with point 6.1.3.1.

(5) The unit shall be equipped with wheels having minimum wheel diameter above 760 mm.

(6) The unit shall be compatible with following rail inclination: 1/20, 1/30 and 1/40. Non compatibility with one or several rail inclinations shall exclude the concerned network(s) of the area of use.

(7) The unit shall be declared as compliant with one of the following reference profiles: G1, GA, GB, GC or DE3 including those used for the lower part GI1, GI2 or GI3.

(8) The maximum speed of the unit shall be lower than 250 km/h.

(9) Units of category B referred to in point 4.1.4 shall be equipped with full cross section partitions in accordance with point 4.2.10.3.4 (3), except sleeping coaches which shall be equipped with other Fire Containment and Control Systems (FCCS) in accordance with point 4.2.10.3.4 (4).

(10) If the unit is equipped with flange lubricators, it shall be possible to activate/deactivate them in accordance with the specification referenced in Appendix J-2 index [A].

(11) If the unit is equipped with eddy current track brake, it shall be possible to activate/deactivate them in accordance with the specification referenced in Appendix J-2 index [A].

(12) If the unit is equipped with magnetic track brake, it shall be possible to activate/deactivate them in accordance with the specification referenced in Appendix J-2 index [A].

(13) Units fitted with an EN-UIC brake system shall be tested in accordance with the specification referenced in Appendix J-1 index [71].

(14) If the unit is intended to operate in mixed traffic in tunnels, higher aerodynamic loads shall be considered in accordance with the specification referenced in Appendix J-1 index [50].

(15) The unit shall be compliant with the specification referenced in Appendix J-2 index [A].

(16) The following unit characteristics shall be recorded in the technical documentation described in point 4.2.12.2 (26):

(a) Applicable “single pole” power supply line voltages in accordance with point 4.2.11.6 (2),

(b) Maximum “single pole” power supply line current consumption of the unit at standstill (A) for each applicable “single pole” power supply line voltages,

(c) For each band of the frequency management defined in the specification referenced in Appendix J-2 index [A] and in the specific cases or technical documents referred to in Article 13 of TSI CCS when they are available. Pending the notification of specific cases referred to in Article 13 of CCS TSI, the notified national rules remain applicable:

(i) Maximum interference current (A), and applicable summation rule,

(ii) Maximum magnetic field (dBµA/m) both radiated field and field due to the return current, and applicable summation rule,

(iii) Minimum vehicle impedance (Ohm).

(d) Comparable parameters specified in the specific cases or in the technical documents referred to in Article 13 of CCS TSI when they are available.

In order to determine the characteristics listed in subclauses (c) and (d), the unit shall be tested. The parameters of subclauses (a) and (b) can be determined by simulation, calculation or testing.

(17) Electric interfaces between units and communication protocols shall be described in the general documentation described in point 4.2.12.2(3a) of this

TSI, with the reference to the standards or other normative documents that have been applied.

(18) Communication networks shall comply with the specification referenced in Appendix J-1, index [53].

(19) The compliance/non-compliance with the specific case on the step position for vehicle access and egress defined in point 7.3.2.6 of the TSI PRM shall be recorded in the technical file. For units intended to operate in Germany, the compliance/non-compliance with the specific cases shall be documented by the application of the specification referenced in Appendix J-1 index [74] to Table 20 and Table 21 of the PRM TSI.

(20) For units designed for operation on 1435mm track gauge, the following specific cases shall also be considered:

(a) The compliance/non-compliance with the requirements regarding the axle bearing condition monitoring by line side equipment as set out in point 7.3.2.3 shall be recorded in the technical file.

(b) The compliance/non-compliance with the requirements regarding aerodynamic effects as set out in point 7.3.2.8 shall be recorded in the technical file. Non-compliance with the requirements shall exclude Italy from the area of use.

(c) The compliance/non-compliance with the requirements regarding fire safety and evacuation as set out in point 7.3.2.20 shall be recorded in the technical file. Non-compliance with the requirements shall exclude Italy from the area of use.

(d) The compliance/non-compliance with requirements regarding running capability and fire containment and control system as set out in point 7.3.2.21 shall be recorded in the technical file. Non-compliance with the requirements shall exclude the Channel tunnel from the area of use.

(e) The compliance/non-compliance with the requirements regarding the axle bearing condition monitoring by line side equipment as set out in point 7.3.2.3 shall be recorded in the technical file. Non-compliance with the requirements shall exclude France and/or Sweden from the area of use.

(f) For units intended to operate in Germany, the compliance/non-compliance of the unit characteristic wind curve (CWC) with the limits defined in the document referenced in Appendix J-2 index [C] shall be recorded in the technical file. Non-compliance with the requirements shall exclude Germany from the area of use.

(g) For units intended to operate in Germany on lines with a gradient above 40 ‰, the compliance/non-compliance with requirements defined in the document referenced in Appendix J-2 index [D] shall be recorded in the technical file. Non-compliance does not prevent the access of the unit to the national network.

(h) For units intended to operate in Germany, the compliance/non-compliance of the emergency exits with the document referenced in Appendix J-2 index [E] shall be recorded in the technical file. Non-

compliance with the requirements shall exclude Germany from the area of use.

(i) For units intended to operate in Austria, the verification of the requirement for wheel-rail contact geometry, shall consider in addition to point 4.2.3.4.3, the following network characteristics:

- $V \leq 160$ km/h: $0.7 \leq \tan \gamma e < 0.8$
- 160 km/h $< V \leq 200$ km/h: $0.5 \leq \tan \gamma e < 0.6$
- $V > 200$ km/h: $0.3 \leq \tan \gamma e < 0.4$

The compliance/non-compliance with requirements shall be recorded in the technical file. Non-compliance with the requirements shall result in a limitation of the vehicle speed.

(j) For units intended to operate in Germany, the verification of the requirement for wheel-rail contact geometry, shall consider in addition to point 4.2.3.4.3, the following network characteristics:

- $V \leq 160$ km/h: $\tan \gamma e \leq 0.8$;
- $160 < V \leq 230$ km/h: $\tan \gamma e \leq 0.5$;
- $V > 230$ km/h: $\tan \gamma e \leq 0.3$.

The compliance/non-compliance with requirements shall be recorded in the technical file. Non-compliance with the requirements shall result in a limitation of the vehicle speed.

(21) For units designed for operation on 1668 mm track gauge, the compliance with points 7.3.2.5 and 7.3.2.6 is mandatory and the following specific cases shall be considered:

(a) The compliance/ non-compliance with the specific case on bogies designed to run on 1 668 mm track gauge defined in point 7.3.2.5a shall be recorded in the technical file. Non-compliance shall exclude Spanish 1 668 mm track gauge network from the area of use.

(b) The compliance/ non-compliance with the specific case on the step position for vehicle access and egress defined in point 7.3.2.6 of the TSI PRM shall be recorded in the technical file. For units designed for operation on 1435mm track gauge and not compliant with the specific case, point 7.3.2.7 of the TSI PRM shall apply.

(22) Non-compliance with any specific environmental condition as set out in point 7.4 shall result in restrictions of use on the network for which the specific condition has been defined, but not in the exclusion of that network from the area of use.

(23) The unit shall be marked in accordance with the specification referenced in Appendix J-1, index [5]

7.1.1.5.2 Additional optional conditions applicable to coaches intended to be used in general operation

(1) The compliance with the following set of conditions set out in points (2) to (12) is optional and aims to facilitate exchange of units intended to be used within train formations that aren't defined at design stage, i.e. units for general operations. Compliance with these provisions does not assure full interchangeability of units and does not exempt the railway undertaking of its responsibilities regarding the use of these units in a train formation as defined in point 6.2.7. If the applicant selects this option, a notified body shall assess the compliance within the EC verification procedure. This shall be reported in the certificate and in the technical documentation.

(2) The unit shall be fitted with a manual coupling system as defined in points 4.2.2.2.3(b) and 5.3.2.

(3) The unit shall be fitted with an EN-UIC braking system as defined in the specification referenced in Appendix J-1, index [12] and index [70]. The braking system shall be tested in accordance with the specification referenced in Appendix J-1 index [71].

(4) The unit shall meet the requirements of this TSI at least within the temperature range T1 (– 25 °C to + 40 °C; nominal) as defined in point 4.2.6.1 and in the specification referenced in Appendix J-1, index [18].

(5) The tail lights requested in point 4.2.7.1 shall be provided by fixed tail lamps.

(6) If the unit is fitted with a gangway, the gangway shall fulfil the specification referenced in Appendix J-1, index [54].

(7) "Single pole" power supply shall be compliant to point 4.2.11.6 (4).

(8) The physical interface between units for the signal transmission shall ensure that the cable and plug of at least one line is compatible with the 18-conductor cable defined in the plate 2 of the specification referenced in Appendix J-1, index [61].

(9) The door control device specified in point 4.2.5.5.3 shall be in accordance with the specifications described in Appendix J-1 index [17].

7.1.2. ***Changes to rolling stock in operation or to an existing rolling stock type***

7.1.2.1. Introduction

(1) This point 7.1.2 defines the principles to be applied by the entities managing the change and authorising entities in line with the EC verification procedure described in Article 15(9), Article 21(12) of Directive (EU) 2016/797 and Annex IV thereto. This procedure is further developed in Article 13, 15 and 16 of Implementing Regulation (EU) 2018/545 and in Decision 2010/713/EU.

(2) This point 7.1.2 applies in case of any change(s) to rolling stock in operation or to an existing rolling stock type, including renewal or upgrade. It does not apply in case of changes:

– that do not introduce a deviation from the technical files accompanying the EC declarations for verification for the subsystems, if any, and

– that do not have an impact on basic parameters not covered by the EC declaration, if any.

The holder of the vehicle type authorisation shall provide, under reasonable conditions, the information necessary for assessing the changes to the entity managing the change.

7.1.2.2. Rules to manage changes in both rolling stock and rolling stock type

(1) Parts and basic parameters of the rolling stock that are not affected by the change(s) are exempt from conformity assessment against the provisions in this TSI.

(2) Without prejudice to points 7.1.2.2a and 7.1.3, compliance with the requirements of this TSI, the TSI NOI (see point 7.2 of that TSI) and the TSI PRM (see point 7.2.3 of that TSI) shall only be needed for the basic parameters in this TSI which may be affected by the change(s).

(3) In accordance with Articles 15 and 16 of Implementing Regulation (EU) 2018/545 and Decision 2010/713/EU and by application of modules SB, SD/SF or SH1 for the EC verification, and if relevant in accordance with Article 15(5) of Directive (EU) 2016/797, the entity managing the change shall inform a notified body of all changes affecting the conformity of the subsystem with requirements of the relevant TSI(s) requiring new checks by a notified body. This information shall be provided by the entity managing the change with corresponding references to the technical documentation relating to the existing EC type or design examination certificate.

(4) Without prejudice of the general safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797, in case of changes requiring reassessment of the safety requirements set out in points 4.2.3.4.2, 4.2.3.5.3, 4.2.4.2.2, 4.2.5.3.5, 4.2.5.5.8 and 4.2.5.5.9 , the procedure set out in point 6.2.3.5 shall be applied. Table 17 below sets out when a new authorisation is required.

Table 17				
Vehicle originally assessed against…				
		First method of point 6.2.3.5(3)	Second method of point 6.2.3.5(3)	No CSM on RA applied
Change assessed against…	First method of point 6.2.3.5(3)	No new authorisation required	Check (1)	No new authorisation required
	Second method of point 6.2.3.5(3)	Check (1)	Check (1)	Check (1)
	No CSM on RA applied	Not possible	Not possible	Not possible
(1) The word 'Check' means that the applicant will apply Annex I of the CSM on RA in order to demonstrate that the changed vehicle ensures an equal or higher level of safety. This demonstration shall be independently assessed by an assessment body as defined in CSM on RA. If the body concludes that the new safety assessment demonstrates a lower level of safety or the result is unclear, the applicant shall request an authorization for placing on the market.				

The following lines are added in table 17a:

Table 17a			
Basic design characteristics related to basic parameters set out in the LOC&PAS TSI			
1. TSI clause	2. Related basic design characteristic(s)	3. Changes impacting the basic design characteristic and not classified as 21(12)(a) of Directive (EU) 2016/797	4. Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797
"4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems	Flange lubrication	Fitting/removal of the flange lubrication function	NA
	Possibility of preventing the use of flange lubrication	NA	Fitting/removal of the control preventing the use of flange lubrication"

(4a) Without prejudice of the general safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797, in case of changes impacting requirements set out in 4.2.4.9, 4.2.9.3.1 and 4.2.10.3.4 which require a new reliability study, a new authorisation for placing in the market shall be required unless the NoBo concludes that the safety-related requirements covered by the reliability study are improved or maintained. The NoBo will consider in its judgement the revised maintenance and operation documentation, where required.

(5) National migration strategies related to the implementation of other TSIs (e.g. TSIs covering fixed installations) shall be taken into account when defining to what extent the TSIs covering rolling stock needs to be applied.

(6) The basic design characteristics of the rolling stock are defined in Table 17a and Table 17b below. Based on these tables and on the safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797, the changes shall be categorised as follows:

(a) as defined by Article 15(1), point (c), of Implementing Regulation (EU) 2018/545 if they are above the thresholds set out in column 3 and below thresholds set out in column 4 unless the safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797 requires to categorise them as defined by Article 15(1), point (d), of Implementing Regulation (EU) 2018/545, or

(b) as defined by Article 15(1), point (d), of Implementing Regulation (EU) 2018/545 if they are above the thresholds set out in column 4 or if the safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797 requires to categorise them as as defined by Article 15(1), point (d), of Implementing Regulation (EU) 2018/545.

The determination whether the changes are beyond or above the thresholds mentioned in the first paragraph shall be done in reference to the values of the parameters at the time of the last authorisation of the rolling stock or rolling stock type.

(7) Changes not covered by point 7.1.2.2(6) are deemed not to have any impact on the basic design characteristics and may be categorised as defined by Article 15(1), point (a) or Article 15(1), point (b), of Implementing Regulation (EU) 2018/545, unless the safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797 requires to categorise them as defined by Article 15(1), point (d), of Implementing Regulation (EU) 2018/545.

(8) The safety judgement mandated in Article 21(12), point (b), of Directive (EU) 2016/797 shall cover changes concerning basic parameters of the table of point 3.1, related to all the essential requirements, in particular the requirements ‘Safety’ and ‘Technical compatibility’.

(9) Without prejudice to point 7.1.2.2a , all changes shall remain compliant with the applicable TSIs regardless their classification.

(10) The replacement of one or more vehicle(s) within a fixed formation after a severe damage does not require a conformity assessment against this TSI, as long as the unit or the vehicle(s) are unchanged in technical parameters and

function to the ones they replace. Such units must be traceable and certified in accordance with any national or international rule, or any code of practice widely acknowledged in the railway domain.

Table 17a			
Basic design characteristics related to basic parameters set out in this TSI			
1. TSI point	2. Related basic design characteristic(s)	3. Changes impacting the basic design characteristic and not classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797	4. Changes impacting the basic design characteristic and classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797
4.2.2.2.3 End coupling	Type of end coupling	Change of end coupler type	N/A
4.2.2.10 Load conditions and weighed mass 4.2.3.2.1 Axle load parameter	Design mass in working order	Change in any of the corresponding basic design characteristics resulting in a change of the EN line category(ies) the vehicle is compatible with	N/A
	Design mass under normal payload		
	Design mass under exceptional payload		
	Operational mass in working order		
	Operational mass under normal payload		
	Maximum design speed (km/h)		
	Static axle load in working order		
	Static axle load under exceptional payload		
	Vehicle length		

	Static axle load under normal payload		
	Position of the axles along the unit (axle spacing)		
	EN line category(ies)		
	Total vehicle mass (for each vehicle of the unit)	Change in any of the corresponding basic design characteristics resulting in a change of the EN line category(ies) the vehicle is compatible with	Change of more than ± 10 %
	Mass per wheel	Change in any of the corresponding basic design characteristics resulting in a change of the EN line category(ies) the vehicle is compatible with or Change of more than ± 10 %	N/A
4.2.3.1 Gauging	Reference profile	N/A	Change of reference profile the vehicle is conform to
	Minimum vertical convex curve radius capability	Change in minimum vertical convex curve radius capability the vehicle is compatible with of more than 10 %	N/A

	Minimum vertical concave curve radius capability	Change in minimum vertical concave curve radius capability the vehicle is compatible with of more than 10 %	N/A
4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems	Compatibility with train detection systems	N/A	Change of declared compatibility with one or more of the three following train detection systems: – Track circuits – Axle counters – Loop equipment
4.2.3.3.2 Axle bearing condition monitoring	On-board detection system	Fitting of on-board detection system	Removal of declared on-board detection system
4.2.3.4. Rolling stock dynamic behaviour	Combination of maximum speed and maximum cant deficiency for which the vehicle was assessed	N/A	Increase in maximum speed of more than 15 km/h or change of more than ± 10 % in maximum admissible cant deficiency
	Rail inclination	N/A	Change of rail inclination(s) the vehicle is conform to ([1])
4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets	Wheelset gauge	N/A	Change of track gauge the wheelset is compatible with
4.2.3.5.2.2 Characteristics of wheels	Minimum required in-service wheel diameter	Change of minimum required in-service diameter of more than ± 10 mm	N/A

4.2.3.5.2.3 Automatic variable gauge systems	Wheelset gauge changeover facility	Change in the vehicle leading to a change in the changeover facility(ies) the wheelset is compatible with	Change of track gauge(s) the wheelset is compatible with
4.2.3.6. Minimum curve radius	Minimum horizontal curve radius capability	Increase of minimum horizontal curve radius of more than 5 m	N/A
4.2.4.5.1 Braking performance — General requirements	Maximum average deceleration	Change of more than ± 10 % on the maximum average brake deceleration	N/A
4.2.4.5.2 Braking performance – Emergency braking	Stopping distance and deceleration profile for each load condition per design maximum speed.	Change of stopping distance of more than ± 10 % Note: Brake weight percentage (also called 'lambda' or 'braked mass percentage') or braked mass may also be used, and can be derived (directly or via stopping distance) from deceleration profiles by a calculation. The allowed change is the same (± 10 %)	N/A
4.2.4.5.3 Braking performance – Service braking	Stopping distance and maximum deceleration for the load condition 'design mass under normal payload' at the design maximum speed	Change of stopping distance of more than ± 10 %	N/A

4.2.4.5.4 Braking performance – Thermal capacity	Maximum brake thermal energy capacity	N/A	Change of maximum brake thermal energy >= 10 %
	or		
	Thermal capacity in terms of maximum line gradient, associated length and operating speed	Change of maximum gradient, associated length or operating speed for which the brake system is designed in relation with brake thermal energy capacity	
4.2.4.5.5 Braking performance – Parking brake	Maximum gradient on which the unit is kept immobilized by the parking brake alone (if the vehicle is fitted with it)	Change of declared maximum gradient of more than ± 10 %	N/A
4.2.4.6.2. Wheel slide protection system	Wheel slide protection system	N/A	Fitting/removal of WSP function
4.2.4.8.2 Magnetic track brake	Magnetic track brake	N/A	Fitting/removal of magnetic track brake function
	Possibility of preventing the use of the magnetic track brake	N/A	Fitting/removal of the brake control allowing the activation/deactivation of magnetic track brake
4.2.4.8.3 Eddy current track brake	Eddy current track brake	N/A	Fitting/removal of the eddy current track brake function
	Possibility of preventing the use of the eddy current track brake	N/A	Fitting/removal of the brake control allowing the activation/deactivation of eddy current track brake

4.2.6.1.1 Temperature	Temperature range	Change of temperature range (T1, T2, T3)	N/A
4.2.6.1.2 Snow, ice and hail	Snow, ice and hail conditions	Change of the selected range 'snow, ice and hail' (nominal or severe)	N/A
4.2.8.2.2 Operation within range of voltages and frequencies	Energy supply system (voltage and frequency)	N/A	Change of voltage(s)/frequency(ies) of the energy supply system (AC 25 kV-50 Hz, AC 15 kV-16,7 Hz, DC 3 kV, DC 1,5 kV, DC 750 V, third rail, others)
4.2.8.2.3 Regenerative brake with energy to the overhead contact line	Regenerative brake	N/A	Fitting/removal of regenerative brake function
	Possibility of preventing the use of the regenerative brake when fitted	Fitting/removing the possibility of preventing the use of regenerative brake	N/A
4.2.8.2.4 Maximum power and current from the overhead contact line	*Applicable to Electric units with power higher than 2 MW only:* Power or current limitation function	Power or current limitation function fitted/removed	N/A
4.2.8.2.5 Maximum current at standstill	Maximum current at standstill per pantograph for each DC system the vehicle is equipped for	Change of the maximum current value by 50 A without exceeding the limit set in this TSI	N/A

	Vehicle equipped with electric energy storage for traction purposes and equipped with the function of charging with OCL at standstill	Adding or removing the function	N/A
4.2.8.2.9.1.1 Height of interaction with contact wires (RST level)	Height of interaction of pantograph with contact wires (over top of rail)	Change of height of interaction allowing/no longer allowing mechanical contact with one of the contact wires at heights above rail level between: 4800 mm and 6500 mm 4500 mm and 6500 mm 5550 mm and 6800 mm 5600 mm and 6600 mm	N/A
4.2.8.2.9.2 Pantograph head geometry (IC level)	Pantograph head geometry	N/A	Change of pantograph head geometry to or from one of the types defined in points 4.2.8.2.9.2.1, 4.2.8.2.9.2.2 or 4.2.8.2.9.2.3
4.2.8.2.9.4.2 Contact strip material	Contact strip material	New contact strip as per 4.2.8.2.9.4.2(3)	N/A
4.2.8.2.9.6 Pantograph contact force and dynamic behaviour	Mean contact force curve	Change requiring a new assessment of pantograph dynamic behaviour.	N/A

4.2.8.2.9.7 Arrangement of pantographs (RST level)	Number of pantograph and shortest distance between two pantographs	N/A	Where the spacing of 2 consecutive pantographs in fixed or predefined formations of the assessed unit is reduced by means of removing a vehicle
4.2.8.2.9.10 Pantograph lowering (RST level)	Automatic dropping device (ADD)	Automatic dropping device (ADD) function fitted/removed	N/A
4.2.9.3.7 Derailment detection and prevention signal processing	Presence of derailment prevention and detection signal processing	Fitting/removing of prevention/detection function	N/A
4.2.9.3.7a On-board derailment detection and prevention function	Presence of derailment prevention and detection function	Fitting/removing of prevention/detection function	N/A
4.2.10.1. General and categorisation	Fire safety category	N/A	Change of fire safety category
4.2.12.2. General documentation — number of units in multiple operation	Maximum number of trainsets or locomotives coupled together in multiple operation.	N/A	Change of maximum allowed number of trainsets or locomotives coupled together in multiple operation
4.2.12.2. General documentation – number of vehicles in a unit	For fixed formations only: Vehicles composing the fixed formation	N/A	Change in the number of vehicles composing the fixed formation

([1]) The rolling stock fulfilling one of the following conditions are deemed to be compatible with all rail inclinations:

– Rolling stock assessed according to the specification referenced in Appendix J-1 index [9] or [73]

– Rolling stock assessed according to the specification referenced in Appendix J-1 index [63] (amended or not amended by ERA/TD/2012-17/INT) or to the specification referenced in Appendix J-1 index [64] with the result, that there is no restriction to one rail inclination

– Rolling stock assessed according to the specification referenced in Appendix J-1 index [63] (amended or not amended by ERA/TD/2012-17/INT) or to the specification referenced in Appendix J-1 index [64] with the result, that there is a restriction to one rail inclination and a new assessment of the wheel-rail-contact test conditions based on real wheel- and rail profiles and measured track gauge show compliance with the requirements on wheel-rail-contact conditions of the specification referenced in Appendix J-1 index [9].

Table 17b

Basic design characteristics related to basic parameters set out in the TSI PRM

1. TSI point	2. Related basic design characteristic(s)	3. Changes impacting the basic design characteristic and not classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797	4. Changes impacting the basic design characteristic and classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797
2.2.11. Step position for vehicle access and egress	Platform heights for which the vehicle is designed	N/A	Change of platform height the vehicle is compatible with

(11) In order to establish the EC type or design examination certificate, the notified body selected by the entity managing the change may refer to:

– the original EC type or design examination certificate for parts of the design that are unchanged or those that are changed but do not affect the conformity of the subsystem, as far as it is still valid;

– additional EC type or design examination certificate (amending the original certificate) for modified parts of the design that affect the conformity of the subsystem with the TSIs referred to in the certification framework defined in point 7.1.3.1.1 .

In case the validity period of the EC type or design examination certificate for the original type is limited to 7 years (due to the application of the former Phase A/B concept), the validity period of the EC type or design examination

certificate for the modified type, type variant or type version shall be limited to 14 years after the date of appointment of a notified body by the applicant for the initial rolling stock type (beginning of phase A of the original EC type or design examination certificate).

(12) In any case, the entity managing the change shall ensure that the technical documentation which is relating to the EC type or design examination certificate is updated accordingly.

(13) The updated technical documentation, related to the EC type or design examination certificate is referred to in the technical file accompanying the EC declaration of verification issued by the entity managing the change for rolling stock declared as conformant to the modified type.

7.1.2.2a. Particular rules for rolling stock in operation not covered by an EC declaration of verification with a first authorisation for placing in service before 1 January 2015

In addition to point 7.1.2.2 the following rules apply to rolling stock in operation with a first authorisation for placing in service before 1 January 2015, where the scope of the change has an impact on basic parameters not covered by the EC declaration (if any):

(1) The compliance with technical requirements of this TSI is deemed established when a basic parameter is improved in the direction of the TSI defined performance and the entity managing the change demonstrates that the corresponding essential requirements are met and the safety level is maintained and, where reasonably practicable, improved. The entity managing the change shall in this case justify, the reasons for which the TSI defined performance was not met, taking into account point 7.1.2.2 (5). This justification shall be included in the technical file, if any, or in the original technical documentation of the vehicle.

(2) The rule set out in point (1) is not applicable to changes to basic parameters classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797, as specified in Tables 17c and 17d. For those changes, compliance with this TSI requirements is mandatory.

Table 17c

Changes to basic parameters for which compliance with TSI requirements is mandatory for rolling stock not holding an EC type or design examination certificate

TSI point	Related basic design characteristic(s)	Changes impacting the basic design characteristic and classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797
4.2.3.1 Gauging	Reference profile	Change of reference profile the vehicle is conform to

4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems	Compatibility with train detection systems	Change of declared compatibility with one or more of the three following train detection systems: – Track circuits – Axle counters – Loop equipment
4.2.3.3.2 Axle bearing condition monitoring	On-board detection system	Fitting/Removal of declared on-board detection system
4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets	Wheelset gauge	Change of track gauge the wheelset is compatible with
4.2.3.5.2.3 Automatic variable gauge systems	Wheelset gauge changeover facility	Change of track gauge(s) the wheelset is compatible with
4.2.8.2.3 Regenerative brake with energy to the overhead contact line	Regenerative brake	Fitting/removal of regenerative brake function

Table 17d		
Changes to basic parameters of the TSI PRM for which compliance with TSI requirements is mandatory for rolling stock not holding an EC type or design examination certificate		
TSI point	Related basic design characteristic(s)	Changes impacting the basic design characteristic and classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797
4.2.2.11. Step position for vehicle access and egress	Platform heights for which the vehicle is designed	Change of platform height the vehicle is compatible with

7.1.2.2b. Particular rules for vehicles modified to test performance or reliability of technological innovations for a limited period of time

(1) The following rules apply, in addition to point 7.1.2.2, in case of modifications to single authorised vehicles for the purpose of testing the performance and reliability of technological innovations for a fixed period of time not longer than 1 year. They don't apply if the same modifications are made to several vehicles.

(2) The compliance with technical requirements of this TSI is deemed established when a basic parameter is kept unchanged or improved in the direction of the TSI defined performance and the entity managing the change demonstrates that

the corresponding essential requirements are met and the safety level is maintained and, where reasonably practicable, improved.

7.1.3. ***Rules related to the EC type or design examination certificates.***

7.1.3.1. Rolling stock subsystem

7.1.3.1.1 Definitions

(1) Initial assessment framework

The initial assessment framework is the set of TSIs (i.e. this TSI, TSI NOI and TSI PRM) applicable at the beginning of the design phase when the notified body is contracted by the applicant.

(2) Certification framework

The certification framework is the set of TSIs (i.e. this TSI, the TSI NOI and the TSI PRM) applicable at the time of issuing the EC type or design examination certificate. It is the initial assessment framework amended with the revisions of TSIs that came into force during the design phase.

(3) Design phase

The design phase is the period starting once a notified body, which is responsible for EC verification, is contracted by the applicant and ending when the EC type or design examination certificate is issued.

A design phase can cover a type and one or several type variant(s) and type version(s). For all type variant(s) and type version(s), the design phase is considered as starting at the same time as for the main type.

(4) Production phase

The production phase is the period during which rolling stock subsystems may be placed on the market on the basis of an EC declaration of verification referring to a valid EC type or design examination certificate.

(5) Rolling stock in operation :

Rolling stock is in operation when it is registered with 'Valid' registration code '00', in the National Vehicle Register in accordance with Commission Decision 2007/756/EC* or in the European Vehicle Register in accordance with Commission Implementing Decision (EU) 2018/1614** and maintained in a safe state of running in accordance with Commission Implementing Regulation (EU) 2019/779***.

7.1.3.1.2 Rules related to the EC type or design examination certificate

(1) The notified body shall issue the EC type or design examination certificate referring to the certification framework

(2) When a revision of this TSI or of the TSI NOI or the TSI PRM comes into force during the design phase, the notified body shall issue the EC type or design examination certificate according to the following rules:

– For changes in the TSIs that are not referenced in appendix L, conformity with the initial assessment framework leads to conformity to the certification framework. The Notified Body shall issue the EC type or design examination certificate referring to the certification framework without additional assessment.

– For changes in the TSIs that are referenced in appendix L, their application is mandatory according to the transition regime defined in the appendix. During the defined transition period, the Notified Body may issue the EC type or design examination certificate referring to the certification framework without additional assessment. The Notified Body shall list in the EC type or design examination certificate all the points assessed according to the initial assessment framework.

(3) When several revisions of this TSI or of the TSI NOI or the TSI PRM come into force during the design phase, point (2) shall apply to all revisions successively

(4) It is always permissible (but not mandatory) to use a most recent version of any TSI, either totally or for particular points, unless explicitly otherwise specified in the revision of these TSIs; in case of application limited to particular points, the applicant has to justify and document that applicable requirements remain consistent, and this has to be approved by the notified body.

7.1.3.1.3 Validity of the EC type or design examination certificate

(1) When a revision of this TSI or of the TSI NOI or the TSI PRM comes into force, the EC type or design examination certificate for the subsystem remains valid unless it is required to be revised according to the specific transition regime of a TSI change.

(2) Only the changes to the TSIs with a specific transition regime can apply to Rolling Stock in production phase or to Rolling Stock in operation.

7.1.3.2. Interoperability constituents

(1) This point concerns an interoperability constituent which is subject to type or design examination or to suitability for use.

(2) Unless otherwise explicitly specified in the revision of this TSI or of the TSI NOI or the TSI PRM, the type or design examination or suitability for use remains valid even if a revision of these TSIs enters into force.

During this time, new constituents of the same type are permitted to be placed on the market without a new type assessment.

7.1.4. ***Rules for the extension of the area of use for rolling stock having an authorisation in accordance with Directive 2008/57/EC or in operation before 19 July 2010***

(1) In the absence of full conformity with this TSI, point 2 applies to rolling stock that fulfils the following conditions when requesting the extension of its area of use in accordance with Article 21(13) of Directive (EU) 2016/797:

(a) it has been authorised in accordance with Directive 2008/57/EC or put in operation before 19 July 2010;

(b) it is registered with 'Valid' registration code '00', in the National Vehicle Register in accordance with Decision 2007/756/EC or in the European Vehicle Register in accordance with Implementing Decision (EU) 2018/1614 and maintained in a safe state of running in accordance with Implementing Regulation (EU) 2019/779.

The following provisions for extension of area of use apply also in combination with a new authorisation as defined in Article 14(3), point (a), of Implementing Regulation (EU) 2018/545.

(2) Authorisation for an extended area of use of the rolling stock referred to in point 1 shall be based on the existing authorisation, if any, and on the technical compatibility between the rolling stock and the network in accordance with point (d) of Article 21(3) of Directive (EU) 2016/797 and compliance with the Basic Design Characteristics of Tables 17a and 17b , taking into account any restrictions or limitations.

The applicant shall provide an 'EC declaration of verification' accompanied by technical files giving evidence of compliance with the requirements set out in this TSI, or with provisions having equivalent effect, for each basic parameter referred to in column 1 of Tables 17a and 17b and with the following points of this TSI:

– 4.2.4.2.2, 4.2.5.5.8, 4.2.5.5.9, 4.2.6.2.3, 4.2.6.2.4, 4.2.6.2.5, 4.2.8.2.7, 4.2.8.2.9.8 (when running through phase or system separation sections is managed automatically), 4.2.9.3.1, 4.2.9.6, 4.2.12 and 4.2.12.6

– 4.2.5.3 in Italy

– 4.2.5.3.5 and 4.2.9.2.1 in Germany

through one or a combination of the following:

(a) compliance with requirements set out in this TSI;

(b) compliance with corresponding requirements set out in a previous TSI;

(c) compliance with alternative specifications deemed to have equivalent effect;

(d) evidence that the requirements for technical compatibility with the network of the extended area of use are equivalent to the requirements for technical compatibility with the network for which the rolling stock is already authorised or in operation. Such evidence shall be provided by the applicant and may be based on the information of the register of railway infrastructure (RINF).

(3) The equivalent effect of alternative specifications to the requirements of this TSI (point 2(c)) and the equivalence of requirements for technical compatibility with the network (point 2(d)) shall be justified and documented by the applicant by applying the risk management process set out in Annex I of Regulation (EU) No 402/2013. The justification has to be assessed and confirmed by an assessment body (CSM RA).

(4) In addition to the requirements mentioned referred to in point (2) above and where applicable, the applicant shall provide an 'EC declaration of verification' accompanied by technical files giving evidence of compliance with the following:

(a) specific cases relating to any part of the extended area of use, listed in this TSI, the TSI NOI, the TSI PRM and the TSI CCS;

(b) the national rules referred to in Article 13(2), points (a), (c) and (d), of Directive (EU) 2016/797 as notified in accordance with Article 14 of that Directive.

(5) The authorising entity shall make publicly available through the Agency website details of the alternative specifications referred to in point 2(c) and of the requirements for technical compatibility with the network referred to in point 2(d) on the basis of which it granted authorisations for the extended area of use.

(6) Where an authorised vehicle benefited from non-application of TSIs or part of them pursuant to Article 9 of Directive 2008/57/EC, the applicant shall seek derogation(s) in the Member States of the extended area of use in accordance to Article 7 of Directive (EU) 2016/797.

(7) In accordance with Article 54(2) of Directive (EU) 2016/797, coaches used under *Regolamento Internazionale Carrozze* (RIC) shall be deemed authorised in accordance with the conditions under which they were used, including the area of use where they are operated. Following a change which requires a new authorisation for placing on the market in accordance with Article 21(12) of Directive (EU) 2016/797, coaches accepted under the latest RIC agreement shall conserve the area of use in which they were operating without further checks on the unchanged parts.

7.1.5. ***Pre fitment requirements for new rolling stock design where ETCS is not yet installed***

(1) This case applies to newly developed vehicle design, including special vehicle referred to in point 7.4.3.2 of TSI CCS when point 7.1.1.3 (1) of LOC&PAS TSI applies, where ETCS on-board is not yet installed, with the aim to have rolling stock subsystem ready when this system will be installed.

(2) The following requirements apply to newly developed vehicle designs requiring a first authorisation as defined in Article 14 of Implementing Regulation 2018/545:

(a) Compliance with the requirements related to train interface functions as mentioned in basic parameters that refers to Appendix A, Table A.2, index 7 of TSI CCS (see column 1 and 2 of Table 9 of the TSILOC&PAS).

(b) Description of train interface functions implemented including specification of interfaces and protocols of communication shall be documented in the technical documentation described in point 4.2.12.2 (23).

(c) A space shall be available for installation of ETCS on-board equipments defined in TSI CCS (e.g ETCS DMI, antennas, etc.). The conditions for installation of equipments must be documented in the technical documentation described in point 4.2.12.2 (24).

(3) The Notified Body in charge of EC verification for the Rolling Stock subsystem shall verify that the documentation requested in points 4.2.12.2 (23) and (24), is provided.

(4) When ETCS on-board is installed, the assessment of the integration of the interface functions in the vehicle is part of the EC verification for the CCS on-board subsystem in accordance with point 6.3.3 of TSI CCS.

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* Commission Decision 2007/756/EC of 9 November 2007 adopting a common specification of the national vehicle register provided for under Articles 14(4) and (5) of Directives 96/48/EC and 2001/16/EC (OJ L 305, 23.11.2007, p. 30).

** Commission Implementing Decision (EU) 2018/1614 of 25 October 2018 laying down specifications for the vehicle registers referred to in Article 47 of Directive (EU) 2016/797 of the European Parliament and of the Council and amending and repealing Commission Decision 2007/756/EC (OJ L 268, 26.10.2018, p. 53).

*** Commission Implementing Regulation (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 445/2011 (OJ L 139I , 27.5.2019, p. 360).";

(161) point 7.3.2. is replaced by the following:

"7.3.2. List of specific cases

7.3.2.1. Mechanical interfaces (4.2.2.2)

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

End coupling, height above rail (clause 4.2.2.2.3).

A.1 Buffers

The height of the centre line of the buffers shall be in the range 1090 mm (+ 5/– 80 mm) above rail level in all loading and wear conditions.

A.2 Screw coupling

The height of the centre line of the draw hook shall be in the range 1070 mm (+ 25/– 80 mm) above rail level in all loading and wear conditions.

7.3.2.2. Gauging (4.2.3.1)

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

It is permissible for the reference profile of the upper and the lower part of the unit to be established in accordance with the national technical rules notified for this purpose.

7.3.2.3. Rolling stock requirements for compatibility with trackside equipment (4.2.3.3.2.2)

Specific case Finland ('P')

For rolling stock intended to be used on Finnish network (1524 mm track gauge) which depends on track side equipment for axle bearing condition monitoring, the target areas on the underside of an axle box that shall remain un-obstructed to permit observation by a trackside HABD shall use dimensions as defined in EN 15437-1:2009, and replace the values by the following:

System based on trackside equipment:

The dimensions in points 5.1 and 5.2 of EN 15437-1:2009 are replaced respectively by the following dimensions. There are two different target areas (I and II) including their prohibitive and measuring zones defined:

Dimensions for the target area I:

– WTA, greater than or equal to 50 mm

– LTA, greater than or equal to 200 mm

– YTA shall be 1045 mm to 1115 mm

– WPZ, greater than or equal to 140 mm

– LPZ, greater than or equal to 500 mm

– YPZ shall be 1080 mm ± 5 mm

Dimensions for the target area II:

– WTA, greater than or equal to 14 mm

– LTA, greater than or equal to 200 mm

– YTA shall be 892 mm to 896 mm

– WPZ, greater than or equal to 28 mm

– LPZ, greater than or equal to 500 mm

– YPZ shall be 894 mm ± 2 mm

Specific case France ('P')

This specific case is applicable to all units which are not fitted with on-board axle bearing condition monitoring equipment.

Points 5.1 and 5.2 of standard EN 15437-1 apply with the following specificities. The notations are the ones used in picture 3 of standard.

– WTA = 70 mm

– YTA = 1092,5 mm

– LTA = Vmax x 0,56 (Vmax being the maximal line speed at the level of HABC, expressed in km/h) ».

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

Rolling stock that depends on track side equipment for axle bearing condition monitoring, shall meet the following the target areas on the underside of an axle box (dimensions as defined in EN 15437-1:2009):

Table 18

Target area

	Y_{TA} [mm]	W_{TA} [mm]	L_{TA} [mm]	Y_{PZ} [mm]	W_{PZ} [mm]	L_{PZ} [mm]
1600 mm	1110 ± 2	≥ 70	≥ 180	1110 ± 2	≥ 125	≥ 500

Specific case Sweden ('T2')

This specific case is applicable to all units which are not fitted with on-board axle bearing condition monitoring equipment and are intended for operation on lines with non-upgraded axle bearing detectors. These lines are indicated in the infrastructure register as being non-TSI compliant in this respect.

The two zones underneath the axle box/journal set out in table below referring to the parameters of the standard EN 15437-1:2009 shall be free to facilitate vertical monitoring by trackside axle box detection system:

Table 19

Target and prohibitive zone for units intended to be operated in Sweden

	Y_{TA} [mm]	W_{TA} [mm]	L_{TA} [mm]	Y_{PZ} [mm]	W_{PZ} [mm]	L_{PZ} [mm]
System 1	862	≥ 40	whole	862	≥ 60	≥ 500
System 2	905 ± 20	≥ 40	whole	905	≥ 100	≥ 500

The compatibility with these systems shall be set out in the technical file for the vehicle.

7.3.2.4. Internal air quality (4.2.5.8)

Specific case Channel Tunnel ('P')

Passenger vehicles: passenger trains must have systems in place to provide ventilation capable of ensuring CO2 levels remain under 10,000ppm for at least 90 minutes in the event of a failure of traction systems.

7.3.2.5. Running dynamic behaviour (4.2.3.4.2, 6.2.3.4)

Specific case Finland ('P')

The following modifications to the running dynamic behaviour points of the TSI applies to vehicle to be operated solely on Finnish 1524 mm network:

– Test zone 4 is not applicable for running dynamic testing.

– Mean value of curve radius of all track sections for test zone 3 shall be 550 ± 50 metres for running dynamic testing.

– Track quality parameters in running dynamics testing shall be according to RATO 13 (Track inspection).

– Measuring methods are according to EN 13848-1:2019.

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

For technical compatibility with the existing network it is permissible to use notified national technical rules for the purpose of assessing running dynamic behaviour.

Specific case Spain ('P')

For rolling stock intended to be used on 1668 mm track gauge, the quasi-static guiding force Yqst limit value shall be evaluated for curve radii

250 m ≤ Rm < 400 m.

The limit value shall be: (Yqst)lim = 66 kN.

For the normalisation of the estimated value to the radius Rm = 350 m according to point 7.6.3.2.6 (2) of EN 14363:2016, the formula 'Ya,nf,qst = Ya,f,qst – (10500 m/Rm – 30) kN' shall be replaced by 'Ya,nf,qst = Ya,f,qst – (11550 m/Rm – 33) kN'.

Values of cant deficiency can be adapted to 1668 mm track gauge by multiplying the corresponding 1435 mm parameter values by the following conversion factor: 1733/1500.

7.3.2.5a Structural design of bogie frame (4.2.3.5.1)

Specific case Spain ('P')

For bogies designed to run on 1 668 mm track gauge, alpha (α) and beta (β) parameters shall be considered as 0,15 and 0,35 respectively in conformity with the specification referenced in Appendix J-1, index [11] [Annex F of EN 13749]

7.3.2.6. Mechanical and geometric characteristics of wheelset and wheel (4.2.3.5.2.1 and 4.2.3.5.2.2)

Specific case Estonia, Latvia, Lithuania and Poland for 1520 mm system ('P')

The geometrical dimensions of the wheels as defined in Figure 2 shall be compliant with limit values specified in the Table 20.

Table 20

In-service limits of the geometric dimensions of wheel

Designation	Wheel diameter D (mm)	Minimum value (mm)	Maximum value (mm)
Width of the rim (B_R + Burr)	400 ≤ D ≤ 1220	130	146
Thickness of the flange (S_d)		25[(1)]	33
Height of the flange (S_h)		28	37
[(1)] For inner wheels of the 3-axle bogies a dimension of 21mm is permitted			

New wheel profile for locomotives and trainsets of maximum speed up to 200 km/h is defined in the figure 3 below

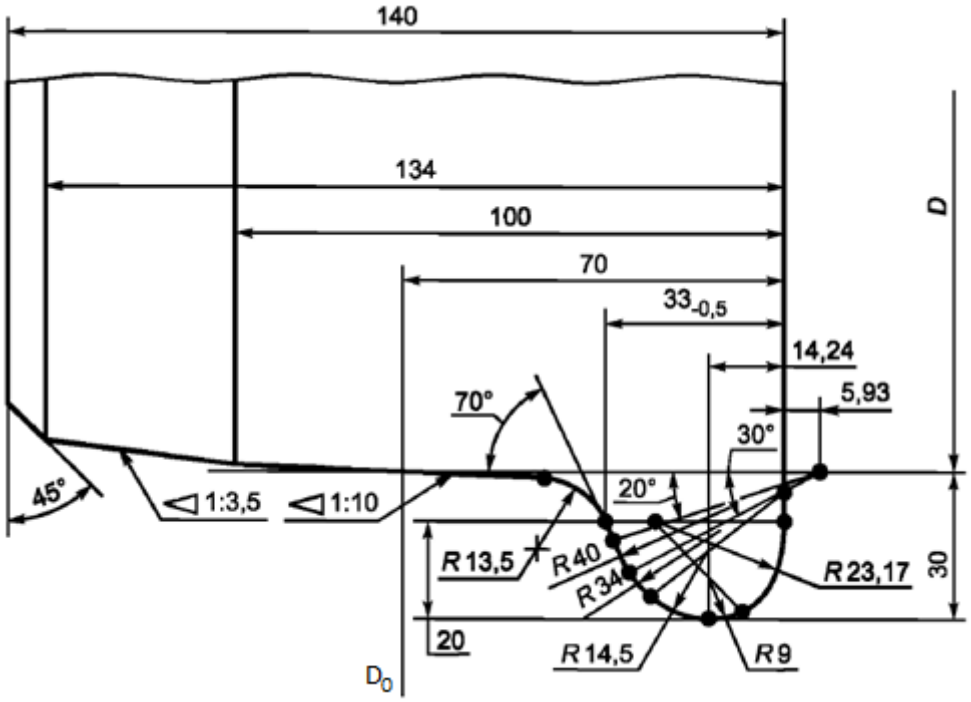


Figure 3 New wheel profile for locomotives and trainsets of maximum speed up to 200 km/h

New wheel profile for trainsets of maximum speed up to 130 km/h is defined in figure 4 below

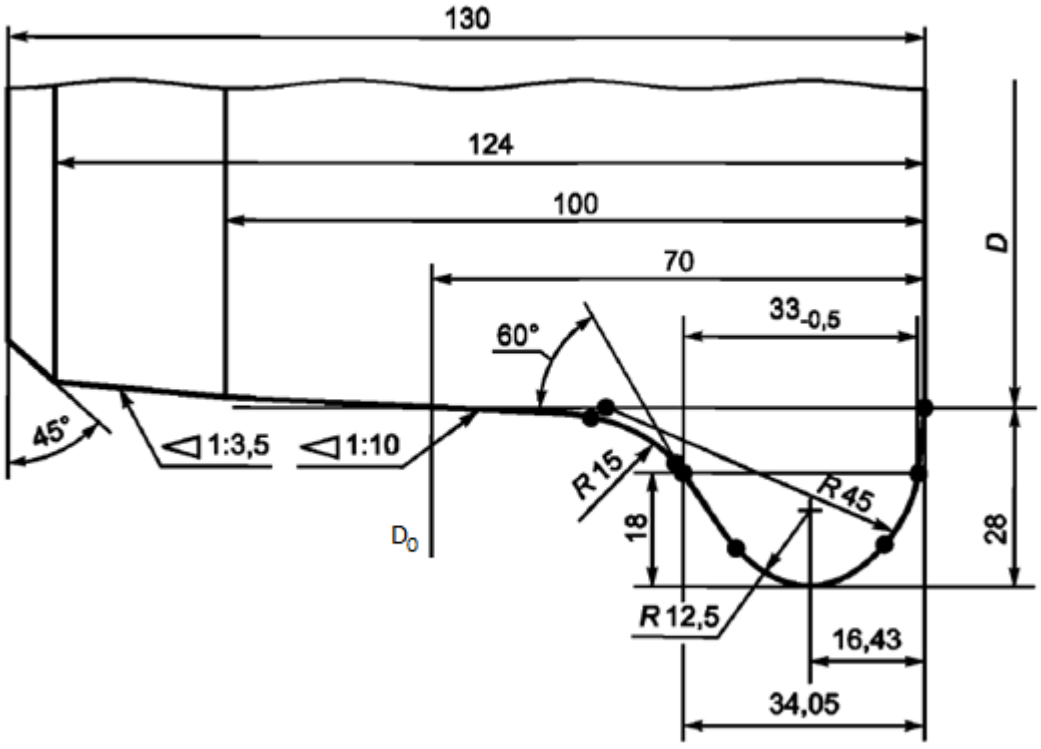


Figure 4 New wheel profile for trainsets of maximum speed up to 130 km/h

Specific case Finland ('P')

The minimum wheel diameter shall be taken as 400 mm.

For rolling stock to be used in traffic between Finnish 1524 network and a third country 1520 network, it is allowed to use special wheelsets designed to accommodate the differences in track gauges.

Specific case Ireland ('P')

The geometrical dimensions of the wheels (as defined in Figure 2) shall be compliant with limit values specified in the Table 21:

Table 21

In-service limits of the geometric dimensions of wheel

	Designation	Wheel diameter D (mm)	Minimum value (mm)	Maximum value (mm)
1600 mm	Width of the rim (B_R) (with maximum BURR of 5 mm)	$690 \leq D \leq 1016$	137	139
	Thickness of the flange (S_d)	$690 \leq D \leq 1016$	26	33
	Height of the flange (S_h)	$690 \leq D \leq 1016$	28	38
	Face of the flange (q_R)	$690 \leq D \leq 1016$	6,5	—

Specific case for the United Kingdom in respect of Northern Ireland ('P')

The geometrical dimensions of the wheelsets and the wheels (as defined in Figure 1 and 2) shall be compliant with limit values specified in the Table 22:

Table 22

In-service limits of the geometric dimensions of wheelsets and wheel

	Designation	Wheel diameter D (mm)	Minimum value (mm)	Maximum value (mm)
1600 mm	Front-to-front dimension (SR) SR = AR + Sd, left + Sd, right	$690 \leq D \leq 1016$	1573	1593,3

	Back to back distance (AR)	690 ≤ D ≤ 1016	1521	1527,3
	Width of the rim (BR) (with maximum BURR of 5 mm)	690 ≤ D ≤ 1016	127	139
	Thickness of the flange (Sd)	690 ≤ D ≤ 1016	24	33
	Height of the flange (S_h)	690 ≤ D ≤ 1016	28	38
	Face of the flange (q_R)	690 ≤ D ≤ 1016	6,5	—

Specific case Spain for 1668 mm track gauge ('P')

The minimum value of thickness of the flange (Sd) for wheel diameter D ≥ 840 mm shall be taken as 25 mm.

For wheel diameters 330 mm ≤ D < 840 mm, the minimum value shall be taken as 27,5 mm.

Specific case Czech Republic ('T0')

For the inner wheels of 3-axle bogies, that are not involved in track guidance, lower limit values of the wheels geometrical dimensions than those required in Table 1 and in Table 2 are permitted for the thickness of the flange (S_d) and for the front to front dimension (S_R).

7.3.2.6a. Minimum curve radius (4.2.3.6)

Specific case Ireland ('P')

In the case of track gauge system 1600 mm, the minimum curve radius to be negotiated shall be 105 m for all units.

7.3.2.7 Not used

7.3.2.8. Aerodynamic effects (4.2.6.2)

Specific case Italy ('P')

Maximum pressure variations in tunnels (4.2.6.2.3):

For unrestricted operation on the existing lines taking into account the numerous tunnels with a cross section of 54 m2 which are traversed at 250 km/h, and those with a cross section of 82,5 m2 and traversed at 300 km/h, units of maximum design speed higher than or equal to190 km/h shall conform to the requirements set out in the Table 23.

Table 23							
Requirements for interoperable train in a solo run in a non-inclined tube-like tunnel							
	Gauge	Reference Case		Criteria for the Reference Case			Allowed maximum speed [km/h]
		V_{tr} [km/h]	A_{tu} [m^2]	Δ_{pN} [Pa]	$\Delta_{pN} + \Delta_{pFr}$ [Pa]	$\Delta_{pN} + \Delta_{pFr} + \Delta_{pT}$ [Pa]	
$V_{tr,max}$ < 250 km/h	GA or smaller	200	53,6	≤ 1750	≤ 3000	≤ 3700	≤ 210
	GB	200	53,6	≤ 1750	≤ 3000	≤ 3700	≤ 210
	GC	200	53,6	≤ 1750	≤ 3000	≤ 3700	≤ 210
$V_{tr,max}$ < 250 km/h	GA or smaller	200	53,6	≤ 1195	≤ 2145	≤ 3105	< 250
	GB	200	53,6	≤ 1285	≤ 2310	≤ 3340	< 250
	GC	200	53,6	≤ 1350	≤ 2530	≤ 3455	< 250
$V_{tr,max}$ ≥ 250 km/h	GA or smaller	250	53,6	≤ 1870	≤ 3355	≤ 4865	250
$V_{tr,max}$ ≥ 250 km/h	GA or smaller	250	63,0	≤ 1460	≤ 2620	≤ 3800	> 250
	GB	250	63,0	≤ 1550	≤ 2780	≤ 4020	> 250
	GC	250	63,0	≤ 1600	≤ 3000	≤ 4100	> 250

If a vehicle does not fulfil the values specified in the table above (e.g. TSI compliant vehicle), operating rules (e.g. speed restrictions) may apply.

7.3.2.8.a. Lamp controls (4.2.7.1.4)

Specific case France, Luxembourg, Belgium, Spain, Sweden (T0)

It shall be possible for the driver to activate the head lamps in flashing/blinking mode to inform of an emergency situation.

7.3.2.9. Not used

7.3.2.10. Not used

7.3.2.11 Operation within range of voltages and frequencies (4.2.8.2.2)

Specific case Estonia (‘T1’)

Electric units designed to be operated on DC 3,0 kV lines shall be able to operate within the ranges of voltages and frequencies as set out in the TSI ENE point 7.4.2.1.1.

Specific case France (‘T2’)

To avoid restrictions of use, electric units designed to be operated on DC 1,5 kV or AC 25 kV lines shall comply with the characteristics described in the register of infrastructure (parameter 1.1.1.2.2.1.3). The maximum current at standstill per pantograph (point 4.2.8.2.5) allowed on DC 1,5 kV existing lines may be lower than the limit values as set out in the TSI ENE point 4.2.5; the current at standstill per pantograph shall be limited accordingly on electric units designed to be operated on these lines.

Specific case Latvia (‘T1’)

Electric units designed to be operated on DC 3,0 kV lines shall be able to operate within the ranges of voltages and frequencies as set out in the TSI ENE point 7.4.2.4.1.

7.3.2.12. Use of regenerative brakes (4.2.8.2.3)

Specific case Belgium (‘T2’)

For technical compatibility with the existing system, the maximum voltage regenerated to the catenary (Umax2 according to EN 50388-1:2022 point 12.2.1) on 3 kV network shall not be higher than 3,8 kV.

Specific case Czech Republic (‘T2’)

For technical compatibility with the existing system, the maximum voltage regenerated to the catenary (Umax2 according to EN 50388-1:2022 point 12.2.1) on 3 kV network shall not be higher than 3,55 kV.

Specific case Sweden (‘T2’)

For technical compatibility with the existing system, the maximum voltage regenerated to the catenary (Umax2 according to EN 50388-1:2022 point 12.2.1) on 15 kV network shall not be higher than 17,5 kV.

7.3.2.13. Height of interaction with contact wires (RST level) (4.2.8.2.9.1.1)

Specific case The Netherlands (‘T0’)

For unrestricted access to the 1500 V DC lines, the maximum height of pantograph shall be limited to 5 860 mm.

7.3.2.14. Pantograph head geometry (4.2.8.2.9.2)

Specific case Croatia (‘T1’)

For operation on the existing network 3 kV DC system, it is allowed to equip electric units with a pantograph having a head geometry of length 1450 mm as depicted in EN 50367:2020+A1:2022 annex B.3 figure B1 (as alternative to requirement in point 4.2.8.2.9.2).

Specific case Finland (‘T1’)

For technical compatibility with the existing network, the width of the pantograph head shall not exceed 0.422 metres.

Specific case France (‘T2’)

For operation on the existing network, in particular on lines with catenary system only compatible with narrow pantograph, and for operation in France and Switzerland, it is allowed to equip electric units with a pantograph having a head geometry of length 1450 mm as depicted in EN 50367:2020+A1:2022, Annex B.3 figure B.1 (as alternative to requirement in point 4.2.8.2.9.2).

Specific case Italy (‘T0’)

For operation on the existing network 3 kV DC and 25 kV AC HST systems (and additionally in Switzerland on 15 kV AC system), it is allowed to equip electric units with a pantograph having a head geometry of length 1450 mm as depicted in EN 50367: 2020+A1:2022 annex B.3 figure B1 (as alternative to requirement in point 4.2.8.2.9.2).

Specific case Portugal (‘T0’)

For operation on the existing network 25 kV 50 Hz system, it is allowed to equip electric units with a pantograph having a head geometry of length 1450 mm as depicted in EN 50367:2020+A1:2022, Annex B.3 figure B.1 (as alternative to requirement in point 4.2.8.2.9.2).

For operation on the existing network 1,5 kV DC system, it is allowed to equip electric units with a pantograph having a head geometry of length 2180 mm as depicted in national rule notified for this purpose (as alternative to requirement in point 4.2.8.2.9.2).

Specific case Slovenia (‘T0’)

For operation on the existing network 3 kV DC system, it is allowed to equip electric units with a pantograph having a head geometry of length 1450 mm as depicted in EN 50367:2020+A1:2022, Annex B.3 figure B.1 (as alternative to requirement in point 4.2.8.2.9.2).

Specific case Sweden (‘T0’)

For operation on the existing network, it is allowed to equip electric units with a pantograph having a head geometry of length 1800 mm as depicted in EN 50367:2020+A1:2022, Annex B.3 figure B.5 (as alternative to requirement in point 4.2.8.2.9.2).

7.3.2.15. Contact strip material (4.2.8.2.9.4.2)

Specific case France (‘P’)

The metallic content of the carbon contact strips is allowed to be increased up to 60 % by weight where used on 1500 V DC lines.

7.3.2.16. Pantograph contact force and dynamic behaviour (4.2.8.2.9.6)

Specific case France (‘T2’)

For technical compatibility with the existing network, electric units intended to be operated on DC 1,5 kV lines shall, in addition to the requirement of point 4.2.8.2.9.6,

be validated with consideration of a mean contact force in the following range: 70 N < Fm< 0,00178*v2 + 110 N with a value of 140 N at standstill.

The conformity assessment procedure (simulation and/or test according to points 6.1.3.7 and 6.2.3.20) shall take into account the following environmental conditions:

—	summer conditions	:	ambient temperature ≥ 35 °C; contact wire temperature > 50 °C for simulation.
—	winter conditions	:	ambient temperature 0 °C; contact wire temperature 0 °C for simulation.

Specific case Sweden (‘T2’)

For technical compatibility with the existing network in Sweden, the static contact force of the pantograph shall fulfil the requirements in EN 50367:2020+A1:2022 Annex B Table B3 column SE (55 N). The compatibility with these requirements shall be set out in the technical file for the vehicle.

Specific case Channel tunnel (‘P’)

For technical compatibility with existing lines, the verification at interoperability constituent level (points 5.3.10 and 6.1.3.7) shall validate capability of the pantograph to collect current for the additional range of contact wire heights between 5920 mm and 6020 mm.

7.3.2.17. Not used

7.3.2.18. Not used

7.3.2.19 Not used

7.3.2.20 Fire safety and evacuation (4.2.10)

Specific case Italy (‘T0’)

Additional specifications for units intended to be operated in the existing Italian tunnels are detailed below.

Fire detection systems (points 4.2.10.3.2 and 6.2.3.23)

In addition to the areas specified in point 6.2.3.23 , fire detection systems shall be installed in all passenger and train staff areas.

Fire containment and control systems for passenger rolling stock (point 4.2.10.3.4)

In addition to requirements of the point 4.2.10.3.4, units of category A and B passenger rolling stock shall be equipped with active Fire Containment and Control Systems.

Fire Containment and Control Systems shall be assessed according to the notified National Rules about fire automatic extinguishing systems.

In addition to the requirements specified in point 4.2.10.3.4 , the units of category A and B passenger rolling stock shall be equipped with automatic fire extinguishing systems in all technical areas.

Freight locomotives and freight self-propelling units: fire spreading protection measures (point 4.2.10.3.5) and running capability (point 4.2.10.4.4)

In addition to the requirements specified in point 4.2.10.3.5 , freight locomotives and freight self-propelling units shall be equipped with fire automatic extinguishing systems in all technical areas.

In addition to the requirements specified in point 4.2.10.4.4 , freight locomotives and freight self-propelling units shall have a running capability equivalent to that of category B passenger rolling stock.

Review clause:

At the latest by 31 July 2025, the Member State shall deliver to the Commission a report on possible alternatives to the above additional specifications, in order to remove or significantly reduce the constraints on rolling stocks caused by the non-compliance of the tunnels with the TSIs.

7.3.2.21 Running capability (4.2.10.4.4) and fire containment and control system (4.2.10.3.4)

Specific case Channel Tunnel ('P')

Passenger rolling stock intended to be operated in the Channel Tunnel shall be of category B, considering the length of the tunnel.

Due to the lack of firefighting points with safe area (see TSI SRT, point 4.2.1.7) amendments to the following points of this TSI apply:

- point 4.2.10.4.4 (3):

The running capability of a Passenger rolling stock intended to be operated in the Channel Tunnel shall be demonstrated by application of the specification referenced in Appendix J-1, index [33], in which the system functions impacted by a 'type 2' fire shall be braking and traction; these functions shall be assessed in the following conditions:

– for a duration of 30 minutes at a minimum speed of 100 km/h, or

– for a duration of 15 minutes at a minimum speed of 80 km/h (according to point 4.2.10.4.4) under the condition specified in the national rule notified by the Channel tunnel safety authority for this purpose.

- point 4.2.10.3.4 (3) & (4):

Where the running capability is specified for a duration of 30 minutes according to the point above, the fire barrier between the driver's cab and the compartment to the rear of it (assuming the fire starts in the rear compartment) shall satisfy requirements for integrity for a minimum of 30 minutes (instead of 15 minutes).

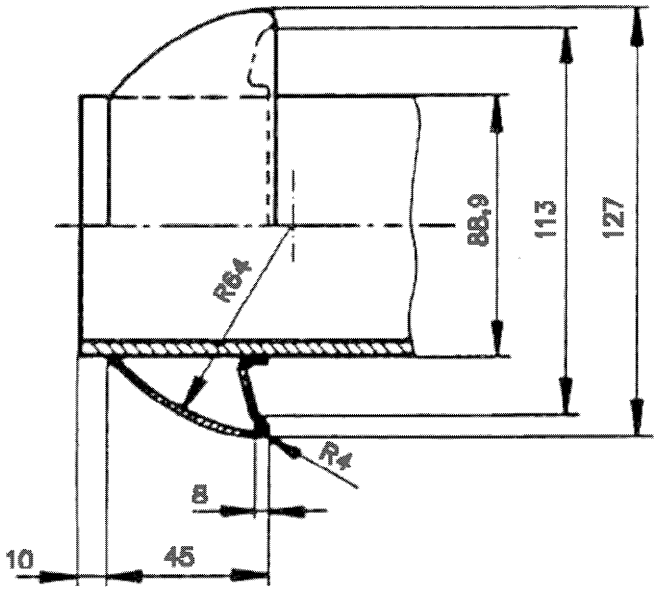
Where the running capability is specified for a duration of 30 minutes according to the point above, and for passenger vehicles that do not allow the exit of passengers at both ends (no through route), measures to control the spread of heat and fire effluents (full cross section partitions or other FCCS, fire barriers between combustion engine/electrical supply/traction equipment and passenger/staff areas) shall be designed for a minimum of 30 minutes fire protection (instead of 15 minutes).

7.3.2.22. Interface for toilet discharge (4.2.11.3)

Specific case Finland ('P')

Alternatively to, or in addition to what is specified in point 4.2.11.3 , it is allowed to install connections for toilet discharge and for rinsing of the sanitary discharge tanks, compatible with the track side installations on the Finnish network in accordance with figure AI1.

Figure AI 1. Emptying connections for toilet tank



Quick connector SFS 4428, connector part A, size DN80

Material: acid-proof stainless steel

Sealing on the counter-connector's side.

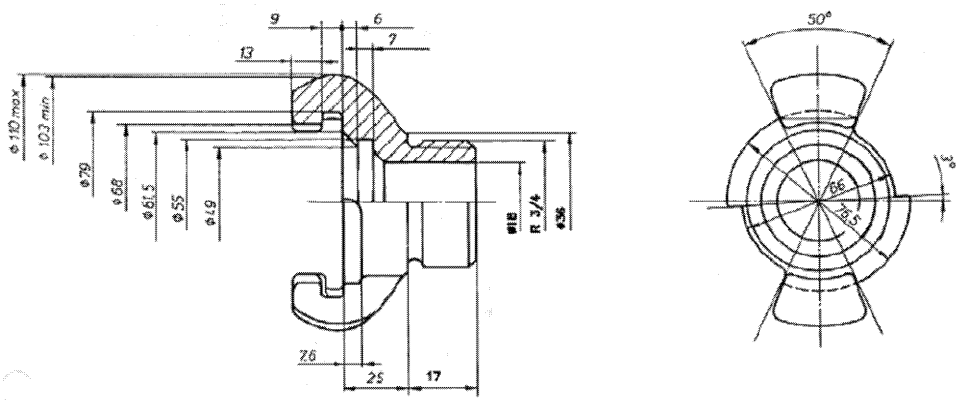
Specific definition in the standard SFS 4428

7.3.2.23 Interface for water refilling (4.2.11.5)

Specific case Finland ('P')

Alternatively to, or in addition to what is specified in point 4.2.11.5 , it is allowed to install water filling connections compatible with the track side installations on the Finnish network in accordance with Figure AII1.

Figure A II1 The water filling adapters



Type: Connector C for fire fighting NCU1

Material: brass or aluminium

Specific definition in the standard SFS 3802 (sealing defined by each connector manufacturer).

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

Alternatively to, or in addition to what is specified in point 4.2.11.5 , it is allowed to install a nozzle type water refilling interface. This nozzle type refilling interface must fulfil the requirements of the national technical rules notified for the purpose.

7.3.2.24 Special requirements for stabling of trains (4.2.11.6)

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

Shore supply of electrical power to stabled trains must fulfil the requirements of the national technical rules notified for the purpose

7.3.2.25 Refuelling equipment (4.2.11.7)

Specific case Finland ('P')

In order to be able to be refuelled on the Finnish network, the fuel tank of units with a diesel filling interface has to be equipped with the over flow controller according to standards SFS 5684 and SFS 5685.

Specific case Ireland and the United Kingdom in respect of Northern Ireland ('P')

The refuelling equipment interface must fulfil the requirements of the national technical rules notified for the purpose.

7.3.2.26 Rolling stock originated from third country (general)

Specific case Finland

('P') The application of national technical rules instead of the requirements in this TSI is allowed for third countries' rolling stock to be used on the Finnish 1524 network in traffic between Finland and 3rd countries 1520 network.

7.3.2.27 Not used.".

(162) Point 7.4 is replaced as follows:

7.4 Specific environmental conditions

Specific conditions Austria

Unrestricted access in Austria under winter conditions is granted if the following conditions are met:

– The additional capability of the obstacle deflector to remove snow as specified for snow, ice and hail severe conditions in point 4.2.6.1.2 shall be provided.

– Locomotives and power head units shall be provided with sanding system.

Specific conditions Bulgaria

Unrestricted access in Bulgaria under winter conditions is granted if the following condition is met:

– Locomotives and railcars shall be equipped with sanding system.

Specific conditions Croatia

Unrestricted access in Croatia under winter conditions is granted if the following condition is met:

– Traction vehicles and vehicles with a driving cab shall be equipped with sanding system.

Specific conditions Estonia Latvia and Lithuania

For unrestricted access of rolling stock on the Estonian, Latvian and Lithuanian network under winter conditions, it shall be demonstrated that the rolling stock meets the following requirements:

– Temperature zone T2 as specified in point 4.2.6.1.1 shall be selected.

– Snow, ice and hail severe conditions as specified in point 4.2.6.1.2 , excluding the scenario 'Snowdrift' shall be selected.

Specific conditions Finland

For unrestricted access of rolling stock on the Finnish network under winter conditions, it shall be demonstrated that the rolling stock meets the following requirements:

– Temperature zone T2 as specified in point 4.2.6.1.1 shall be selected

– Snow, ice and hail severe conditions as specified in point 4.2.6.1.2 , excluding the scenario 'Snowdrift' shall be selected

– Regarding the braking system, unrestricted access in Finland under winter conditions is granted if the following conditions are met:

  - at least half of the bogies are equipped with a magnetic track brake for trainset or passenger coach of nominal speed exceeding 140 km/h.
  - all bogies are equipped with a magnetic track brake for trainset or passenger coach of nominal speed exceeding 180 km/h.

Specific conditions France

Unrestricted access in France under winter conditions is granted if the following condition is met:

– locomotives and power head units shall be provided with sanding system.

Specific conditions Germany

Unrestricted access in Germany under winter conditions, is granted if the following condition is met:

– locomotives and power head units shall be provided with sanding system.

Specific conditions Greece

For unrestricted access to the Greek network under summer conditions, temperature zone T3 as specified in point 4.2.6.1.1 shall be selected.

Unrestricted access in Greece under winter conditions is granted if the following condition is met:

– Traction vehicles shall be equipped with sanding system.

Specific conditions Portugal

For unrestricted access to the Portuguese network under:

(a) summer conditions, temperature zone T3 as specified in point 4.2.6.1.1 shall be selected,

(b) winter conditions, locomotives shall be equipped with sanding system.

Specific conditions Spain

For unrestricted access to the Spanish network under summer conditions, temperature zone T3 as specified in point 4.2.6.1.1 shall be selected.

Specific conditions Sweden

For unrestricted access of rolling stock on the Swedish network under winter conditions, it shall be demonstrated that the rolling stock meets the following requirements:

– Temperature zone T2 as specified in point 4.2.6.1.1 shall be selected

– Snow, ice and hail severe conditions as specified in point 4.2.6.1.2 shall be selected.

(163) Point 7.5 is replaced as follows:

"**7.5. Aspects that have to be considered in the revision process or in other activities of the Agency**

Further to the analysis performed during the drafting process of this TSI, particular aspects have been identified as of interest for the future development of the EU railway system.

These aspects are of 3 different groups:

(1) Those already subject of a basic parameter in this TSI, with a possible evolution of the corresponding specification when the TSI will be revised.

(2) Those not considered in the current state of the art as basic parameter, but which are subject to research projects.

(3) Those relevant in the framework of ongoing studies related to the EU railway system, which are not in the scope of TSIs.

These aspects are identified below, classified according to the breakdown of the point 4.2 of the TSI.

7.5.1. Aspects related to a basic parameter in this TSI

7.5.1.1. Axle load parameter (point 4.2.3.2.1)

This basic parameter covers the interface between infrastructure and rolling stock regarding the vertical load.

Further development is required for route compatibility check regarding static and dynamic compatibility.

Regarding dynamic compatibility, no harmonised classification method of the Rolling Stock is yet available including requirements related to High Speed Load Model (HSLM) compatibility:

– LOC&PAS requirements should further be developed based on finding from CEN enhancing EN1991-2 Annex E with corresponding rolling stock requirements for dynamic compatibility, including compatibility with HSLM compliant structures,

– New basic design characteristics "Compliance of vehicle design with the High Speed Load Model (HSLM)" should be created,

– A harmonised process should be referenced accordingly for route compatibility check purposes in TSI OPE Appendix D.1 based on RINF and ERATV,

– Documents required in RINF parameter 1.1.1.1.2.4.4 should be harmonised as far as possible to facilitate automatic route compatibility check.

7.5.1.2. Not used

7.5.1.3. Aerodynamic effects on ballasted tracks (point 4.2.6.2.5)

Requirements on aerodynamic effects on ballasted tracks have been set up for units of maximum design speed higher than 250 km/h.

As the current state of the art does not allow to provide for a harmonized requirement nor assessment methodology, the TSI allows the application of national rules.

This will need to be reviewed in order to consider the following:

– Study of ballast-pick-up occurrences, and corresponding safety impact (if any).

– Development of a harmonized, cost-effective methodology applicable in EU.

7.5.2. Aspects not related to a basic parameter in this TSI but subject to research projects

7.5.2.1. Not used

7.5.2.2. Further activities related to the conditions for having vehicle type authorisation and/or an authorization for placing on the market not limited to a particular area of use

to facilitate free circulation of locomotives and passenger coaches, conditions for having an authorization for placing on the market not limited to a particular area of use are lay down in clause 7.1.1.5.

These provisions should be complemented with harmonised limit values for interference currents and magnetic fields at unit level, either as a percentage of the value defined for an Influencing unit, or as absolute limit values. These harmonised limits will be determined based on the specific cases or technical documents referred to in Article 13 of CCS TSI and of the future standard EN 50728 expected to be published in 2024..

The specification of interfaces between coaches intended to be used in general operations should be further detailed in point 7.1.1.5.2 with the objective to facilitate the interchangeability of those coaches (new and existing coaches).

7.5.2.3. Equipment of a rolling stock with places for bicycles - Impact of the Passenger Rights Regulation

Article 6(4) of Regulation (EU) 2021/782 of the European Parliament and of the Council[4] specifies the requirements for equipping rolling stock with places for bicycles.

Places for bicycles need to be realised in case of:

– a major change of the layout and furnishing of the passenger area, and

– when the above-mentioned upgrade of existing rolling stock leads to the need for a new vehicle authorisation for placing it on the market.

According to the principle specified in point 7.1.2.2.(1), major upgrades affecting other parts and basic parameters than the layout and furnishing of the passenger area may not entail the equipment of the rolling stock with places for bicycles.";

(164) the appendices are amended as follows:

(a) the contents list is replaced by the following:

"Appendix A: Not used

Appendix B: 1520 mm system gauge T.

Appendix C: Special provisions for On Track Machines (OTMs)

Appendix D: Not used

Appendix E: Anthropometric measurements of the driver

Appendix F: Front visibility

Appendix G: Servicing

Appendix H: Assessment of the rolling stock subsystem

Appendix I: Aspects for which the technical specification is not available (open points)

Appendix J: Technical specifications referred to in this TSI

Appendix J-1: Standards or normative documents

[4] Regulation (EU) 2021/782 of the European Parliament and of the Council of 29 April 2021 on rail passengers' rights and obligations (recast). (OJ L 171, 17.5.2021, p. 1).

Appendix J-2: Technical documents

Appendix K: Validation process for new end pieces of Magnetic Track Brake (MTB)

Appendix L: Changes of requirements and transition regimes";

(b) Appendix C is replaced by the following:

"**APPENDIX C**

Special provisions for On-Track-Machines (OTMs)

C.1 ***Strength of vehicle structure***

The requirements of the point 4.2.2.4 are complemented as follow:

The machine frame shall be able to withstand either the static loads of the specification referenced in Appendix J-1, index [1] or the static loads according to the specification referenced in Appendix J-1, index [51] without exceeding the permissible values given there in.

The corresponding structural category of the specification referenced in Appendix J-1, index [51] is as follows:

– for machines not permitted to be loose shunted or hump shunted: F-II;

– for all other machines: F-I.

The acceleration in x-direction according to the specification referenced in Appendix J-1, index [1], Table 13 or to the specification referenced in Appendix J-1, index [51], Table 10 shall be ± 3 g.

C.2 ***Lifting and jacking***

The machine body shall incorporate lifting points by which the whole machine is capable of being safely lifted or jacked. The location of the lifting and jacking points shall be defined.

To facilitate the work during repair or inspection or when on-tracking the machines, the machines shall be provided on both long sides with at least two lifting points, at which the machines can be lifted in empty or loaded condition.

To allow positioning of jacking devices, clearances shall be provided under the lifting points which shall not be blocked by the presence of non-removable parts. The load cases shall be consistent with the ones chosen in Appendix C.1 and shall apply for lifting and jacking under workshop and servicing operations.

C.3 Running dynamic behaviour

The running characteristics are permitted to be determined by running tests or by reference to a similar type approved machine as detailed in point 4.2.3.4.2of this TSI or by simulation.Running behaviour can be proven by simulation of the tests described in the specification referenced in Appendix J-1, index [9] (with the exceptions as specified below) when there is a validated model of representative track and operating conditions of the machine.

The following additional deviations apply:

(i) The simplified method for this type of machines shall be always accepted;

(ii) if the required test speed cannot be obtained by the machine itself, the machine shall be hauled for the tests.

A model of a machine for simulation of running characteristics shall be validated by comparing the model results against the results of running tests when the same input of track characteristic is used.

A validated model is a simulation model that has been verified by an actual running test that excites the suspension sufficiently and where there is a close correlation between the results of the running test and the predictions from the simulation model over the same test track.

C.4 ACCELERATION AT THE MAXIMUM SPEED

No residual acceleration, as specified in point 4.2.8.1.2 (5), is required for Special vehicles.";

(c) Appendix D not used;"

(d) Appendices E and F are replaced by the following:

"**APPENDIX E**

Anthropometric measurements of the driver

The following data represents the 'state of the art' and shall be used.

– Principal anthropometric measurements of the shortest and tallest driving staff:

The dimensions given in the specification referenced in Appendix J-1, index [62] shall be taken into consideration.

APPENDIX F

Front visibility

F.1. General

The design of the cab shall support the drivers' view of all external information that form part of the driving task as well as protecting the driver from external sources of visual interference. This shall include the following:

– Flicker at the lower edge of the windscreen, which can cause fatigue, shall be reduced

– Protection shall be provided from the sun and glare of headlights from oncoming trains, without reducing the drivers' view of external signs, signals and other visual information

– Location of cab equipment shall not block or distort the drivers view of external information

– The dimension, location, shape and finishes (including maintenance) of the windows shall not inhibit the drivers external view and shall support the driving task

– The location, type and quality of windscreen cleaning and clearance devices shall ensure that the driver is able to maintain a clear external view in most weather and operating conditions, and shall not inhibit the drivers external view.

– The driver's cab shall be designed in such a way that the driver is facing forwards when driving.

– The driver's cab shall be designed to allow the driver at standing and/or seated driving positions a clear and unobstructed line of sight in order to distinguish fixed signals set to both the left and right of the track, as defined in the specification referenced in Appendix J-1 index [62].

The rules expressed in the Appendix above govern the conditions of visibility for each running direction along straight track and in curves with a radius of 300 m and more. They apply to the position(s) of the driver.

Notes:

in case of cab fitted with 2 driver's seats (option with 2 driving positions), they apply to the 2 seated positions.

for locomotives with central cab and for Special Vehicles, the point 4.2.9.1.3.1 of the TSI specifies particular conditions.

F.2. Reference position of vehicle in relation to track:

The specification referenced in Appendix J-1 index [62]shall apply.

The supplies and payload shall be considered as defined in the specification referenced in Appendix J-1, index [6] and point 4.2.2.10 .

F.3. Reference position for the eyes of crew members

The specification referenced in Appendix J-1 index [62] shall apply.

The distance from the driver's eyes in seating posture to the windscreen shall be higher than or equal to 500 mm.

F.4. Conditions of visibility

The specification referenced in Appendix J-1 index [62] shall apply.";

(e) in Appendix H, Table H.1 is amended as follows:

(i) in the row "Cross wind", "Cross wind" is replaced by "Crosswind";

(ii) the row "Maximum current at standstill for DC systems" is replaced by the following:

"

Maximum current at standstill	4.2.8.2.5	X	X (only for DC systems)	n.a	—		

";

(iii) the title "System energy disturbances" is replaced by "Harmonics and dynamic effects AC systems";

(iv) the row "Diesel and other thermal traction system" is deleted;

(v) the title “Onboard tools and portable equipment” is replaced by “On-board tools and portable equipment”;

(vi) the row “Water refilling equipment” is deleted;

(f) Appendix I is replaced by the following:

“APPENDIX I

ASPECTS FOR WHICH THE TECHNICAL SPECIFICATION IS NOT AVAILABLE

(OPEN POINTS)

Open points that relate to technical compatibility between the vehicle and the network:

Element of the Rolling Stock sub-system	Point of this TSI	Technical aspect not covered by this TSI	Comments
Compatibility with train detection systems	4.2.3.3.1	See specification referenced in Appendix J-2, index [A]	Open points also identified in the TSI CCS.
Running dynamic behaviour for 1520 mm track gauge system	4.2.3.4.2 4.2.3.4.3	Running dynamic behaviour. Equivalent conicity.	Normative documents referred to in the TSI are based on experience gained on the 1435 mm system.
Equivalent conicity for 1600 mm track gauge system	4.2.3.4.3	Running dynamic behaviour. Equivalent conicity.	Normative documents referred to in the TSI are based on experience gained on the 1435 mm system.
Braking system independent of adhesion conditions	4.2.4.8.3	Eddy current track brake	The conditions for use of eddy current track brake for technical compatibility with the track are not harmonised
Aerodynamic effect on ballasted track for rolling stock of maximum design speed > 250 km/h	4.2.6.2.5	Limit value and conformity assessment in order to limit risks induced by the projection of ballast	On-going work within CEN. Open point also in TSI INF.

Open points that do not relate to technical compatibility between the vehicle and the network:

Element of the Rolling Stock sub-system	Point of this TSI	Technical aspect not covered by this TSI	Comments
Fire Containment and Control Systems	4.2.10.3.4	Conformity assessment of FCCS other than full partitions.	Assessment procedure of efficiency for controlling fire and smoke developed by CEN according to a request for standard issued by ERA.

”;

(g) Appendix J is replaced by the following:

“Appendix J

Technical specifications referred to in this TSI

J-1 *Standards or normative documents*

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[1]	**EN 12663-1:2010+A1:2014** **Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)**		
[1.1]	Inner coupling for articulated units	4.2.2.2.2 (3)	6.5.3, 6.7.5
[1.2]	Strength of vehicle structure – general	4.2.2.4 (3)	5.1, 5.2, 5.3, 5.4, 5.6
[1.3]	Strength of vehicle structure – method of verification	4.2.2.4 (4)	9.2, 9.3
[1.4]	Strength of vehicle structure – alternative requirements for OTMs	Appendix C Point C.1	6.1 to 6.5
[1.5]	Lifting and jacking — loads for the structure design	4.2.2.6 (9)	6.3.2, 6.3.3
[1.6]	Lifting and jacking — strength demonstration	4.2.2.6 (9)	9.2, 9.3

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[1.7]	Fixing of devices to carbody structure	4.2.2.7 (3)	6.5.2, 6.7.3
[1.8]	Structural design of the bogie frame – body to bogie connection	4.2.3.5.1 (2)	6.5.1, 6.7.2
[2]	**EN 16839:2022** **Railway applications - Rolling stock - Head stock layout**		
[2.1]	Staff access for coupling and uncoupling – space for shunting staff	4.2.2.2.5 (2)	4
[2.2]	End coupling – Compatibility between units –manual UIC type Buffers and screw coupling installation	4.2.2.2.3 (b) (b-2) (1)	5, 6
[2.3]	Dimensions and layout of brake pipes and hoses, couplings and cocks	4.2.2.2.3 (b) (b-2) (2)	7, 8
[2.4]	Rescue coupling — interface with recovery unit	4.2.2.2.4 (3) (a)	7
[3]	**EN 15227:2020** **Railway applications - Crashworthiness requirements for railway vehicle bodies**		
[3.1]	➔Passive safety – general ←	➔4.2.2.5 ←	4, 5, 6, 7 and annexes B, C, D (excluding annex A)←
[3.2]	➔Passive safety – categorisation ←	4.2.2.5 (5)	5.1➔-table 1 ←
[3.3]	➔Passive safety – scenarios ←	4.2.2.5 (6)	➔5.2, 5.3, 5.4 (excluding annex A)←
[3.4]	➔Passive safety – requirements ←	4.2.2.5 (7)	6.1, 6.2, 6.3, 6.4 (excluding annex A)

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[3.5]	➔Passive safety – obstacle deflector ←	4.2.2.5 (8)	➔6.5.1←
[3.6]	Lifeguards	4.2.3.7	6.6.1
[3.7]	➔Environmental conditions – obstacle deflector←	➔4.2.6.1.2 (4) ←	➔6.5.1
[4]	**EN 16404:2016** **Railway applications - Re-railing and recovery requirements for railway vehicles**		
[4.1]	Lifting and jacking — geometry of permanent points	4.2.2.6 (7)	5.2, 5.3
[4.2]	Lifting and jacking — geometry of removable points	4.2.2.6 (7)	5.2, 5.3
[5]	**EN 15877-2:2013** **Railway applications - Markings of railway vehicles - Part 2: External markings on coaches, motive power units, locomotives and on track machines**		
[5.1]	➔Lifting and jacking – marking ←	➔4.2.2.6 (8) ←	➔4.5.19 ←
[5.2]	Coaches intended to be used in general operation	7.1.1.5.1(23)	4.5.5.1, 4.5.6.3
[6]	**EN 15663:2017+A1 :2018** **Railway applications - Vehicle reference masses**		
[6.1]	Load conditions and weighed mass – load conditions	4.2.2.10 (1)	4.5
[6.2]	Load conditions and weighed mass – hypothesis of load conditions	4.2.2.10 (2)	4.1, 4.2, 4.3, 4.4, 4.5, 5, 6, 7.1, 7.2, 7.3 (design conditions)

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[7]	**EN 15273-2:2013+A1:2016** **Railway applications - Gauges - Part 2: Rolling stock gauge**		
[7.1]	Gauging – method, reference profile	4.2.3.1 (3), (4)	5 and depending on the profile : annex A (G1) , B (GA,GB,GC) , C (GB1,GB2), D (GI3), E(G2), F (FIN1), G(FR3,3), H (BE1,BE2,BE3),I (PTb,PTb+,PTc), J(SEa,Sec), K(OSJD), L(DE1 DE2 DE3), M(NL1NL2), P(GHE16….)
[7.2]	Gauging – method, reference profile Verification of pantograph gauge	4.2.3.1 (5)	A.3.12
[7.3]	Gauging – method, reference profile Verification of eddy current track brakes	4.2.4.8.3(3)	5 and depending on the profile : annex A (G1) , B (GA,GB,GC) , C (GB1,GB2), D (GI3), E(G2), F (FIN1), G(FR3,3), H (BE1,BE2,BE3),I (PTb,PTb+,PTc), J(SEa,Sec), K(OSJD), L(DE1 DE2 DE3), M(NL1NL2), P(GHE16….)
[8]	**EN 15437-1:2009** **Railway applications – Axle box condition monitoring – Interface and design requirements - Part 1: Track side equipment and rolling stock axle box**		
[8.1]	Axle bearing condition monitoring – zone visible to track side equipment	4.2.3.3.2.2 (1), (2a) 7.3.2.3	5.1, 5.2

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[9]	**EN 14363:2016+ A2:2022** **Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests**		
[9.1]	Axle loads range	4.2.3.4.1, 4.2.3.4.2(4)	1.1, 5.3.2
[9.2]	Combination(s) of speed and cant deficiency	4.2.3.4.2 (3)	1.4, 7.3.1
[9.3]	Track loading parameters	4.2.3.4.2 (5)	7.5.1, 7.5.3
[9.4]	Running dynamic behaviour – limit values for running safety	4.2.3.4.2.1	7.5.1, 7.5.2
[9.5]	Running dynamic behaviour – track loading limit values	4.2.3.4.2.2 (1)	7.5.1, 7.5.3
[9.6]	Safety against derailment running on twisted track	6.2.3.3 (1)	4, 5, 6.1
[9.7]	Running dynamic behaviour – method of verification	6.2.3.4 (1)	7
[9.8]	Running dynamic behaviour –criteria for assessment	6.2.3.4 (1)	4, 5
[9.9]	Design values for new wheel profiles – evaluation of the equivalent conicity	6.2.3.6 (1)	Annexes O and P
[9.10]	Vehicles conformity with rail inclination	7.1.2 Table 17a note ([1])	4,5,6,7.
[9.11]	Provision for special vehicles: simulation of the tests	Appendix C Section C.3	Annexe T

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[10]	**EN 15528:2021** **Railway applications - Line categories for managing the interface between load limits of vehicles and infrastructure**		
[10.1]	EN line category as the result of a categorisation of the unit	4.2.3.2.1 (2)	6.1, 6.3, 6.4
[10.2]	Standard value of payload in standing areas	4.2.3.2.1 (2a)	Table 4 column 2
[10.3]	Documentation indicating the payload used in standing areas	4.2.3.2.1 (2c)	6.4.1
[11]	**EN 13749:2021** **Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames**		
[11.1]	Structural design of the bogie frame	4.2.3.5.1 (1) 4.2.3.5.1 (3)	6.2,
[12]	**EN 14198:2016+A1:2018+A2:2021** **Railway applications - Braking - Requirements for the brake system of trains hauled by locomotives**		
[12.1]	Braking – type of brake system, UIC brake system	4.2.4.3	5.4
[12.2]	Coaches intended to be used in general operation	7.1.1.5.2 (3)	5.4 5.3.2.6
[13]	**EN 14531-1:2015+A1 :2018** **Railway applications - Methods for calculation of stopping distances, slowing distances and immobilization braking - Part 1:General algorithms**		
[13.1]	Braking performance – calculation – general	4.2.4.5.1 (1)	4
[13.2]	Emergency braking performance – calculation	4.2.4.5.2 (3)	4

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[13.3]	Service braking performance – calculation	4.2.4.5.3 (1)	4
[13.4]	Parking brake performance – calculation	4.2.4.5.5 (3)	5
[13.5]	Braking performance – friction coefficient	4.2.4.5.1 (2)	4.4.6
[13.6]	Emergency braking performance – response time/delay time	4.2.4.5.2 (1)	4.4.8.2.1 4.4.8.3
[14]	**EN 14531-2:2015** **Railway applications - Methods for calculation of stopping and slowing distances and immobilisation braking - Part 2: Step by step calculations for train sets or single vehicles**		
[14.1]	Braking performance – calculation – general	4.2.4.5.1 (1)	4, 5
[14.2]	Emergency braking performance – calculation	4.2.4.5.2 (3)	4, 5
[14.3]	Service braking performance – calculation	4.2.4.5.3 (1)	4, 5
[15]	**EN 15595:2018+AC :2021** **Railway applications - Braking - Wheel slide protection**		
[15.1]	Wheel slide protection system – design	4.2.4.6.2 (6)	5.1, 5.2, 5.4
[15.2]	Wheel slide protection system – verification method and test program	6.1.3.2 (1)	6.1.1, 6.2, 6.5, 7
[15.3]	Wheel slide protection system – wheel rotation monitoring system	4.2.4.6.2 (8)	5.1.7
[15.4]	Wheel slide protection, method of verification of performance	6.2.3.10 (1)	6.3, 7

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[16]	**EN 16207:2014+A1 :2019** **Railway applications - Braking - Functional and performance criteria of Magnetic Track Brake systems for use in railway rolling stock**		
[16.1]	Magnetic track brake	4.2.4.8.2 (3) Appendix K	Annex C
[17]	**EN 14752:2019+A1 :2021** **Railway applications - Bodyside entrance systems for rolling stock**		
[17.1]	Door obstacle detection – sensitivity	4.2.5.5.3 (5)	5.2.1.4.1
[17.2]	Door obstacle detection – maximum force	4.2.5.5.3 (5)	5.2.1.4.2.2
[17.3]	Door emergency opening – manual force to open the door	4.2.5.5.9 (6)	5.5.1.5
[17.4]	Coaches intended to be used in general operation – door control device	7.1.1.5.2 (10)	5.1.1, 5.1.2, 5.1.5, 5.1.6
[18]	**EN 50125-1:2014** **Railway applications - Environmental conditions for equipment -Part 1: Rolling stock and on-board equipment**		
[18.1]	Environmental conditions – temperature	4.2.6.1.1 (1)	4.3
[18.2]	Environmental conditions – snow, ice and hail conditions	4.2.6.1.2 (1)	4.7
[18.3]	Environmental conditions – temperature	7.1.1.5.2 (4)	4.3
[19]	**EN 14067-6:2018** **Railway applications - Aerodynamics - Part 6: Requirements and test procedures for crosswind assessment**		
[19.1]	Aerodynamic effects – crosswind method of verification	4.2.6.2.4 (2)	5

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[19.2]	Aerodynamic effects – crosswind for units of maximum design speed equal or higher than 250 km/h	4.2.6.2.4 (3)	5
[20]	**EN 15153-1:2020** **Railway applications - External visible and audible warning devices - Part 1: Head, marker and tail lamps for heavy rail**		
[20.1]	Head lamps – colour	4.2.7.1.1 (4)	5.3.3
[20.2]	Head lamps – full-beam and dimmed headlamp luminous intensity	4.2.7.1.1 (5)	5.3.3, 5.3.4 table 2 first line
[20.3]	Head lamps – means of alignment	4.2.7.1.1 (6)	5.3.3, 5.3.5
[20.4]	Marker lamps – colour	4.2.7.1.2 (6) (a)	5.4.3.1 table 4
[20.5]	Marker lights – spectral radiation distribution	4.2.7.1.2 (6) (b)	5.4.3.2
[20.6]	Marker lights – luminous intensity	4.2.7.1.2 (6) (c)	5.4.4 table 6
[20.7]	Tail lights – colour	4.2.7.1.3 (4) (a)	5.5.3 table 7
[20.8]	Tail lights – luminous intensity	4.2.7.1.3 (4) (b)	5.5.4 table 8
[20.9]	Head lamps – colour	6.1.3.3 (1)	5.3.3, 6.3
[20.10]	Head lamps – luminous intensity	6.1.3.3 (1)	5.3.3, 6.4
[20.11]	Marker lamps – colour	6.1.3.4 (1)	6.3
[20.12]	Marker lamps – luminous intensity	6.1.3.4 (1)	6.4
[20.13]	Tail lamps – colour	6.1.3.5 (1)	6.3

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[20.14]	Tail lamps – luminous intensity	6.1.3.5 (1)	6.4
[20.15]	Marker lamps – means of alignment	4.2.7.1.2 (7)	5.4.5
[21]	**EN 15153-2:2020** **Railway applications - External visible and audible warning devices - Part 2: Warning horns for heavy rail**		
[21.1]	Warning horn sound pressure levels	4.2.7.2.2 (1)	5.2.2
[21.2]	Horn – sounding	6.1.3.6 (1)	6
[21.3]	Horn – sound pressure level	6.1.3.6 (1)	6
[21.4]	Horn – sound pressure level	6.2.3.17 (1)	6
[22]	**EN 50388-1:2022** **Railway Applications - Fixed installations and rolling stock -** **Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 1: General**		
[22.1]	Regenerative brake with energy to the overhead contact line	4.2.8.2.3 (1)	12.2.1
[22.2]	Maximum power and current from the overhead contact line – automatic regulation of current	4.2.8.2.4 (2)	7.3
[22.3]	Power factor – verification method	4.2.8.2.6 (1)	6
[22.4]	Harmonics and dynamic effects for AC systems –	4.2.8.2.7 (1)	10 (except 10.2)
[22.5]	Electrical protection of the train – coordination of protection	4.2.8.2.10 (3)	11

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[22.6]	Main circuit breaker – coordination of protection	5.3.12 (4)	11.2, 11.3
[22.7]	Maximum power and current from the overhead contact line – method of verification	6.2.3.18 (1)	15.3.1
[22.8]	Power factor — method of verification	6.2.3.19 (1)	15.2
[23]	**EN 50206-1:2010** **Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 1: Pantographs for main line vehicles**		
[23.1]	Working range in height of pantograph (IC level) – characteristics	4.2.8.2.9.1.2 (2)	4.2, 6.2.3
[23.2]	Pantograph current capacity (IC level)	4.2.8.2.9.3a (2)	6.13.2
[23.3]	Pantograph lowering (RST level) – time to lower the pantograph	4.2.8.2.9.10 (1)	4.7
[23.4]	Pantograph lowering (RST level) – ADD	4.2.8.2.9.10 (3)	4.8
[23.5]	Pantograph – verification method	6.1.3.7 (2)	6.3.1
[24]	**EN 50367:2020+A1:2022** **Railway applications - Current collection systems - Technical criteria for the interaction between pantograph and overhead line (to achieve free access)**		
[24.1]	Maximum current at standstill	4.2.8.2.5 (1)	Table 5 of 7.2
[24.2]	Pantograph head geometry	4.2.8.2.9.2 (5)	5.3.2.3
[24.3]	Pantograph head geometry – type 1600 mm	4.2.8.2.9.2.1 (1)	Annex A.2 Figure A.6

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[24.4]	Pantograph head geometry – type 1950 mm	4.2.8.2.9.2.2 (1)	Annex A.2 Figure A.7
[24.5]	Pantograph – temperature of contact wire	6.1.3.7 (1a)	7.2
[25]	**Not used**		
[26]	**EN 50119:2020** **Railway applications - Fixed installations - Electric traction overhead contact lines**		
[26.1]	Pantograph lowering (RST level) – dynamic insulating distance	4.2.8.2.9.10 (1)	Table 2
[27]	**EN 50153:2014-05/A1:2017-08/A2:2020-01** **Railway applications -Rolling stock -Protective provisions relating to electrical hazards**		
[27.1]	Protection against electrical hazard	4.2.8.4 (1)	5, 6, 7, 8
[28]	**EN 15152:2019** **Railway applications - Front windscreens for train cabs**		
[28.1]	Windscreen – resistance to impacts from projectiles	4.2.9.2.1 (2)	6.1
[28.2]	Windscreen – resistance to spalling	4.2.9.2.1 (2)	6.1
[28.3]	Windscreen –secondary image separation	4.2.9.2.2 (2) (a)	5.2.1
[28.4]	Windscreen – optical distortion	4.2.9.2.2 (2) (b)	5.2.2
[28.5]	Windscreen – haze	4.2.9.2.2 (2) (c)	5.2.3
[28.6]	Windscreen – light transmittance	4.2.9.2.2 (2) (d)	5.2.4
[28.7]	Windscreen – chromaticity	4.2.9.2.2 (2) (e)	5.2.5

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[28.8]	Windscreen – characteristics	6.2.3.22 (1)	5.2.1 to 5.2.5 6.1
[29]	**EN/IEC 62625-1:2013+A11:2017** **Electronic railway equipment - On board driving data recording system -Part 1: System specification**		
[29.1]	Recording device – functional requirements	4.2.9.6 (2) (a)	4.2.1, 4.2.2, 4.2.3, 4.2.4
[29.2]	Recording device – recording performance	4.2.9.6 (2) (b)	4.3.1.2.2
[29.3]	Recording device – integrity	4.2.9.6 (2) (c)	4.3.1.4
[29.4]	Recording device – data integrity safeguard	4.2.9.6 (2) (d)	4.3.1.5
[29.5]	Recording device – level of protection	4.2.9.6 (2) (e)	4.3.1.7
[29.6]	Recording device – day and date	4.2.9.6 (2) (f)	4.3.1.8
[30]	**EN 45545-2:2020** **Railway applications - Fire protection on railway vehicles -Part 2: Requirements for fire behaviour of materials and components**		
[30.1]	Measures to prevent fire – material requirements	4.2.10.2.1 (2)	4, 5, 6
[30.2]	Specific measures for flammable liquids	4.2.10.2.2 (2)	Table 5
[31]	**EN 1363-1:2020** **Fire resistance tests - Part 1: General Requirements**		
[31.1]	Fire spreading protection measures for passenger rolling stock – partition test	4.2.10.3.4 (3)	4 to 12

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[31.2]	Fire spreading protection measures for passenger rolling stock – partition test	4.2.10.3.5 (3)	4 to 12
[32]	**EN 13272-1:2019** **Railway applications -Electrical lighting for rolling stock in public transport systems-Part 1: Heavy rail**		
[32.1]	Emergency lighting – lighting level	4.2.10.4.1 (5)	4.3, 5.3
[33]	**EN 50553:2012/A2:2020** **Railway applications - Requirements for running capability in case of fire on board of rolling stock**		
[33.1]	Running capability	4.2.10.4.4 (3)	5 , 6
[34]	**EN 16362:2013** **Railway applications - Ground based services - Water restocking equipment**		
[34.1]	Interface for water filling	4.2.11.5 (2)	4.1.2 figure 1
[35]	**EN/IEC 60309-2:1999/A11:2004, A1: 2007 and A2:2012** **Plugs, socket-outlets and couplers for industrial purposes - Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories**		
[35.1]	Special requirements for stabling of trains – local external auxiliary power supply	4.2.11.6 (2)	8
[36]	**EN 16019:2014** **Railway applications - Automatic coupler - Performance requirements, specific interface geometry and test method**		
[36.1]	Automatic centre buffer coupler – type 10 The type of end coupling (mechanical and pneumatic interface of the head)	5.3.1 (1)	4

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[37]	**EN 15551:2022** **Railway applications - Railway rolling stock - Buffers**		
[37.1]	Manual end coupling – UIC type	5.3.2 (1)	6.2.2, annex A
[38]	**EN 15566:2022** **Railway applications - Railway rolling stock - Draw gear and screw coupling**		
[38.1]	Manual end coupling – UIC type	5.3.2 (1)	Annex B, C, D except the dimension 'a' in Annex B Figure B.1 which shall be treated as informative
[39]	**EN 15020:2022** **Railway applications - Rescue coupler - Performance requirements, specific interface geometry and test methods**		
[39.1]	Rescue coupler – rescue coupler interfaced with the 'type 10"	5.3.3 (1)	4.2.1, 4.2.2, 4.3, 4.5.1, 4.5.2, 4.6 and 5.1.2
[40]	**EN 13979-1:2020** **Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Part 1: Forged and rolled wheels**		
[40.1]	Wheels – mechanical strength calculations	6.1.3.1 (1)	8
[40.2]	Wheels – decision criteria for forged and rolled wheels	6.1.3.1 (2)	8
[40.3]	Wheels – specification for further verification method (bench test)	6.1.3.1 (2)	8
[40.4]	Wheels – verification method Thermomechanical behaviour	6.1.3.1 (5)	7

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[41]	**EN 50318:2018+A1 :2022** **Railway applications -Current collection systems -Validation of simulation of the dynamic interactionbetween pantograph and overhead contact line**		
[41.1]	Pantograph – dynamic behaviour	6.1.3.7 (3)	5, 6, 7, 8, 9, 10, 11
[41.2]	Pantograph – arrangement of pantographs	6.2.3.21 (2)	5, 6, 7, 8, 9, 10, 11
[42]	**EN 50317:2012/AC:2012+A1:2022** **Railway applications - Current collection systems - Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line**		
[42.1]	Pantograph – interaction characteristics	6.1.3.7 (3)	3, 4, 5, 6, 7, 8, 9
[42.2]	Current collection dynamic behaviour – dynamic tests	6.2.3.20 (1)	3, 4, 5, 6, 7, 8, 9
[42.3]	Arrangement of pantographs	6.2.3.21 (2)	3, 4, 5, 6, 7, 8, 9
[43]	**EN 50405:2015+A1:2016** **Railway applications -Current collection systems -Pantographs, testing methods for contact strips**		
[43.1]	Contact strips – verification method	6.1.3.8 (1)	7.2, 7.3 7.4, 7.6 7.7
[44]	**EN 13674-1:2011+A1:2017** **Railway applications - Track - Rail - Part 1: Vignole railway rails 46 kg/m and above**		
[44.1]	Equivalent conicity – rail section definitions	6.2.3.6 - tables 12, 14 and 16	figures A.15, A.23 and A.24

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[45]	**EN 13715:2020** **Railway applications - Wheelsets and bogies - Wheels - Tread profile**		
[45.1]	Equivalent conicity – wheel profile definitions	6.2.3.6 (1), (2) and (3)	Annex B and Annex C
[46]	**EN 13260:2020** **Railway applications - Wheelsets and bogies - Wheelsets - Product requirements**		
[46.1]	Wheelset – assembly	6.2.3.7 (1)	4.2.1
[47]	**EN 13103-1:2017** **Railway applications - Wheelsets and bogies - Part 1: Design method for axles with external journals**		
[47.1]	Wheelset – Powered and non-powered axles, method of verification	6.2.3.7 (2)	5, 6, 7
[47.2]	Wheelset – Powered and non-powered axles, decision criteria	6.2.3.7 (2)	8
[48]	**EN 12082:2017+A1:2021** **Railway applications – Axle boxes - Performance testing**		
[48.1]	Axle boxes/bearings	6.2.3.7 (6)	7
[49]	**EN 14067-4:2013+A1:2018** **Railway applications - Aerodynamics - Part 4: Requirements and test procedures for aerodynamics on open track**		
[49.1]	Slipstream effect – full scale tests	6.2.3.13 (1)	6.2.2.1
[49.2]	Slipstream effect – simplified assessment	6.2.3.13 (2)	4.2.4 and limits in table 7
[49.3]	Head pressure pulse – method of verification	6.2.3.14 (1)	6.1.2.1
[49.4]	Head pressure pulse – CFD	6.2.3.14 (1)	6.1.2.4

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[49.5]	Head pressure pulse – moving model	6.2.3.14 (1)	6.1.2.2
[49.6]	Head pressure pulse – simplified assessment method	6.2.3.14 (2)	4.1.4 and limits in table 4
[49.7]	Slipstream effects – Definition of measurement points	4.2.6.2.1 (1)	4.2.2.1, Table 5
[49.8]	Reference train for fixed/predefined formations	4.2.6.2.1 (3)	4.2.2.2
[49.9]	Formation for single units fitted with a driver cab	4.2.6.2.1 (3)	4.2.2.3
[49.10]	Reference train for units for general operation	4.2.6.2.1 (3)	4.2.2.4
[49.11]	Head pressure pulse – Maximum peak-to-peak pressure	4.2.6.2.2 (2)	Table 2
[49.12]	Head pressure pulse – Measurement positions	4.2.6.2.2 (2)	4.1.2
[50]	**EN 14067-5:2021/AC:2023** **Railway applications - Aerodynamics - Part 5: Requirements and test procedures for aerodynamics in tunnels**		
[50.1]	pressure variations in tunnels : general	4.2.6.2.3(1)	5.1
[50.2]	Unit assessed in fixed or predefined formation	4.2.6.2.3(2)	5.1.2.2
[50.3]	Unit assessed for general operation and fitted with a driver's cab	4.2.6.2.3(2)	5.1.2.3
[50.4]	coaches for general operation	4.2.6.2.3(2)	5.1.2.4
[50.5]	conformity assessment procedure	6.2.3.15	5.1.4, 7.2.2, 7.2.3, 7.3

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[50.6]	Unique authorisation - coaches intended to be used in mixed traffic in tunnels – aerodynamic loads	7.1.1.5.1 (14)	6.3.9
[51]	**EN 12663-2:2010** **Railway applications - Structural requirements of railway vehicle bodies - Part 2: Freight wagons**		
[51.1]	Structural strength	Appendix C Point C.1	5.2.1 to 5.2.4
[52]	**CLC/TS 50534:2010** **Railway applications - Generic system architectures for onboard electric auxiliary power systems**		
[52.1]	'Single pole' power supply line	4.2.11.6 (2)	Annex A
[53]	**IEC 61375-1:2012** **Electronic railway equipment –Train communication network (TCN) – Part 1: General architecture**		
	Unique authorisation - Communication networks	7.1.1.5.1 (18)	5, 6
[53.2]	Coaches intended to be used in general operation - Communication networks	7.1.1.5.2 (12)	5, 6
[54]	**EN 16286-1:2013** **Railway applications - Gangway systems between vehicles - Part 1: Main applications**		
[54.1]	Gangways-Flange intercommunication connections	7.1.1.5.2 (6)	Annexes A and B

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[55]	**EN 50463-3:2017** **Railway applications - Energy measurement on board trains - Part 3: Data handling**		
[55.1]	On-board location function-Requirements	4.2.8.2.8.1 (7)	4.4
[55.2]	The compiling and handling of data within the data handing system-Assessment methodology	6.2.3.19a (2)	5.4.8.3, 5.4.8.5 and 5.4.8.6
[56]	**EN 50463-2:2017/AC :2018-10** **Railway applications - Energy measurement on board trains - Part 2: Energy measuring**		
[56.1]	Energy measurement function – accuracy for active energy measurement:	4.2.8.2.8.2 (3)	4.2.3.1 to 4.2.3.4
[56.2]	Energy measurement function – Class designations	4.2.8.2.8.2 (4)	4.3.3.4, 4.3.4.3 and 4.4.4.2
[56.3]	Energy measurement function — Assessment of the accuracy of devices	6.2.3.19a (1)	5.4.3.4.1, 5.4.3.4.2, 5.4.4.3.1
[56.4]	Energy measurement function — values for input quantity and power factor range	6.2.3.19a (1)	Table 3,
[56.5]	Energy measurement function — effects of temperature on accuracy	6.2.3.19a (1)	5.4.3.4.3.1 and 5.4.4.3.2.1
[56.6]	Energy measurement function: mean temperature coefficient of each device — Assessment methodology	6.2.3.19a (1)	5.4.3.4.3.2 and 5.4.4.3.2.2

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[57]	**EN 50463-1:2017** **Railway applications - Energy measurement on board trains - Part 1: General**		
[57.1]	Energy measurement function: consumption point identification — Definition	4.2.8.2.8.3 (4)	4.2.5.2
[58]	**EN 50463-4:2017** **Railway applications - Energy measurement on board trains - Part 4: Communication**		
[58.1]	Data exchange between EMS and DCS - application services (service layer) of the EMS	4.2.8.2.8.4 (1)	4.3.3.1,
[58.2]	Data exchange between EMS and DCS – User access rights	4.2.8.2.8.4 (2)	4.3.3.3
[58.3]	Data exchange between EMS and DCS - XML schema for structure (data layer)	4.2.8.2.8.4 (3)	4.3.4
[58.4]	Data exchange between EMS and DCS – Methods and XML schema for message mechanism (message layer)	4.2.8.2.8.4 (4)	4.3.5
[58.5]	Data exchange between EMS and DCS – Application protocols for supporting the message mechanism	4.2.8.2.8.4 (5)	4.3.6
[58.6]	Data exchange between EMS and DCS – EMS communication architecture	4.2.8.2.8.4 (6)	4.3.7

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[59]	**EN 50463-5:2017** **Railway applications - Energy measurement on board trains - Part 5: Conformity assessment**		
[59.1]	On-board energy measurement system- Tests	6.2.3.19a (3)	5.3.3 and 5.5.4
[60]	**Reserved**		
[61]	**IRS UIC 50558:2017** **Railway Application -Rolling Stock -Remote control and data cables interfaces -Standard technical features**		
[61.1]	Physical interface between units for the signal transmission	7.1.1.5.2 (8)	7.1.1
[62]	**EN 16186-1:2014+A1 :2018** **Railway applications - Driver's cab - Part 1: Anthropometric data and visibility**		
[62.1]	Anthropometric measurements of the driver	Appendix E	4
[62.2]	Front visibility	F.1	Annex A.
[62.3]	Front visibility	F.2, F.3, F.4	5.2.1.
[63]	**EN 14363:2005** **Railway applications - Testing for the acceptance of running characteristics of railway vehicles – Testing for running behaviour and stationary tests**		
[63.1]	Vehicles conformity with rail inclination	7.1.2 Table 17a note ([1])	5
[64]	**UIC 518:2009** **Testing and approval of railway vehicles from the point of view of their dynamic behaviour - Safety - Track fatigue - Running behaviour**		
[64.1]	Vehicles conformity with rail inclination	7.1.2 Table 17a note (1)	5 to 11

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[65]	**EN 16834:2019** **Railway applications - Braking - Brake performance**		
[65.1]	Braked weight percentage	4.2.4.5.2 (4)	8.1
[66]	**EN 14478:2017** **Railway applications - Braking - Generic vocabulary**		
[66.1]	Emergency braking performance	6.2.3.8 (1)	4.6.3
[66.2]	Service braking performance	6.2.3.9 (1)	4.6.3
[67]	**EN 15328:2020** **Railway applications - Braking - Brake pads**		
[67.1]	Emergency braking performance – friction coefficient	4.2.4.5.2 (5)	5.2
[68]	**EN 16452:2015+A1:2019** **Railway applications - Braking - Brake blocks**		
[68.1]	Emergency braking performance – friction coefficient	4.2.4.5.2 (5)	5.3.1, 5.3.3
[69]	**EN 50163:2004+A1:2007+A2:2020+A3:2022** **Railway applications - Supply voltages of traction systems**		
[69.1]	Operation within range of voltages and frequencies	4.2.8.2.2.(1)	4
[70]	**UIC 541-6:2010-10** **Brakes - Electropneumatic brake (ep brake) and Passenger alarm signal (PAS) for vehicles used in hauled consists**		
[70.1]	Coaches intended to be used in general operation	7.1.1.5.2 (3)	3, 7

Index	Characteristics to be assessed	TSI point	Mandatory standards point
[71]	**EN 17065:2018** **Railway applications - Braking - Passenger coach test procedure**		
[71.1]	Coaches intended to be used in predefined formations	7.1.1.5.1 (13)	5, 6
[71.2]	Coaches intended to be used in general operation	7.1.1.5.2 (3)	5, 6
[72]	**EN/IEC 62625-2:2016** **Electronic railway equipment - On board driving data recording system -Part 2: Conformity testing**		
[72.1]	Testing	4.2.9.6 (3)	5, 6
[73]	**EN 14363:2016** **Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests**		
[73.1]	Vehicles conformity with rail inclination	7.1.2 Table 17a note (1)	4,5,7
[74]	**EN 16586-1:2017** **Railway applications - Design for PRM use - Accessibility of persons with reduced mobility to rolling stock - Part 1: Steps for access and egress**		
[74.1]	Coaches intended to be used in predefined formations	7.1.1.5.1 (19)	Annex A

J-2 *Technical documents (available on ERA website)*

Index	Characteristics to be assessed	TSI point	Mandatory technical document point
[A]	**ERA/ERTMS/033281 - V 5.0** **Interfaces between Control-Command and Signalling Trackside and other Subsystems** **TSI CCS, Appendix A, Table A 2, index [77]**		
Rolling stock characteristics for compatibility with train detection system based on track circuits		4.2.3.3.1.1	
[A.1]	Maximum distance between following axles	4.2.3.3.1.1 (1)	3.1.2.1 (distance a_i in Figure 1)
[A.2]	Maximum distance between front/ rear end of train and first/last axle	4.2.3.3.1.1 (2)	3.1.2.4 3.1.2.5 (distance b_x in Figure 1
[A.3]	Minimum distance between first and last axle	4.2.3.3.1.1 (3)	3.1.2.3
[A.4]	Minimum axle load in all load conditions	4.2.3.3.1.1 (4)	3.1.7.1
[A.5]	Electrical resistance between the running surfaces of the opposite wheels of a wheelset	4.2.3.3.1.1 (5)	3.1.9
[A.6]	For electric units equipped with a pantograph, the minimum vehicle impedance	4.2.3.3.1.1 (6)	3.2.2.1
[A.7]	use of shunting assisting devices	4.2.3.3.1.1 (7)	3.1.8
[A.8]	use of sanding equipment	4.2.3.3.1.1 (8)	3.1.4
[A.9]	use of composite brake blocks	4.2.3.3.1.1 (9)	3.1.6
[A.10]	Requirements for flange lubricators	4.2.3.3.1.1 (10)	3.1.5
[A.11]	requirements related to conducted interference	4.2.3.3.1.1 (11)	3.2.2

Rolling stock characteristics for compatibility with train detection system based on axle counters		4.2.3.3.1.2	
[A.12]	maximum distance between following axles	4.2.3.3.1.2 (1)	3.1.2.1 (distance a_i in Figure 1)
[A.13]	minimum distance between following axles	4.2.3.3.1.2 (2)	3.1.2.2
[A.14]	at the end of a unit intended to be coupled, minimum distance between front/ rear end of train and first/last axle (equal to half of the value specified)	4.2.3.3.1.2 (3)	3.1.2.2
[A.15]	maximum distance between front/ rear end of train and first/last axle	4.2.3.3.1.2 (4)	3.1.2.4 3.1.2.5 (distance b_x in Figure 1)
[A.16]	wheel geometry	4.2.3.3.1.2 (5)	3.1.3.1 to 3.1.3.4
[A.17]	Metal and inductive-components-free space between wheels	4.2.3.3.1.2 (6)	3.1.3.5
[A.18]	characteristics of the wheel material	4.2.3.3.1.2 (7)	3.1.3.6
[A.19]	requirements related to electromagnetic fields	4.2.3.3.1.2 (8)	3.2.1
[A.20]	use of magnetic or eddy current track brakes	4.2.3.3.1.2 (9)	3.2.3
Rolling stock characteristics for compatibility with loop equipment		4.2.3.3.1.3	
[A.21]	vehicle metal construction	4.2.3.3.1.3 (1)	3.1.7.2
Conditions for unique authorisation		7.1.1.5	
[A.22]	unit equipped with flange lubricators	7.1.1.5.1 (10)	3.1.5
[A.23]	unit equipped with eddy current track brake	7.1.1.5.1 (11)	3.2.3
[A.24]	unit equipped with magnetic track brake	7.1.1.5.1 (12)	3.2.3
[A.25]	Design of the unit	7.1.1.5.1 (15)	3.1
[A.26]	Bands of the frequency management	7.1.1.5.1 (16)	3.2

[B]	**SUBSET-034** **Train Interface FIS** **TSI CCS, Appendix A, Table A 2, index [7]**		
[B.1]	Status of the tilting system	4.2.3.4.2	2.6.2.4.3, 2.9 and 3
[B.2]	Brake pressure	4.2.4.3	2.3.2, 2.9 and 3
[B.3]	Special brake status 'Electro Pneumatic (EP) brake'.		2.3.6, 2.9 and 3
[B.4]	Emergency brake command	4.2.4.4.1	2.3.3, 2.9 and 3
[B.5]	Service brake command	4.2.4.4.2	2.3.1, 2.9 and 3
[B.6]	Special brake inhibition area – Trackside orders: regenerative brake	4.2.4.4.4	2.3.4, 2.9 and 3
[B.7]	Special brake inhibit – STM Orders : regenerative brake		2.3.5, 2.9 and 3
[B.8]	Special brake status: regenerative brake		2.3.6, 2.9 and 3
[B.9]	Special brake inhibition area – Trackside orders: Magnetic track brake	4.2.4.8.2	2.3.4, 2.9 and 3
[B.10]	Special brake inhibit – STM Orders: Magnetic track brake		2.3.5, 2.9 and 3
[B.11]	Special brake status: Magnetic track brake		2.3.6, 2.9 and 3
[B.12]	Special brake inhibition area – Trackside orders: Eddy current track brake	4.2.4.8.3	2.3.4, 2.9 and 3
[B.13]	Special brake inhibit – STM Orders : Eddy current track brake		2.3.5, 2.9 and 3
[B.14]	Special brake status: Eddy current track brake		2.3.6, 2.9 and 3
[B.15]	Station platform	4.2.5.5.6	2.4.6, 2.9 and 3
[B.16]	Traction cut off	4.2.8.1.2	2.4.9, 2.9 and 3
[B.1]	Change of allowed current consumption	4.2.8.2.4	2.4.10, 2.9 and 3
[B.17]	Change of traction system	4.2.8.2.9.8	2.4.1, 2.9 and 3
[B.18]	Powerless section with pantograph to be	4.2.8.2.9.8	2.4.2, 2.9 and 3

	lowered – Trackside orders		
[B.19]	Powerless section with main power switch to be switched off – Trackside orders		2.4.7, 2.9 and 3
[B.20]	Main Power Switch – STM orders		2.4.8, 2.9 and 3
[B.21]	Pantograph – STM orders		2.4.3, 2.9 and 3
[B.22]	Cab Status	4.2.9.1.6	2.5.1, 2.9 and 3
[B.23]	Direction controller		2.5.2, 2.9 and 3
[B.24]	Remote shunting	4.2.9.3.6	2.5.5, 2.9 and 3
[B.25]	Sleeping	4.2.9.3.7.1	2.2.1, 2.9 and 3
[B.26]	Passive shunting	4.2.9.3.7.2	2.2.2, 2.9 and 3
[B.27]	Non leading	4.2.9.3.7.3	2.2.3, 2.9 and 3
[B.28]	Traction status	4.2.9.3.8	2.5.4, 2.9 and 3
[B.29]	Air tightness area – Trackside orders	4.2.10.4.2	2.4.4, 2.9 and 3
[B.30]	Air tightness – STM orders		2.4.5, 2.9 and 3
[B.31]	On-Board ATO functionality	4.2.13	2.2.5, 2.9 and 3
[C]	**Leitfaden Sicherstellung der technischen Kompatibilität für Fahrzeuge mit Seitenwindnachweis nach TSI LOC&PAS zu Anforderungen der Ril 807.04: 2016-09**		
[C.1]	unit characteristic wind curve (CWC) limits for units intended to operate in Germany	7.1.1.5.1(20)(f)	Relevant cl.
[D]	**Ergänzungsregelung Nr. B017 zur bremstechnischen Ausrüstung von Fahrzeugen zum Betrieb auf Steilstrecken: 2021-05**		
[D.1]	units intended to operate in Germany on lines with a gradient above 40 ‰	7.1.1.5.1(20)(g)	Relevant cl.
[E]	**Verwaltungsvorschrift zur Prüfung von Notein- und Notausstiegfenstern (NEA) in Schienenfahrzeugen: 2007-02-26**		
[E.1]	emergency exits for units intended to operate in Germany	7.1.1.5.1(20)(h)	Relevant cl.

”;

(h) the following Appendix K is added:

"**Appendix K**

Validation process for new end pieces of Magnetic Track Brake (MTB)

The aim of the validation process is to check the compatibility of the MTB with the track elements. Any new end piece or a geometrical modified end pieces shall be tested with the following parameters:

– The tangents of the fixed crossings of the switches shall be in the range between 0,034 and 0,056 and in the range between 0,08 and 0,12 (see Table 1).

– For the test, the switches shall be crossed three times in each of the four possible directions with activated MTB with every following constant velocity (see Table 1).

Table 1 — Parameters for testing

	Velocity [km/h] direction			
Type of switch	↑	↗	↓	↙
0,08 - 0,12	15	15	15	15
0,08 - 0,12	120	40	120	40
0,034 - 0,056	15	15	15	15
0,034 - 0,056	120	80-100	120	80-100

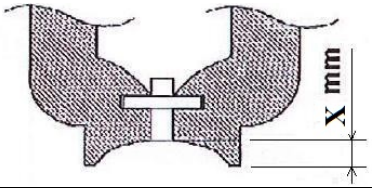
NOTE For the testing, it might be necessary to adapt the control system of the MTB.

– The test shall be performed under dry conditions.

– The test shall be performed in new and worn conditions of the pole shoes and end pieces.

– The test in worn conditions shall be performed at the maximum allowed hollow wear of the friction surface or the pole shoe respectively, defined by the specification (see Figure 1).

Figure 1 — Maximum hollow wear



Key

X maximum allowed hollow wear expressed in mm

Test possibility 1:

This test applies for changes of end pieces listed in the specification referenced in Appendix J-1, index [16] . Only deviations of maximum 10% for no more than 5 dimensions are allowed.

During the test optical check shall be performed by video of all end pieces. The lateral surfaces of all end pieces and pole shoes of the MTB shall be pale painted.

Acceptance criteria:

– No mechanical damage of any part of the MTB;

– No evidence of a permanent derailment of the MTB;

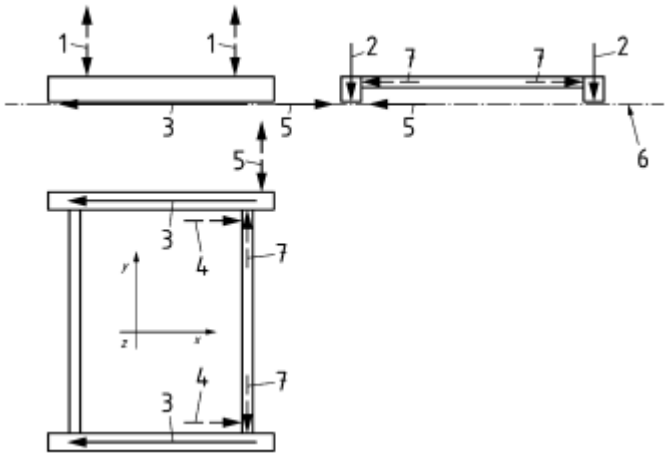
NOTE Sparks are allowed during braking.

– No evidence of a contact at the lateral side of the MTB outside of 55 mm in the vertical direction from the top of rail.

Test possibility 2:

This test applies for new designed end pieces. In addition to test possibility 1, the lateral and longitudinal forces (see Figure 2) between MTB and the bogie shall be measured.

Figure 2 — Overview of transmission of force



Key

1 interface forces with bogie frame F BZ

2 attractive force F HZ

3 longitudinal force F B,x

4 brake force F x

5 lateral force F Q

6 top of the rail

7 interface forces

Acceptance criteria:

Acceptance criteria for test possibility 1:

- **Lateral force FQ and longitudinal force FB,x when running over switches and crossings in inside direction** : Action of a lateral force equal to 0,18 times the magnetic attractive force in inside direction (toward the track centre) in the vicinity of the end pieces with a simultaneous longitudinal force of 0,2 times the magnetic attractive force shall be respected.
- **Lateral force FQ and longitudinal force FB,x when running over switches and crossings in outside direction** : Action of a lateral force equal to 0,12 times the magnetic attractive force in outside direction in the vicinity of the end pieces with a simultaneous longitudinal force of 0,2 times the magnetic attractive force shall be respected.
- **Exceptional lateral force FQ in inside direction (toward the track centre) when running over switches and crossings** : Measurements so far performed on vehicles have identified forces in inside direction up to about 0,35 times the magnetic attractive force (greatly dependent on the wear condition of the switch and crossing that has been traversed).
- **Exceptional lateral force FQ in outside direction when running over switches and crossings** : Measurements so far performed on vehicles have identified forces in outside direction up to about 0,23 times the magnetic attractive force (greatly dependent on the wear condition of the switch and crossing that has been traversed).

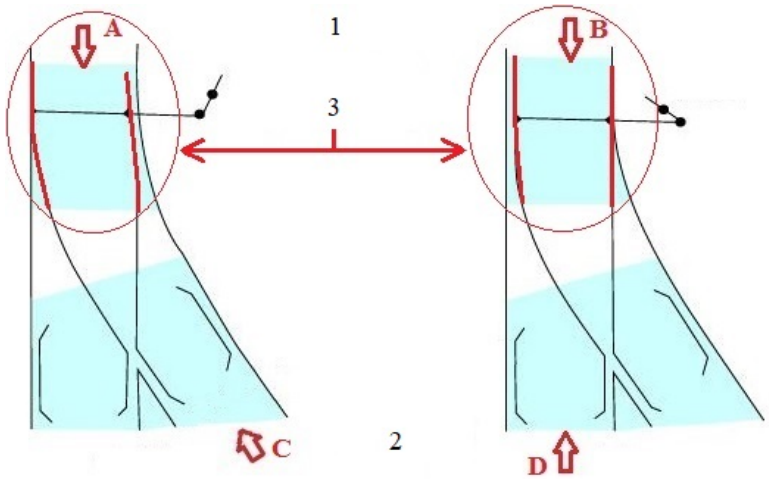
Test possibility 3:

This test applies for new designed end pieces. Subsequent to test possibility 2, the test possibility 3 shall be performed if the measurement of the displacement of the switches is required. It is allowed to perform the possibilities 2 and 3 in one test run.

Measurement of displacement of switch: The switch is equipped with sensors for measuring the displacement of moving parts identified in red in Figure 3 below (zone toe).

Test sequence: The test sequence consists of performing 3 runs per position A, B, C and D at constant speed. The speed of test shall correspond to the speed inducing the maximum coefficient of friction (typically around a speed of 15 km/h).

Figure 3 — Measurement of Displacement of Switch



Key

1 Switch toe

2 Switch heel

3 Zone equipped with sensors

Acceptance criteria :

The displacement for runs types A and B from switch toe to switch heel shall not exceed 4,0 mm.

The displacement for runs types C and D from switch heel to switch toe shall not exceed 7,0 mm.";

(i) the following Appendix L is added:

"Appendix L

Changes of requirements and transition regimes

For other TSI points than these listed in Table L.1 and Table L.2, compliance with the 'previous TSI' (i.e. this Regulation as amended by Commission Implementing Regulation (EU) 2020/387[5]) imply compliance with this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]*.

Changes with a generic transition regime of 7 years:

For TSI points listed in Table L.1, compliance with the previous TSI does not imply compliance with the version of this TSI applicable from [*Publications Office: please insert the date of entry into force of this amending act*].

[5] Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem 'rolling stock — locomotives and passenger rolling stock' (OJ L 356 12.12.2014, p. 228).

Projects already in design phase on [*Publications Office: please insert the date of entry into force of this amending act*] shall comply with the requirement of this TSI from [*Publications Office: please insert the date of entry into force of this amending act + 7 years*].

Projects in production phase and rolling stock in operation are not affected by the TSI requirements listed in Table L.1

Table L.1 – transition regime of 7 years

TSI point(s)	TSI point(s) in previous TSI	Explanation of the TSI change
4.2.2.5 (7)	4.2.2.5 (7)	Evolution of the specification referenced in Appendix J-1 index [3]
4.2.2.10 (1)	4.2.2.10 (1)	Additional requirements
4.2.3.2.1 (2)	4.2.3.2.1 (2)	Change of the requirement
4.2.3.7	4.2.3.7	Change of the requirements
4.2.4.3 7.1.1.5.2 (3)	4.2.4.3 6.2.7a	Evolution of the specification referenced in Appendix J-1 index [12]
4.2.4.5.1 4.2.4.5.2 4.2.4.5.3 4.2.4.5.5	4.2.4.5.1 4.2.4.5.2 4.2.4.5.3 4.2.4.5.5	Evolution of the specification referenced in Appendix J-1 indexes [13] and [14]
4.2.4.5.2 (4)	4.2.4.5.2 (4)	Evolution of the specification referenced in Appendix J-1 (index [65])
4.2.4.5.2 (5)	4.2.4.5.2 (5)	Evolution of the specification referenced in Appendix J-1 (index [67] or [68])
4.2.4.6.2 (6) 6.1.3.2 (1) 4.2.4.6.2 (8) 6.2.3.10 (1)	4.2.4.6.2 (6) 6.1.3.2 (1) 4.2.4.6.2 (8) 6.2.3.10 (1)	Evolution of the specification referenced in Appendix J-1 index [15]
4.2.6.2.4 (3)	4.2.6.2.4 (3)	Updated reference to the standard – removal of the reference to the HS TSI 2008
4.2.5.3.2 (4a)	No requirement	New requirement
4.2.5.4 (7)	No requirement	New requirement to record in the documentation the existence or not of communication devices

4.2.7.1.4 (3)	4.2.7.1.4 Note	Clear requirement on where it is required to use the head lamps in automatic flashing / Blinking mode
4.2.8.2.5 (1)	4.2.8.2.5 (1)	Extension to AC systems
4.2.8.2.9.6 (3a) and 6.2.3.20	n.a	New requirement
4.2.8.2.9.7 (3) and (4) and 6.2.3.21	4.2.8.2.9.7 (3) and (4)	Change of parameter
4.2.9.2.1 and 4.2.9.2.2	4.2.9.2.1 and 4.2.9.2.2	Evolution of the specification referenced in Appendix J-1 index [28]
4.2.9.3.7 and 4.2.9.3.7a	No requirement	New requirement
4.2.10.2.1 (2) and 4.2.10.2.2 (2)	4.2.10.2.1 (2) and 4.2.10.2.2 (2)	Evolution of the standard referenced See also point 7.1.1.4
4.2.12.2	4.2.12.2	Evolution of the required documentation in relation to the evolution of requirements
7.1.1.3 (1)	7.1.1.3 (1)	New requirement
7.1.6	No requirement	This case applies to newly developed vehicle design where ETCS onboard is not yet installed with the aim to have rolling stock subsystem ready when ETCS will be installed.
Points referring to Appendix J-2, index [A] (except point 3.2.2)	Points referring to Appendix J-2, index 1	ERA/ERTMS/033281 version 5 replaces ERA/ERTMS/033281 Version 4, main changes concern frequency management for interference current limits and closure of open points. Transition regime is defined in Appendix B, Table B.1 of the TSI CCS

Changes with a specific transition regime:

For TSI points listed in table L.2, compliance with the previous TSI does not imply compliance with this TSI applicable from [*Publications Office: please insert the date of entry into force of this amending act*].

Projects already in design phase on [*Publications Office: please insert the date of entry into force of this amending act*], projects in production phase, and units in operation shall comply with the requirement of this TSI in accordance with the respective transition regime set out in Table L.2 starting from [*Publications Office: please insert the date of entry into force of this amending act*].

Table L.2 – Specific transition regime

TSI point(s)	TSI points(s) in previous version	Explanation on TSI change	Transition regime			
			Design phase not started	Design phase started	Production phase	units in operation
Points referring to the specification referenced in Appendix J-2, index [B]	4.2.4.4.1, 4.2.5.3.4, 4.2.5.5.6, 4.2.8.2.9.8, 4.2.10.4.2	Train interface functions specified between ETCS onboard and rolling stock are identified end to end including provisions on EC verification	For new train interface functions identified in index 7, transition regimes are defined in Appendix B, Table B.1 – ETCS system version of TSI CCS. For train interface functions not modified in index 7, transition regimes are defined in Appendix B, Table B1 – partial fulfilment of TSI CCS			
4.2.13	No requirements	Interface requirements applicable to units equipped with ETCS onboard and intended to be fitted with Automatic Train Operation onboard up to Grade of Automation 2.	Transition regimes for ATO On-Board Implementation are defined in Appendix B; Table B1 – ATO On-Board Implementation of TSI CCS			
Points referring to point 3.2.2 of Appendix J-2, index [A]	points referring to point 3.2.2 of Appendix J-2, index 1	ERA/ERTMS/033281 V5 replaces ERA/ERTMS/033281 V4, main changes concern frequency management for interference current limits and closure of open points..	Transition regime is defined in Appendix B, Table B.1 of TSI CCS			
7.1.1.3 point 2 (a)	7.1.1.3	Mandatory EC certification for special vehicles	6 months		N.A.	

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