

Moving Europe towards a sustainable and safe railway system without frontiers.

Guide for the application of the LOC&PAS TSI

In accordance with Article 19(3) of Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016

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This guide does not contain any legally binding advice. It may serve as a clarification tool without however dictating in any manner compulsory procedures to be followed and without establishing any legally binding practice. The guide provides explanations on the provisions contained in the TSIs and should be helpful for understanding the approaches and rules described therein. However, it does not substitute for them.

The guide is publicly available and it will be regularly updated to reflect progress with European standards and changes to the TSIs.

The reader should refer to the website of the European Union Agency for Railways for information about its latest available edition.

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1. SCOPE OF THIS GUIDE

1.1. Content of the guide

1.1.1. Scope

This document is an Annex to the “Guide for the Application of TSIs”. It provides information on the application of Technical Specification for Interoperability for the “rolling stock subsystem - Locomotives and passenger rolling stock” adopted by the Commission Regulation (Commission Regulation (EU) No 1302/2014 of 18 November 2014 and amended by the Commission Implementing Regulations (EU) 2016/919, 2018/868, 2019/776, 2020/387 and 2023/1694) (from now on referred as LOC&PAS TSI).

The guide needs to be read and used only in conjunction with the LOC&PAS TSI. It is intended to facilitate its application but it does not substitute for it. The general part of the “Guide for the Application of TSIs” has also to be considered.

1.1.2. Content of the guide

In chapter 2 of this document, extracts of the original text of the LOC&PAS TSI are provided, shown in a shaded text box and these are followed by a text that gives guidance.

Guidance is not provided for every point, as not all LOC&PAS TSI points require further explanation.

Guidance is of voluntary application. It does not mandate any requirement in addition to those set out in the LOC&PAS TSI.

Guidance is given by means of further explanatory text and where relevant by reference to standards that are means of demonstrating compliance with the LOC&PAS TSI; relevant standards are listed in the Annex I of this document, and their purpose is indicated in the column “purpose” of the table of Annex I. For a general information on Standards please refer to the “Guide for the Application of TSIs”

1.2. Reference Documents

Reference documents are indicated in Commission Regulation and in its annexes (LOC&PAS TSI), and in the general part of the “Guide for the Application of TSIs”.

1.3. Definitions and abbreviations

General terms and abbreviations are defined in the “Guide for the Application of TSIs”.

2. GUIDANCE ON THE APPLICATION OF THE LOC&PAS TSI

2.1. Introduction

The structure of this chapter of the application guide follows the structure of the TSI and contains the following sections:

- Scope of the TSI.
- Content of the TSI.
- Characterisation of the rolling stock subsystem.
- Interoperability constituents.
- Assessment of conformity.
- Implementation.

The LOC&PAS TSI is not a standalone regulation; additional legal provisions apply for the placing in the market of structural subsystems as set out in the Regulation (EU) 2018/545. This document does not provide any guidance related to Regulation (EU) 2018/545.

2.2. Scope and definition of the subsystem

2.2.1. Points 2.2.2(A) and 2.3:1(C) Rolling stock in the scope of this TSI

2.2.2. Rolling stock:

Definitions below are classified in three groups as defined in the section 2 of Annex I to Directive (EU) 2016/797.

(A) Locomotives and passenger rolling stock, including thermal or electric traction units, self-propelling thermal or electric passenger trains, and passenger coaches;:

(1) Thermal or electric traction units

[...]

Traction in a train can also be provided by a powered vehicle with or without driving cab, which is not intended to be uncoupled during normal operation. Such a vehicle is called a Power Unit (or power car) in general or a Power Head when located at one end of the trainset and fitted with a driving cab.

The concept of thermal unit as defined in TSI could be applied to units fitted with a thermal engine other than a diesel engine, such as gas propelled units. In this case, the innovative solution principle should be applied at least to the points specifically aimed at diesel units (e.g, point 4.2.10.3.3).

(C) Special vehicles

Special vehicles, such as On-Track Machines (OTMs), are categorised in the EVR Commission Implementing Decision (EU) 2018/1614⁽⁷⁾. 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.

Examples of special vehicles can be found in appendix 6 part 11 of EVR decision 2018/1614 (https://www.era.europa.eu/system/files/2022-11/appendix_6_p11_en.pdf). For simplification, it was proposed to group the types and sub-types defined in that appendix into the five subsets defined above.

2.3.1 Types of rolling stock

(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.

For vehicles with different sets of wheels, the case of transport on (road) wheels with tyres (condition 1) is not in the scope of the TSI.

For movements on a closed track, there is no need to be detected by a track based train detection system (condition 2), therefore this case is not in the scope of the TSI.

Running mode, travelling mode and working mode are defined in point 3 of EN 14033-1:2017 and further explained in CEN TR 17498:2020.

It is to be noted that for some basic parameters (e.g points 4.2.2.4, 4.2.2.5, appendix C) , the LOC&PAS TSI contains specific requirements applicable to On Track Machines. Such specific requirements may apply also to infrastructure inspection vehicles when these are not designed to be integrated into fixed passenger train formation.

Infrastructure inspection vehicles designed to be integrated into a fixed passenger train formation shall be considered as non-passenger carrying vehicles as defined in point (A) (3), and not as special vehicles and shall apply the generic requirements.

In case of special vehicles, the applicant can apply either the WAG TSI (only when hauled) or the LOC&PAS TSI for conformity assessment; a vehicle may be assessed under either TSI depending on the characteristics and the intended use of the vehicle in question in comparison with the technical scope of the respective TSIs.

2.3. Content of the TSI

2.3.1. Point 3.1 Essential requirements

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.

The TSI does not repeat requirements specified in other applicable EU Directives.

2.4. Characterisation of the subsystem

2.4.1. Point 4.1.2: Description of the rolling stock subject to the application of this TSI

(1) Rolling stock subject to the application of this TSI (designated as a unit in the context of this TSI) shall be described in the certificate of 'EC' verification, using one of the following characteristics:

- *Trainset in fixed formation, and when required, predefined formation(s) of several trainsets of the type under assessment for multiple operation.*
- *Single vehicle or fixed rakes of vehicles intended for predefined formation(s)*
- *Single vehicle or fixed rakes of vehicles intended for general operation and when required, predefined formation(s) of several vehicles (locomotives) of the type under assessment for multiple operation.*

Note: Multiple operation of the unit under assessment with other types of rolling stock is not in the scope of this TSI."

Predefined formation of several trainsets or vehicles of the type under assessment for multiple operation can be covered by the EC verification if required by the applicant.

As examples, for an electric and/or diesel multiple unit, multiple operation may include several predefined formations (two trainsets, three trainsets...), for locomotives, multiple operation may cover the case of two locomotives coupled in a train.

In the case of articulated trainsets with several predefined formation(s), the predefined formation can be described using vehicles ('running on its own wheels'), rakes of vehicles or vehicles without or with partial running gear (e.g. on one end).

The 'other types of rolling stock' referred to in the note may already be authorised to be placed in service. They are not subject to conformity assessment against this TSI at the same time as the unit under assessment. Therefore, they are not considered in the EC verification related to that unit.

Multiple operation of the unit under assessment with other types of rolling stock is managed by the RU according to the OPE TSI, point 4.2.2.5.

For vehicles intended to be used in general operation see also point 6.2.7 of the TSI.

2.4.2. Point 4.1.3: Main categorisation of the rolling stock for application of TSI requirements

(3) The technical categories of rolling stock are the following:

(...)

- *Unit fitted with traction equipment*
- *Electric unit, defined as a unit supplied with electric energy by electrification system(s) specified in the Energy TSI.*
- *Thermal traction unit*

(...) A unit is characterised by one or several of the categories above.

(4) Unless stated otherwise in the points of Section 4.2, requirements specified in this TSI apply to all technical categories of rolling stock defined above.

(6) The maximum design speed of the unit (...)

The categories have been designed with the objective to attribute requirements to each unit under assessment.

For example, a passenger coach with a cab falls into the following categories: “Unit designed to carry passengers” and “Unit fitted with a cab”.

If it is equipped with a pantograph for current collection, it falls in the category “electric unit” too, because it is supplied with electric energy in accordance with the ENE TSI.

Units fitted with traction equipment such as hydrogen cells or batteries only are neither thermal nor electric traction units. However, they are traction units and there are points in the LOC&PAS TSI which apply to them (e.g. 4.2.4.2.2(2)). In this case, the innovative solution principle should be applied at least to the points specifically aimed at electric units not related to energy supply in accordance with ENE TSI (e.g. point 4.2.8.2.10).

Regarding maximum design speed and speed criteria, the LOC & PAS TSI uses km/h in a number of points to differentiate between requirements. Strict mathematical conversion of these figures to mph would lead to inappropriate requirements for the railway networks where that unit is used. For example ‘speeds greater than 200 km/h’ would include 125 mph which is not the intention. Table in Annex 2 provides agreed values that should be used to convert from km/h to mph where the figures are used to differentiate requirements.

2.4.3. Point 4.2.1.3 Safety aspects

(4) Electronic devices and software, which are used to fulfil functions essential to safety shall be developed and assessed according to a methodology adequate for safety related electronic devices and software.

The harmonised standards listed in Annex 1 give presumption of conformity to this requirement.

2.4.4. Point 4.2.2.2.4: Rescue coupling

(3) ...This is achieved either by means of a permanently installed compatible coupling system or through a rescue coupler (also called rescue adaptor). In the latter case, the unit assessed against this TSI shall be designed so that it is possible to carry the rescue coupler on board.

The LOC & PAS TSI does not mandate the provision of a rescue coupler on each unit, and therefore, the decision not to install a rescue coupler on-board should be made by the railway undertaking in conjunction with the infrastructure manager who, typically, has responsibility for clearing the line. When determining the provision of rescue couplers, the time and need to make them available should be taken into account.

However, in all cases where the unit does not have a permanently installed compatible coupling system, it is required to have the possibility to carry the rescue coupler on board. The manufacturer is allowed to flexibly choose the stowing location. The TSI does not prescribe any requirement on the stowing place or the fixation of the rescue coupler.

EN15020:2022 ‘Railway applications — Rescue coupler — Performance requirements’, specific interface geometry and test methods’ provides a presumption of conformity for vehicles equipped with Type 10 automatic coupling and a rescue vehicle equipped with UIC pattern of buffers and draw gear. This standard is mandatory according to the TSI (therefore, this reference is not repeated in Annex 1 of this Application Guide).

2.4.5. Point : 4.2.2.5 Staff access for coupling and uncoupling

(2) 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.

Handrails designed and tested according to EN 16116-1:2022, clause 5.4.1, are deemed to be compliant to the last point.

2.4.6. Point 4.2.2.3: Gangways

(1) Where a gangway is provided as a means for passengers to circulate from one coach or one trainset to another, it shall accommodate all relative movements of vehicles in normal operation without exposing passengers to undue risk.

(2) Where operation with the gangway not being connected is foreseen, it shall be possible to prevent access by passengers to the gangway.

(3) Requirements related to the gangway door when the gangway is not in use are specified in point 4.2.5.7 "Passenger related items – Inter-unit doors".

(4) Additional requirements are expressed in the TSI PRM.

(5) These requirements of this point do not apply to the end of vehicles where this area is not intended for regular use by passengers.

Compliance with clauses 7.4, 7.9, 9.2 and 9.3 of EN 16286-1:2013 gives presumption of conformity.

Additionally to the LOC&PAS TSI, the following points of the PRM TSI apply:

- 4.2.2.6, 4.2.2.9 (7) for all gangways, and
- 4.2.2.8 for gangways with height changes.

2.4.7. Point 4.2.2.4: Strength of vehicle structure

(2) For OTMs, alternative requirements to those expressed in this point for static load, category and acceleration are set out in Appendix C, point C.1.

The strength of the OTM structure can be assessed by an alternative arrangement, as set out in Appendix C, point C.1 of the TSI.

Therefore, it is possible according to point 4.2.2.4 of the TSI to demonstrate compliance with the requirements either by calculation or by tests. It is also made possible by point 4.2.2.4 of the TSI and Appendix C, point C.1 to classify the OTM either as PI, PII, FI or FII for the load definitions that are taken into account in the demonstration.

(8) Joining techniques are covered by the above requirements. A verification procedure shall exist to ensure at the production phase that defects that may decrease the mechanical characteristics of the structure are controlled.

As set out in Commission Decision 2010/713/EC (decision on assessment modules), verification of joining techniques used is part of the complete design and manufacturing assessment process and should be part of the quality management system of manufacturers, taking into account risks associated to the techniques used (assembly by screws or rivets, welding, gluing...).

For welding of metallic parts, Annex 1 lists the relevant standards that give presumption of conformity.

Note: verification of joining techniques may apply as well to joints of the bogie frame covered by point 4.2.3.5.1 (see EN 13749-2021 clause 7 applicable on a voluntary basis)

2.4.8. Point 4.2.2.5 Passive safety

(5) Passive safety is aimed at complementing active safety when all other measures have failed...

Passive safety is more commonly known as vehicle structural crashworthiness and should not be confused with 'Interior Passive Safety'. 'Interior Passive Safety' is a separate topic to further support the objective of minimising the risk of injury to passengers on board due to secondary impact; there is no verification mandated in this TSI regarding 'interior passive safety'.

NB. LOC&PAS TSI 1302/2014 amended by Regulations (EU) 2016/919, 2018/868, 2019/776, 2020/387 included a point 7.5.2.1 that was indicating: "Pending the revision of this TSI Member States may use national rules to cover such risks. In any case this shall not prevent the access of TSI compliant rolling stock operating across Member State borders onto their national network".

2.4.9. Point 4.2.2.6 Lifting and jacking

(3) It shall be possible to safely lift or jack each vehicle composing the unit, for recovery purposes (following derailment or other accident or incident), and for maintenance purposes. To this purpose, suitable vehicle body interfaces (lifting/jacking points) shall be provided, which permit the application of vertical or quasi-vertical forces. The vehicle shall be designed for complete lifting or jacking, including the running gear (e.g. by securing/attaching the bogies to the vehicle body). It shall also be possible to lift or jack any end of the vehicle (including its running gear) with the other end resting on the remaining running gear(s).

All relevant topics of EN 16404:2016 covering structural requirements were taken into account in an amendment to EN 12663-1:2010+A1:2014.

Note: EN 16404 has been revised in 2016 to take into account the particular conditions at the re-railing of low floor vehicles.

2.4.10. Point 4.2.2.9: Mechanical characteristics of glass (other than windscreens)

(1) Where glass is used in glazing (including mirrors), it shall be either laminated or toughened glass which is in accordance with one of the relevant publicly available standard suitable for

railway application with regard to the quality and area of use, thereby minimising the risk to passenger and staff being injured by breaking glass.

Some of the relevant standards are listed in Annex 1 of this Application Guide. Other relevant standards should be accepted as a basis for conformity assessment, provided that its relevance is proven by the applicant to the NoBo.

2.4.11. Point 4.2.2.10: Load conditions and weighted mass

(3) For OTMs, different load conditions (minimum mass, maximum mass) may be used, in order to take into account optional on-board equipment.

An OTM may be operated in different configurations, for example equipped with different tools for different tasks or functions. This optional on-board equipment might, for each configuration, affect the mass of the vehicle. Therefore, the different masses depending on the configuration may be considered when defining the load conditions according to the TSI.

2.4.12. Point 4.2.3.1: Gauging

(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.

The applicant (who signs the EC declaration of verification) selects freely the reference profile used to design the rolling stock (chosen profile). The outer boundaries of the rolling stock are subsequently assessed against this chosen profile and the result is recorded in the technical documentation. This means that the LOC&PAS TSI does not impose specific reference profiles, but their registration in the technical file.

It is recommended that applicants take into account the infrastructure reference profile available in the Register of Infrastructure (RINF)

Furthermore, EN 15273-2:2013+A1:2016 contains requirements on the minimum vertical convex / concave curve radius capability which have to be registered in the Register of Authorised Types of Vehicles (ERATV) as these are a basic design characteristic and part of the route compatibility check.

The intended assessed profile may present deviations from a 'known' reference profile (e.g. national gauges given in Annexes of EN 15273-2:2013+A1:2016); in this case, deviations should be recorded in the technical documentation.

(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.

The applicant is furthermore required to state if the rolling stock is compatible with (one of) the reference profile(s) (i.e. reference profile according to EN 15273:2013+A1:2016) of the categories of line as per the INF TSI. These reference profile(s) the rolling stock complies with (if any) are to be recorded in the technical documentation; they provide a reference for interoperability purpose.

Regarding the possibility to widen the rolling stock in function of the possibilities offered by the infrastructure due to tolerances (Annex I of EN 15273-1:2013+A1:2016) it is permitted to design the rolling stock using this extra widening option. But then it is not anymore considered compliant with the original reference profile and will not be recorded as such in ERATV.

The intended profile recorded in the technical documentation has to mention the original reference profile and the limitations/reverses linked to the application of Annex I of EN 15273-1:2013+A1:2016.

This possibility offered by the infrastructure and corresponding limitations should also be recorded in RINF.

Annex R.3 of EN 15273-2:2013+A1:2016 lists documents that can be taken into account to verify the conformity of a gauge.

(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⁽⁸⁾ ('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.

The pantograph envelope has interfaces with the three TSIs that are INF, ENE and LOC&PAS TSIs:

- It is based on the pantograph head geometry defined in point 4.2.8.2.9.2 of LOC&PAS TSI, used as a reference for the overhead line contact position.
- The mechanical kinematic pantograph gauge calculation method is described in the Annex D of ENE TSI.
- This is complemented by the electrical clearance, which has to be considered for the structure gauge defined in the point 4.2.3.1 of the INF TSI.

The necessary electrical clearance between the pantograph and fixed installations depends on the supply voltage (i.e 25 kV AC, 15 kV AC, 1.5 kV DC, 3 kV DC) and on local conditions for the insulation and creepage distances calculations (which are known by the IM); they are needed for defining the structure gauge. Note: this aspect is covered when defining the structure gauge; it is not in the scope of the LOC&PAS TSI; the IM has to consider electrical clearances between the conductive parts of the pantograph or catenary and the structure, in addition to the requirements of the INF TSI.

(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 verifying the sway coefficient (or the flexibility coefficient) of the pantograph, which is considered in the mechanical part of the equation, it is permitted to use simulations, or input from past designs, or finally a 'type' test.

2.4.13. Point 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⁽⁹⁾ ('TSI INF'), the axle load is a performance parameter and depends on the traffic code of the line.

This paragraph is intended to provide information to facilitate the route compatibility check in accordance with Appendix D.1 of OPE TSI performed after vehicle authorisation. This compatibility check is not part of the conformity assessment against LOC&PAS TSI.

The load carrying capacity of the infrastructure defines the limiting value that the rolling stock axle load is required not to exceed in operation. Axle load is not sufficient to define the loading interface between vehicles and infrastructure, which is a function of axle load, the spacing of axles and the speed of the vehicle.

Designing a vehicle considering the published infrastructure capability information will facilitate the route compatibility checks in accordance with the TSI OPE Appendix D.1.

(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 m², 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].

It is allowed to determine and to document additional EN line categories for different passenger payloads.. This may be required where a vehicle is intended to be used in a network with a certain value of passenger payload lower than the standard value according EN 15528:2021 and within the range permitted by EN 15528:2021 Table 4 in order to determine the EN line category for route compatibility purposes.

ERATV includes parameter 4.5.1.1 for the documentation of EN line categories. The documentation using such a parameter should always include the EN line category determined for the standard value of passenger payload in kg per m² described above. Where particular values of payload are used to determine the associated EN line categories, these may also be recorded there.

(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 Commission Implementing Regulation (EU) 2019/ 773⁽¹⁰⁾ ('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.

The axle load and the axle spacing of a rolling stock, and the EN line category are parameters used for the technical compatibility of the rolling stock to the infrastructure (as described in EN 15528:2021). The TSI does not set out the maximum axle load which has to be taken into account for this technical compatibility assessment, as this approach would be too restrictive.

Instead, reference is made to point 4.2.2.5 of the OPE TSI which states that these parameters have been checked through the authorisation process, and that the RU, being responsible for the train composition and the route compatibility, has to ensure that “the weight of the train must be within the maximum permissible for the section of route. Axle load limitations must be respected”. In this way the RU should control by operating rules the payload of its train in order to be compatible with the route.

2.4.1. Point 4.2.3.2.2: Wheel load

(1) The ratio of wheel load difference per axle $D_{qj} = (Q_l - Q_r) / (Q_l + Q_r)$, shall be evaluated by wheel load measurement, considering the load condition ‘design mass in working order’. Wheel load difference higher than 5 % of the axle load for that wheelset are allowed only if demonstrated as acceptable by the test to prove safety against derailment on twisted track specified in the point 4.2.3.4.1 of this TSI.

(2) The conformity assessment procedure is described in point 6.2.3.2 of this TSI.

The measurement procedure for static vertical wheel and wheelset forces from standard EN 15654-2:2019 “Railway applications – Measurement of vertical forces on wheels and wheelsets – Part 2: Test in workshop for new, modified and maintained vehicles” may be used to demonstrate wheel load requirements of clause 4.2.3.2.2.

The influence of external conditions may be considered as per Annex B of the same standard.

2.4.2. Point 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⁽¹¹⁾). 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.

The set of parameters in order to be compatible with train detection systems, such as track circuits, axle counters and loop systems, have been identified in the TSI with references to the CCS TSI for each parameter and type of train detection system.

The technical documentation shall list with which train detection systems the rolling stock has been assessed as being compatible. It should also include the set of rolling stock characteristics for compatibility with train detection target systems given in points 4.2.3.3.1.1, 4.2.3.3.1.2 and 4.2.3.3.1.3..

As referred into article 13 of TSI CCS, by 31 December 2024, Member States that operate non-TSI-compliant train-detection systems must request a specific case and shall notify the Agency of these systems by informing it about:

- the interference current limits for track circuits including the evaluation methods and vehicle impedance in accordance with point 3.2.2 of index 77 of CCS TSI
- field limits for axle counters in X, Y and Z axis including the evaluation methods in accordance with point 3.2.1 of index 77 of CCS TSI

For non TSI compliant train detection system, pending that parameters above are specified in the specific cases or in the technical documents referred in Article 13 of CCS TSI , national rules remain applicable:

- National rules are assessed by Designated Bodies.
- Assessment by NoBo can be performed only when the parameters above will be specified in the specific cases or in the technical documents mentioned in Article 13 of CCS TSI

The assessment of the rolling stock regarding compatibility with train detection systems (requirements specified in index 77 of CCS TSI, referred in point 4.2.3.3.1 of this TSI) is part of EC verification for the Rolling Stock subsystem and is to be assessed by the RST NoBo, this include the relevant specific cases defined in point 7.7 of CCS TSIs.

The limit(s) defined in Appendix J-2 index [A] are applicable to the rolling stock influencing the train detection system known as Influencing Unit (IU), this IU includes one or more traction units, for example one or more trainsets (EMUs) or locomotive and coaches. Not all the combinations are necessarily tested, and the application of summation rules is a possibility to demonstrate compliance with the limit(s). Demonstration of compatibility of the coach(es), as unit(s) to be used in general operation, with track circuits is to be combined with the emissions of other units. The train formation (IU) shall meet the limit(s) defined in Appendix J-2 index [A]. The provisions of 6.2.7 can be used for assessment of units intended to be used in general operation. The verification of compatibility of the train formation with the unit(s), for example a combination of locomotive(s) and coach(es), is the responsibility of the RU and is described in TSI OPE Annex D1.

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:

[...]

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

The electrical resistance of the wheelset may be assessed at the level of the component 'wheelset' and not at the level of the subsystem.

2.4.3. Point 4.2.3.4.2: Running dynamic behaviour

(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-I, index [9].

Note 1: although EN 14363:2016 defines the process for assessment of the running characteristics of railway vehicles on standard track gauge only (1435 mm), that standard can be applied for the assessment of the running characteristics in other track gauges by analogy (e.g. the test procedures described in EN 14363:2016 can be applied to vehicles operated on networks with other track gauges too).

Note 2: even if some points (4.2.3.4.2.x) of the LOC&PAS TSI refer to specific chapters of EN 14363:2016, this does not mean that other chapters can be fully disregarded. There are general principles and some relationships between chapters that may be relevant, even if they are not directly mentioned as mandatory in the Appendix J–1.

The rolling stock may have to be tested for several combinations of admissible speed and cant deficiency (combinations to be selected by the applicant) for their running dynamic behaviour in accordance with EN 14363:2016. This technical specification covers tilting systems too.

The specified limit values (running safety, track loading) are to be met under the conditions of use of the rolling stock (operational parameters/restrictions), such as the combination of speed and cant deficiency.

It means that neither the TSI nor the standards limit the possible combinations; the applicant is free to define these values. The only requirement being that the limit values are met under those conditions chosen by the applicant.

Note 3: In EN 14363:2016 (1 Scope): “[...] The document contains acceptance criteria for all types of vehicles with nominal static vertical wheelset forces up to 225 kN (of the highest loaded wheelset of the vehicle in the assessed load configuration specified in 5.3.2). In addition for freight vehicles with nominal static vertical wheelset forces up to 250 kN the acceptance criteria are defined. [...]”

The infrastructure where the rolling stock will be operated should be taken into account by the applicant to define the necessary combinations to be tested.

For speed >300 km/h, EN 14363:2016 does not specify specific limits for the track quality due to a lack of return of experience. This case is covered by the following sentence in Annex M.4 of EN 14363:2016: “*For speed above 300 km/h, the target test conditions shall correspond to better track quality than the track quality specified for the speed 300 km/h*”. This is justified by the following considerations:

- on these sections of track, operation at 300 km/h is possible, therefore the required track quality shall be as good as for 300 km/h.
- an open point on such subject is not satisfactory because there is no sufficient return of experience for defining national rule(s).

It is expected in such case that the concerned manufacturer, railway undertaking and infrastructure manager will cooperate in order to ensure the feasibility of the railway project (operation from 300 km/h up to 350 km/h).

In any case, the values met on the test track shall be reported as required in Annex M.5 of EN 14363:2016; corresponding operating limitations shall be reported too. The process for innovative solution may be used by the stakeholders in order to take into account the values met on the test track for complementing TSI and EN 14363:2016.

For other track gauges than 1435 mm, test conditions and limit values may be defined for particular application/operating conditions, notwithstanding any specific case defined in the TSI. The geometrical track qualities and conditions the rolling stock was tested for, will define the limiting operating conditions of the rolling stock.

2.4.4. Point 4.2.3.4.3.2: In-service values of wheelset equivalent conicity

(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.

The following elements regarding maintenance limits of wheels and wheelsets, and how local conditions of the network may be considered, are given to the attention of RUs (Railway Undertakings) and ECMs (Entities in Charge of Maintenance):

The maintenance plan should set out the RU's (or ECM's) procedures for maintaining wheelsets and wheel profiles. The procedures should take account of the equivalent conicity ranges for which the vehicle is designed (see point 4.2.3.4.2 of the TSI). During operation, these limits are to be kept within the limit values considering the local conditions of the infrastructure where the rolling stock is operated.

Wheelsets should be maintained to ensure (directly or indirectly) that the wheelset equivalent conicity remains within the approved limits for the vehicle when the wheelset is modelled passing over those of the representative samples of track test conditions (simulated by calculation) specified in tables 11-16 of the TSI which are relevant considering local conditions of the network.

For a novel bogie / vehicle design, or for operation of a known vehicle on a route with relevant different characteristics, the development of wear of a wheel profile, and therefore the change in wheelset equivalent conicity, is usually not known. For this situation a provisional maintenance plan should be proposed. The validity of the plan should be confirmed following monitoring of the wheel profile and equivalent conicity in service. The monitoring should consider a representative number of wheelsets and should take into account the variation between wheelsets in different positions in the vehicle and between different vehicle types in the trainset.

In case the running dynamic test required in the point 4.2.3.4.2 of the TSI has been performed with a representative wheel profile (naturally worn in service or theoretically worn) on test track sections as defined in Table 2 of EN 14363:2016, the maintenance plan may be based on the monitoring of the geometrical dimensions of the wheels, with a wheel profile limit extrapolated from the test conditions (and compliant to the point 4.2.3.5.2.2 of the TSI). The in-service value of equivalent conicity is then indirectly controlled, with the assumption that the test track sections are representative of the actual network on which the vehicle is operated.

(2) If ride instability is reported, the railway undertaking and the Infrastructure Manager shall localise the section of the line in a joint investigation.

(3) The railway undertaking shall measure the wheel profiles and the front-to-front distance (distance of active faces) of the wheelsets in question. The equivalent conicity shall be calculated using the calculation scenarios provided in point 6.2.3.6 in order to check if compliance with the maximum equivalent conicity the vehicle was designed and tested for is met. If it is not the case, the wheel profiles have to be corrected.

These points (2) and (3) are to be applied during operation; they are not part of the conformity assessment against the TSI and are not assessed by the notified body.

During operation, for any problem met, it is recommended to make sure that an inspection of the train and track, according to the usual maintenance procedures (including periodicity) of RU and IM, respectively, has been conducted. This may include reviewing wheels, yaw dampers, suspension components, etc. for the RU/ECM and track geometric defects, etc. for the IM. If it is not the case, this lack of maintenance has to be corrected.

Despite of the application of usual maintenance procedures, if ride instability is reported, the RU/ECM should model the measured wheel profiles and distances between active faces of the wheels over the representative sample of track test conditions specified in relevant tables 11-16 of the chapter 6 of the TSI to calculate the equivalent conicity and check its compliance with the maximum equivalent conicity at which the vehicle is designed and assessed to be stable.

As examples:

- For the 1435mm track gauge the following scenarios are considered representative for the check of the equivalent conicity:
 - for speeds up to 200 km/h, the cases 1,2,7 and 8 under test conditions in table 12 of clause 6.2.3.6 are representative,
 - for higher speeds only the cases 1 and 2 are representative.
- For the 1668 mm track gauge, the following scenarios are considered representative for the check of the equivalent conicity:
 - for speeds up to 200 km/h, the cases 1 and 3, rail sections 54 E1 and 60 E1,
 - for higher speeds only the case 1 is representative, rail section 60 E1.

If the wheelset parameters do not comply with the maximum equivalent conicity at which the vehicle is designed and assessed to be stable, the maintenance strategy of the wheel profiles are to be modified to avoid unstable behaviour.

If the wheelsets comply with the maximum equivalent conicity at which the vehicle is designed and certified to be stable, the INF TSI requires the IM to check the track for compliance with the requirements set out in the INF TSI.

If both vehicle and track comply with the requirements of the relevant TSIs, a joint investigation by the RU and the IM should be undertaken to determine the reason for the instability.

2.4.5. Point 4.2.3.5.2.1 Mechanical and geometric characteristics of wheelsets / Conformity assessment point 6.2.3.7: Axles

(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].

The verification of the axle is intended to be done by calculation as set out in EN 13103-1:2017+A1:2022 that defines:

- the load cases to be considered;
- the specific calculation methods for the design of the axle and the decision criteria;
- the permissible stress:
 - for steel grade EA1N and
 - the methodology to determine the permissible stress with other materials.

(4) 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 axles.

(5) The tensile strength of the material in the axle, the resistance to impact, the surface integrity, 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.

The axle is considered a safety relevant component which needs to be checked and controlled, not only for the design criteria, but also for ensuring end quality of the product. EN 13261:2020 sets out the verification procedure to be followed for the parameters stated in the TSI; the number of samples to be checked in production, the procedures to follow for any significant changes in the design of the axle or changes of manufacturer of the material of the axle, etc.

This may be part of the assessment of the quality management system of the manufacturer: sampling, batch size and similar issues may be based on EN 13261:2020 Annex I.

2.4.6. Point 4.2.3.5.2.2: Mechanical and geometrical characteristics of wheels / Conformity assessment point 6.1.3.1

(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].

The wheel is required to be designed following the methodology set out in EN 13979-1:2020 clause 7 which requires calculations to be performed and subsequent tests if design criteria are not met.

(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 wheel is considered to be a safety relevant component which needs to be checked and controlled, not only for the design criteria, but also for ensuring end quality of the product. EN 13262:2020 sets out the verification procedure to be followed for the parameters stated in the TSI; this verification covers the material characteristics and the number of samples to be checked in production, the procedures to follow for any changes in the design of the wheel or changes of manufacturer of the material of the wheel, etc.

In particular, the verification of the fatigue characteristics of the wheel material is intended to be performed if there is a change of supplier of the raw material for the production of the wheel, or there are any significant changes to the manufacturing process, or the design of the wheel is appreciably changed in diameter and web shape.

This may be part of the assessment of the quality management system of the manufacturer; sampling, batch size and similar issues may be based on EN 13262:2020 Annex E.

2.4.7. *Point 4.2.3.5.3: Automatic variable gauge systems / Conformity assessment point 6.1.3.1a*

Point 4.2.3.5.3:

(1) This requirement is applicable to units equipped with an automatic variable gauge system with changeover mechanism of the axial position of the wheels allowing the unit to be compatible with 1435 mm track gauge and other track gauge(s) within the scope of this TSI by means of passage through a track gauge changeover facility.

Section 4.2.3.5.3 applies without prejudice to sections 4.2.3.5.1 and 4.2.3.5.2.

Point 4.2.3.5.3:

(5) The failure of the locking of the position of the wheels and braking equipment (if relevant) during operation has typical credible potential to lead directly to a catastrophic accident (resulting in multiple fatalities); considering this severity of the failure consequence, it shall be demonstrated that the risk is controlled to an acceptable level.

(6) The automatic variable gauge system is defined as an interoperable constituent (point 5.3.4b). The conformity assessment procedure is specified in point 6.1.3.1a (IC level), in point 6.2.3.5 (safety requirement) and in point 6.2.3.7b (subsystem level) of this TSI.

The latest revision of the common safety method for risk evaluation and assessment (Commission Implementing Regulation (EU) 402/2013) clarifies in point 2.5.6 of its Annex I that the harmonised design targets, which are needed to apply the ‘explicit risk estimation and evaluation’, cannot be used neither for purely mechanical systems nor for purely mechanical part of mixed systems.

Considering that the safety target is fixed in the TSI for the locking of the position of the wheels and braking equipment in the variable gauge system, as long as this system is:

- purely mechanical, or
- composed of both a purely mechanical part and an electrical, electronic and programmable electronic part,

a safety demonstration, as referred to in points 4.2.3.5.3, 6.1.3.1 and 6.2.3.7b of the TSI, should use as risk acceptance principles either “codes of practice” or “similar reference systems”. This means that the manufacturer will have to compare the proposed solution to similar existing ones (e.g. mechanical systems subject to similar forces); a risk analysis based on “explicit risk estimation and evaluation” should not be acceptable for the purely mechanical part.

The existing codes of practice for the validation of these systems are:

- EN 17069-1:2019, clause 6.3.2 “Railway applications - Systems and procedures for change of track gauge”
- National rules (e.g. Annex G of ETH de Material Rodante Ferroviario. Unidades Autopropulsadas, DGF-MFOM, 2009)
- UIC 510-4, v.2, 2002

Existing systems already in service can be referred to as reference systems.

Point 6.1.3.1a:

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

The manufacturer has the ultimate responsibility of meeting all the essential requirements applicable to automatic variable gauge system. The LOC&PAS TSI specifies the need to perform validation tests (both on gauge changeover facilities and on-track) representative of in-service conditions. For these ‘representative of in-service condition tests’, the applicant can choose whether to perform them on dedicated lines open to the traffic or in dedicated railway test-rings / facilities; the application of module CV is purely voluntary.

According to Decision 2010/713/EU it is the manufacturer who defines the programme for validation of a variable gauge system by in-service experience using module CV. The on-track tests described in EN 17069-1:2019 “Railway applications - Systems and procedures for change of track gauge” may be taken as reference. The provisions of this draft standard may be altered by the manufacturer taken into account the area of use of the automatic variable gauge system and the level of experience that the manufacturer possesses with similar designs of this equipment. The objective of in-service testing is to perform the tests under real conditions and tailored to match the area of use of the automatic variable gauge system.

2.4.8. PointBraking - Point 4.2.4.2.1: Functional requirements

(6) [...] The temperature reached around the brake components shall also be considered in the design of the rolling stock.

The TSI mandates that the components in the vicinity of brake components be designed with consideration of the temperature reached around these components, and maintain their functionality at that temperature. This applies in particular to wheels with built-in brake discs; the applicant responsible for the design and the selection of the wheel (as IC) should take into account the attachment of the disc, the effective temperature reached and the heat transfer when brakes are used in order to prevent thermo-mechanical problems (thermal fatigue) in the wheel web.

The applicant has to take into account other fire risks (e.g. sparks) independently of conformity assessment to TSIs.

(14) A brake application command, whatever its control mode, shall take control of the brake system, even in case of active brake release command; this requirement is permitted not to apply when intentional suppression of the brake application command is given by the driver (e.g. passenger alarm override, uncoupling...).

Intentional suppression (combined with other functions) of the brake application by the driver is permitted by the TSI in those specific situations described in the documented procedures for train operation.

(15) [...]For speeds higher than 5 km/h, the maximum jerk due to the use of brakes shall be lower than 4 m/s³. The jerk behaviour may be derived from the calculation and from the evaluation of the deceleration behaviour as measured during the brake tests (as described in the points 6.2.3.8 and 6.2.3.9).

The jerk rate of 4 m/s³ is generally associated with rapid changes to the brake demand for the safety of standing passengers.

2.4.9. Point 4.2.4.4.1: Emergency braking command

(2) At least two independent emergency brake command devices shall be available, allowing the activation of the emergency brake by a simple and single action from the driver in his normal driving position, using one hand.

The sequential activation of these two devices may be considered in the demonstration of compliance to the safety requirement N°1 of table 3 of point 4.2.4.2.2.

One of these devices shall be a red punch button (mushroom push button).

The emergency brake position of these two devices when activated shall be self locking by a mechanical device; unlocking this position shall be possible only by an intentional action.

(...)

(4) Unless the command is cancelled, the emergency brake activation shall lead permanently, automatically to the following actions:

- *transmission of an emergency brake command along the train by the brake control line.*
- *cut-off of all tractive effort in less than 2 second; this cut-off shall not be able to be reset until the traction command is cancelled by the driver.*
- *an inhibition of all 'release brake' commands or actions.*

Activation of the emergency brake leads to the described actions; these actions may only be cancelled by the intentional actions of the driver. In the case where the signal which has led to the emergency braking activation disappears for other reasons than intentional cancellation (for example in case of command failure), this is not considered as a cancellation, and the TSI mandates the described actions that continue to be applied.

2.4.10. Point 4.2.4.4.2: Service braking command

(2) The service brake function shall allow the driver to adjust (by application or release) the brake force between a minimum and a maximum value in a range of at least 7 steps (including brake release and maximum brake force), in order to control the speed of the train.

The TSI does not mandate mechanical notches on the brake lever corresponding to the steps; the brake lever may be of any type (continuous, with pulses, time dependant...); the objective is to have a sufficient precision of the service brake command.

2.4.11. Point 4.2.4.4.5: Parking braking command

(2) The parking braking command shall lead to the application of a defined brake force for an unlimited period of time, during which a lack of any energy on board may occur.

“Unlimited period of time” means that the parking brake force should not rely on stored energy on-board (e.g. compressed air, electric); this may be validated by design review because a test can only be performed during a limited period of time. According to point 4.2.4.5.5 of this TSI the parking brake performance (force) shall be verified by calculation.

2.4.12. Point 4.2.4.5.1: Braking performance – General requirements

(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]).

The friction coefficients considered in the calculation should be chosen from data (obtained from calculations or test results) provided by the supplier, taking into account their environmental conditions as described in the standard EN 14531-1:2015+A1:2018 (which depend on general environmental conditions specified in point 4.2.6.1 of the TSI, and on effects internal to the rolling stock due to the braking system). They should correspond to the value met during tests (possible correction after tests).

As mentioned in the standard above, the friction coefficients of composite blocks and pads could be reduced by humidity. Operation during severe climatic conditions could be addressed by additional operational rules and the use of speed restrictions too (see point 4.2.6.1 of the TSI).

(5) The maximum average deceleration developed with all brakes in use, including the brake independent of wheel/rail adhesion, shall be lower than 2,5 m/s²; this requirement is linked to the longitudinal resistance of the track.

The maximum average deceleration to be evaluated should correspond to the longitudinal deceleration 'transmitted' to the track; it may be obtained by filtering the signal 'deceleration = f(time)' with a filter one second.

2.4.13. Point 4.2.4.5.2: Emergency braking

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

[...]

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]).

[...]

On degraded modes, the TSI mandates to identify single point failures and to evaluate their impact on the braking performance.

On degraded conditions, the specification referenced in Appendix J-1, index [67] is EN 15328:2020, point 5.2. That point also refers to points 5.5 (Frictional requirements for brake pads) and 5.6 (Requirements and optional test programs for brake pads for coaches). These references don't make the complete points 5.5 and 5.6 mandatory, but only what is relevant to the variation of the friction coefficient.

The same principle applies to index [68]: clauses 5.3.1 and 5.3.3 refer to other clauses of the standard. These references don't make the complete referred clauses in table 1 of clause 6.2 mandatory, but only what is relevant to the variation of the friction coefficient.

(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.

Maximum braking load should be evaluated taking into account the realistic worst case likely to be encountered in service (including applicable speed limitations depending on load if any).

2.4.14. Point 4.2.4.5.3: Service braking

Maximum service braking performance:

(3) When the service braking has higher design performance capability than the emergency braking, it shall be possible to limit the maximum service braking performance (by design of the braking control system, or as a maintenance activity) at a level lower than the emergency braking performance.

Note: A Member State may ask the emergency braking performance to be at a higher level than the maximum service braking performance for safety reasons, but in any case it cannot prevent the access to a railway undertaking using a higher maximum service braking performance, unless that Member State is able to demonstrate that the national safety level is endangered."

The TSI permits the design of RST with the service braking having a higher performance capability than the emergency braking.

The limitation of the service braking performance (when required as stated above) may be obtained by an intervention at maintenance workshop (for example change of software, or change of settings of components of the braking system).

The NSA is permitted to limit the maximum service braking performance, but in cases where a RU does not agree and has adequate operating rules, the TSI mandates that the NSA demonstrates that such a limitation is necessary to maintain the national level of safety.

2.4.15. Point 4.2.4.5.4: Calculations related to thermal capacity

(2) For OTMs, it is allowed to verify this requirement by temperature measurements on wheels and brake equipment.

For OTMs it is not mandatory to provide thermal capacity calculation, this can be replaced by temperature measurements.

2.4.16. Point 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 pre-defined 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 pre-defined 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.

The wheel rail adhesion limits specified are considered as realistic values on the basis that the wheel rail contact should not rely on higher adhesion coefficients.

These limits do not prevent the unit under test to verify the efficiency of the WSP system (test required in point 4.2.4.6.2).

During emergency brake, 0.15 is the usual limit for units operated in general operation (train formation not known at design stage); for these units, the WSP test is performed with a representative train configuration (as the future train formations are not known).

For short trainsets, a lower limit is specified because it is known that they are more sensitive to degraded adhesion conditions; the opposite applies for long trainsets. For all trainsets, the check of the efficiency of the WSP is performed with the real train configuration, therefore validating the real behaviour of the train in degraded adhesion conditions.

2.4.17. Point 4.2.4.6.2: Wheel slide protection system

(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 stopping distance compared to the stopping distance on dry rail) when integrated in the unit; the conformity assessment procedure is specified in point 6.2.3.10.

The point 6.2.3.10 requires a test in low adhesion conditions according to EN 15595:2018+A1:2023. The test in low adhesion conditions is specified in point 7.3. The content of the test report to be provided is described in EN 15595:2018+A1:2023.

In case a test in very low adhesion conditions as specified in point 7.3 is performed too, it should be documented in the test report too.

The conditions and limitations of use of the WSP are defined by the conformity assessment tests that are performed; these conditions and limitations should be included in the documentation (part of the technical file).

2.4.18. Point 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.

Where the dynamic brake is included in the emergency braking performance, the TSI mandates evaluation of the global reliability of this dynamic brake; this is needed to assess the safety requirement, No. 3 of the TSI point 4.2.4.2.2, considering the possible compensation by pneumatic brake too. If relevant, the on-board parts of the power supply have to be considered too (pantograph, inverter...), and an assumption has to be made regarding the availability of the external power supply.

2.4.19. Point 4.2.4.8.2: Magnetic track brake

(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.

This point addresses only emergency brake.

It does not prohibit the use of braking systems independent of wheel-rail adhesion for service brake; this use may be subject of restrictions, which are described in RINF.

Point 4.2.6.2.2 of the INF TSI states:

“(1) The track, including switches and crossings, shall be designed to be compatible with the use of magnetic braking systems for emergency braking.

[...]

(3) For the 1600 mm track gauge system it shall be permitted not to apply paragraph (1).”

Electro-magnetic compatibility aspects for interface to axle counters are covered in point 4.2.3.3.1.2.

Note. Point 5 of EN 16207:2014+A1 :2019 defines design requirements of magnetic track brake that provide presumption of conformity regarding magnetic track brake design.

2.4.20. Point 4.2.4.8.3: Eddy current track brake

(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.

The maximum distance has to be determined in order to ensure the compatibility with the gauge. It may be useful for the electromagnetic compatibility (currently 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),*

The findings of the ECUC project (Eddy CUrrent brake Compatibility - [Eddy CUrrent Brake Compatibility | ECUC | Project | Fact sheet | FP7 | CORDIS | European Commission \(europa.eu\)](#)) may be used to determine the thermal effect to the infrastructure when performing the verification of compatibility of the unit with a network or route.

2.4.21. Point 4.2.4.9: Brake state and fault indication

(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.

The control of the status of the braking system is directly dependent on the design of the system; the choice of the parts to be controlled independently is made by the applicant. It has a direct impact on degraded operating conditions, which have to be described in the documentation required by point 4.2.12.4.

(2) If the parking brake always depends directly on the state of main brake system, it is not required to have an additional and specific indication for the parking brake system.

This point (2) applies to certain brake architectures (e.g. units fitted with automatic parking brake), in which the parking brake depends directly on the state of the main brake system.

Applicability to units intended for general operation:

(7) Only functionalities that are relevant to the design characteristics of the unit (e.g. presence of a cab,...) shall be considered.

The signals transmission required (if any) between the unit and the other coupled unit(s) in a train for the information regarding the brake system to be available at train level shall be documented, taking into account functional aspects.

This TSI does not impose any technical solution regarding physical interfaces between units.

For example, in case of assessment of a passenger carriage for general operation with no cab, it is not possible to check the information the driver will receive in the cab; it is only possible to check local indications (for example external brake indicators), and electric or numeric information that is to be transmitted to a cab when the carriage is integrated in a train.

2.4.22. Point 4.2.5: Passenger-related items

For information purposes only, the following non exhaustive list gives an overview of the basic parameters covered by the TSI PRM, which are applicable to units which are intended to carry passengers:

The PRM TSI is in force and applies independently of the LOC&PAS TSI to the RST that is designed to carry passengers and that is in the scope of the LOC&PAS TSI.

2.4.23. Point 4.2.5.1: Sanitary systems

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⁽¹²⁾.

The above requirement can be fulfilled by providing certificates of materials compatible with water intended for human consumption for the components of the sanitary systems.

However, due to the possible cross-contamination during operation of the rolling stock, it is permitted to affix, nearby the water taps provided for the use of passengers, a visual sign to indicate that the water provided at the tap is not intended for drinking due to possible reservations regarding the hygienic conditions of the tap, e.g. pictogram of the Figure 1 below combined with text “Please do not drink”.



Figure 1 – pictogram “Please do not drink”

2.4.24. Point 4.2.5.2: Audible communication system

(3) The equipment shall be able to remain on standby independently of the main energy source for at least three hours. During the standby time the equipment shall be able to actually function at random intervals and periods during an accumulated time of 30 minutes.

(4) The communication system shall be designed in such a manner that it continues to operate at least half (distributed throughout the train) of its loudspeakers in the event of a failure in one of its transmission elements or, as an alternative, another means shall be available to inform the passengers in the event of a failure.

In case of units fitting a IRS 50558:2017 or similar bus for audible communication via loudspeakers, the first alternative of requirement (4) is deemed to be fulfilled under the following conditions:

- passenger areas are equipped with two independent lines for amplifiers and loudspeakers using one transmission path of IRS 50558:2017 (see Figure 2 below) and
- driver cabs are equipped with one microphone and one amplifier connected to the transmission path of the IRS 50558:2017 bus.

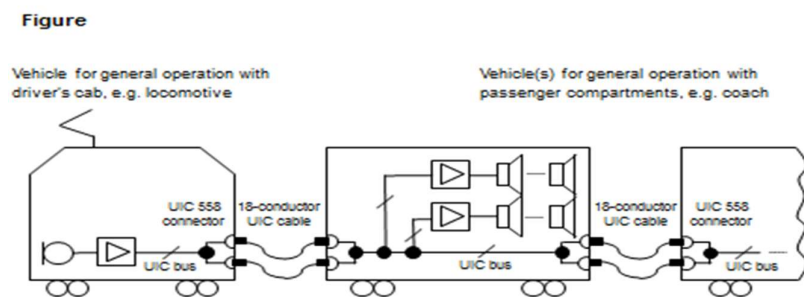


Figure 2 – Equipment of passenger areas with two independent lines for amplifiers and loudspeakers

2.4.25. Point 4.2.5.3.1: Passenger alarm

(1) This point is applicable to all units designed to carry passengers and units designed to haul passenger trains.

(2) The passenger alarm function gives to anyone in the train [...]

This point is applicable at train level in the conditions set out in point 4.2.5.3.3 only. Shunting mode may be excluded from the scope of this point as far as the shunting operations are not carried out under such conditions.

2.4.26. Point 4.2.5.3.2: Passenger alarm: Requirements for information interfaces

(4) A device in the cab shall allow the driver to acknowledge his awareness of the alarm. The driver's acknowledgement shall be perceivable at the place where the passenger alarm was triggered and shall stop the acoustic signal in the cab.

When a passenger alarm is initiated, this results in a visual and an acoustic signs in the cab. In the case of no acknowledgement of the alarm by the driver, a brake will be initiated after 10 seconds, which will be perceived by passengers as a confirmation of the alarm.

In case the passenger alarm is acknowledged by the driver, the point above applies. There will be no automatic application of the brake, but passengers should be informed that the driver is aware of the alarm; the means to inform passengers is not specified in the TSI, but it is required as being a direct consequence of the acknowledgement by the driver; it is not mandatory to have this information generated immediately, but it should be given within the 10 seconds of the passenger alarm being initiated. For example, the means to inform passengers could be an acoustic signal in the unit, or it could be a visual sign (light at the position where the alarm was initiated).

(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 the activated devices have been reset.

The terms “generating a new passenger alarm” cover:

- visual and acoustic signs indicated to the driver (point 4.2.5.3.2(3)), and
- acknowledgement that service brake shall not be initiated (point 4.2.5.3.3(2)).

2.4.27. Point 4.2.5.3.4: Passenger alarm: Criteria for a train departing from a platform

(1) A train is deemed to be departing from a platform during the period of time elapsing between the moment when door status is changed from ‘released’ to ‘closed and locked’ and the moment when the train has partly left the platform.

(2) This moment shall be detected on-board (function allowing physical detection of the platform or based on speed or distance criteria, or any alternative criteria).

The following ways to detect that the train has partly left the platform are (among others) permitted:

- Physical detection of the platform (marker on the tracks).
- The speed of the train reaches the speed criteria specified in clause 6.5 of EN 16334-1:2014+A1:2022.
- The distance covered is 100 (+/- 20) m.
- The time elapsed since the train starts to move after the door status is changed from ‘released’ to ‘closed and locked’ is more than 10 s.

The applicant may implement a similar technical solution using a distance higher than 100 m, or a higher speed criteria providing that he demonstrates that the criterion “train departing from a platform” as defined in the TSI point above will cease to apply.

2.4.28. Point 4.2.5.3.5: Passenger alarm: Safety requirements

(1) For the scenario ‘failure in the passenger alarm system leading to the impossibility for a passenger to initiate the activation of brake in order to stop the train when train departs from a platform’, it shall be demonstrated that the risk is controlled to an acceptable level considering that the functional failure has typical credible potential to lead directly to “single fatality and/or severe injury.

Pending the publication of the harmonized risk acceptance criteria in the foreseen amendment to the CSM on risk assessment regulation, clause 9 of **EN 16334-1:2014+A1:2022** specifies a failure rate that may be used for demonstration of conformity to the requirements of point 4.2.5.3.5.

2.4.29. Point 4.2.5.3.6: Passenger alarm: Degraded modes

(1) Units fitted with a driver's cab shall be fitted with a device which allows authorised staff to isolate the passenger alarm system.

(2) If the passenger alarm system is not functioning, either after intentional isolation by staff, due to a technical failure, or by coupling the unit with a non-compatible unit, this shall be permanently indicated to the driver in the active driver's cab, and application of the passenger alarm shall result in a direct application of brakes.

On the one hand, the 'communication' part of the passenger alarm system and, on the other hand, the 'brake' part of the passenger alarm system have to be differentiated. In the degraded mode of the passenger alarm described in point 4.2.5.3.6, it is only the 'communication' part which will be isolated, not the 'brake' part. In this situation, application of the passenger alarm will lead to immediate braking. This application of brakes should not prevent the driver from overriding the brake application.

Note: no separate emergency brake handles and passenger alarm buttons are required. There is only one interface required: the TSI doesn't specify the type of interface (e.g. button or else).

2.4.30. Point 4.2.5.3.7: Passenger alarm: Applicability to units intended for general operation

(1) Only functionalities that are relevant to the design characteristics of the unit (e.g. presence of a cab, of a crew interface system,...) shall be considered.

(2) The signals transmission required between the unit and the other coupled unit(s) in a train for the passenger alarm system to be available at train level shall be implemented and documented, taking into account functional aspects described above in this point.

When the unit under assessment has to be coupled to other units to be operated as a train, and the train composition is not defined, it is not usually possible to verify all functionalities; only information available on the unit under assessment needs to be verified.

Note: this is also applicable to point 4.2.5.4 'Communication devices for passengers' and to point 4.2.5.5 'Exterior doors'.

2.4.31. Point 4.2.5.4: Communication devices for passengers

The device allowing the communication function described in this point may use the device of the communication function described in point 4.2.5.3.2 (5) (passenger alarm).

However, the initiative of establishing the communication link is specific to each function (passenger's initiative for communication device, driver's initiative following the activation of a passenger alarm). The TSI contains no requirements regarding the reliability of the communication device. On a voluntary basis, the user may specify such requirements and ask the Notified Body to assess them.

EN 16683:2015, clause 5 and annex D, provides additional guidance on the communication device for passengers.

2.4.32. Point 4.2.5.8: Internal air quality

(2) The CO₂ level shall not exceed 5000 ppm in all operating conditions, excepted in the 2 cases below:

- *In case of interruption of the ventilation, due to an interruption of the main power supply or to a breakdown of the system, an emergency provision shall ensure the supply of outside air into all passenger and staff areas. If this emergency provision is ensured through battery supplied forced ventilation, the duration in which the CO₂ level will remain below 10000 ppm shall be defined assuming a passenger load derived from the load condition “design mass under normal payload*

The conformity assessment procedure is defined in point 6.2.3.12.

This duration shall not be less than 30 minutes.

[...]

The maximum CO₂ level is specified for all operating conditions, i.e. at any speed up to the maximum speed of the unit, and also at standstill.

If the emergency provision is ensured through battery supplied forced ventilation, this functionality is limited in time due to the autonomy of the battery; therefore, it is required to evaluate the expected duration during which the functionality will be met.

Alternatively, the requirement can be met by provision of passive facilities such as openable windows or flaps (providing external air into the train). Since the airflow through such passive devices will vary with the ambient conditions, and therefore cannot be directly assessed, there is no assessment procedure required, and there is no minimum area of opening specified. Operational rules (outside of scope of the LOC&PAS TSI) are needed for the effective use of such facilities.

- *In case of switch off or closing of all means of external ventilation, or switch off of air conditioning system, in order to prevent passengers being exposed to environmental fumes that may be present, especially in tunnels, and in the event of a fire, as described in point 4.2.10.4.2.*

The means to be used by the train staff (manual closing, closing by remote control) are not specified; any means is acceptable.

2.4.33. Point 4.2.6.1: Environmental conditions - general

(4)...For the functions identified in the points below, design and/or testing provisions taken to ensure that the rolling stock is meeting the TSI requirements in this range shall be described in the technical documentation.

The applicant defines the range of environmental conditions in terms of temperature, snow ice and hail conditions (and the combination of the conditions) the rolling stock is intended to be operated under.

In section 7.4 ‘Specific environmental conditions’ of the TSI, Member States have identified the specific conditions that shall be taken into account for rolling stock to operate without any restrictions on their network. The applicant can choose to apply these conditions in order to avoid restrictions at operating level (e.g. under winter conditions), but this is not mandatory for a vehicle to get an ‘authorisation for placing in service’ in the concerned Member State.

All the provisions taken by the applicant to ensure that the vehicle is capable of operating under the chosen conditions (e.g. temperature zone) are to be documented in the technical documentation. This should allow the user of the vehicle to define and take additional provisions where necessary, depending on real operating conditions.

Note: Point 5 and 6 of CEN/TR16251:2016 define design guidance and criteria for validation of the rolling stock and its constituents under specific (severe) environmental conditions to which this rolling stock may be subject.

2.4.34. Point 4.2.6.1.2: Snow, ice and hail

(3) Where more severe “snow, ice and hail“ conditions are selected, rolling stock and the parts of the subsystem shall then be designed to meet TSI requirements considering the following scenarios:

- *Snowdrift (light snow with low water equivalent content), covering the track up to 80 cm continuously above top rail level.*
- *Powder snow, snowfall of large quantities of light snow with low water equivalent content.*
- *Temperature gradient, temperature and humidity variation during one single run causing ice build-ups on the rolling stock.*
- *Combined effect with low temperature according to the temperature zone chosen as defined in point 4.2.6.1.1.*

(...)

A more detailed description of the conditions/scenarios related to snow that may be considered by the applicant when defining design and/or testing provisions is provided below. The applicant may choose other conditions/scenarios depending on the area and conditions of use of the rolling stock:

These conditions/scenarios are based on a return of experience gathered by Nordic countries; they are not expressed in terms of design criteria directly applicable to vehicles.

Weather conditions resulting in whirling snow in the air along the train in the temperature area of $-10^{\circ}\text{C} < T < 0^{\circ}\text{C}$:

Conditions with whirling snow are frequently occurring during winter time in Finland, Norway and Sweden. They are caused by loose snow whirled by the wind and the train's speed and may result in clogging of air intakes; build-ups of snow and ice, causing e.g. derailment, brake hose breakage, or obstruction of sight from the driver's position.

The braking power may be considerably decreased if suitable measures are not ensured. On disc braked rolling stock the snow tends to build up a layer of snow/ice between the brake pads and the brake disc. The same phenomenon is found on blocks braked rolling stock. A prolonged stopping distance has to be avoided. Composite brake pads and composite brake blocks proven suitable for winter conditions are necessary to avoid operational restrictions. Extensive testing therefore has been carried through during the last three decades to find acceptable composite friction elements.

Operational rules, such as routine brake testing/braking during such conditions, are frequently utilised in order to minimise the risk of any adverse loss of brake capacity under these conditions.

Routine brake testing before starting the operation and also during the run (heat braking to be sure that the braking power is maintained, and test braking before signals, stations and especially long and steep gradients for instance) is also utilised.

Very low temperatures are mainly found in the inland of Finland and Sweden, but also in Norway (the further North, the colder).

Low ambient temperature and rapid variation of temperature combined with humidity may require measures to limit condensation and/or proper drainage (i.e. for structures that are closed and may collect humidity).

Light snow on the line in heights up to 800 mm above top of the rails:

In the Nordic area, severe snow falls are mainly found in Sweden and Norway. In Sweden un-ploughed lines with up to 800 mm light snow may be found resulting from 24 hours of snowfall; in such a case, the Infrastructure Manager acting as the Traffic Manager or at the request of the Traffic Manager may have to apply particular procedures.

This is not common in Norway where the fallen snow tends to be heavier (higher density), and the heaviest snow falls are not so intensive. In Finland the height of snow is low.

Heavier snow on the line with varying heights above top of the rail, and where the top of the snow might be laterally level or inclining:

Avalanches, snow drifts, ice-slides etc. on the line are almost solely found on Norwegian lines, and mostly on the mountainous lines. Snow drifts may also occur more sporadically at conditions with heavy snowfall and strong wind.

Laterally inclining top of a snow drift or an avalanche will cause strong lateral forces when running into it and challenge the resistance to derailment. A snow plough with a shape securing downwards forces is necessary (see point on obstacle deflector in the TSI).

Consistency of the snow as everything from very loose and light to ice- or concrete-like, from dry to near soak-wet snow with any density from 100-400 kg/m³:

Heavy snow causes high resistance when running into it. Appropriate strength of primarily the snow plough and its fastenings and the front of the rolling stock is necessary (see point on obstacle deflector in the TSI).

In addition openly mounted under-floor equipment needs enforced protection to avoid harm from e.g. ice lumps.

Sudden changes when running through long tunnels:

Despite low outside air temperature the air inside long tunnels always will show some degrees above zero and the relative air humidity will be near 100 %. Where the line has many long tunnels and the outside air temperature is low snow and ice tends to build up especially on the vehicle ends, on the under-floor equipment and on/in the running gear.

The rolling stock will instantly gather condense on the outside. Repeated cycles builds up ice that i.e. may obstruct free movements increasing the risk for derailment. Accumulated snow/ice results in increased weight and forces.

The high relative humidity in cooling air may cause breakdown of electronics.

2.4.35. Point 4.2.6.2: Aerodynamic effects

(1) The requirements in this point apply to all rolling stock. For rolling stock operated on the 1 520 mm and 1 600 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.

For vehicles intended to operate in several track gauges, compliance with requirements of points 4.2.6.2.1, 4.2.6.2.2 and 4.2.6.2.4 should be demonstrated for all track gauges the vehicle is intended to be compatible with.

The compliance may be demonstrated either by assessing the vehicle in both track gauges or by assessing the vehicle in one track gauge and demonstrating that such track gauge is the worst case scenario.

2.4.36. Point 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].

A vehicle may be exempted of demonstrating compliance with this requirement if its operation will be restricted to networks without tunnels or a network where the maximum speed in the tunnels is lower than 200 km/h. The authorisation granted to such vehicle may include this restriction in accordance with Article 21(10) of the Directive(EU) 2016/797.

2.4.37. Point 4.2.6.2.4: Cross wind

- (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.*

When assessing changes, it is recommended to check first, if the modifications to the existing unit do not lower the cross wind stability of the unit. In this case, evidence is provided, that the modified unit has at minimum the same cross wind stability as the existing one. Thus, an assessment of the unit with modifications according to [19] to determine a CWC is not necessary. For documentation, the same CWC may be applied to the modified unit.

In case the change increases the maximum speed of the unit above the threshold of requirements (2) or (3), the corresponding requirement (2) or (3) shall be applied.

Additional information for defining relevant operating rules:

The resulting characteristic wind curves recorded in the technical documentation should be taken into account for the railway undertaking to define relevant operating rules also considering available information provided by the Infrastructure Manager on wind conditions for a given line (in particular, where these wind conditions are considered as critical).

2.4.38. Point 4.2.7.1: External lights

External lights are interoperability constituents, and their colour and luminous intensity are required to be tested at an IC level. The test may include particular conditions of integration of the lights (e.g. additional glazing); such condition is part of the area of use of the component.

In case of uncertainty regarding the area of use, the applicant may undertake additional verifications at vehicle level, and submit the results to the Notified Body.

(1) The colour green shall not be used for external light or illumination; this requirement is made to prevent any confusion with fixed signals.

This requirement is applicable when the vehicle is running. When at standstill in stations, it is permitted to have green lighting at the level of the passenger access doors.

2.4.39. Point 4.2.7.1.1: Head lights

(2) Two white headlamps shall be provided at the front end of the train in order to give visibility for the train driver.”

[...]

(7) Additional head lamps may be provided (e.g. upper head lamps). [...]

The TSI specifies minimum requirements regarding head lights that are sufficient to operate on the EU network.

The use by RUs of additional headlamps is not prohibited by TSI; the use of these additional headlamps may be subject to restrictions on certain networks; however, their presence cannot be a condition for access to a network. The standard EN 15153-1:2020 provides guidance on the location of these additional headlamps.

2.4.40. Point 4.2.7.1.4: Lamp controls

(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 clause 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.

The TSI specifies the lamp controls at the level of the unit; there is no specification at the level of the train.

The use of lights to inform of an emergency situation is not prohibited by the TSI; Member States where this possibility is used declared it as a specific case in point 7.3.2.8a.

2.4.41. Point 4.2.8.2.2: Operation within range of voltages and frequencies

(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]

The point 4.2.8.2.2 of LOC&PAS TSI refers to point 4.2.3 of ENE TSI which includes following voltages : AC 25 kV, 50 Hz; AC 15 kV, 16,7 Hz; DC 3 kV and DC 1,5 kV. It covers the technical compatibility between a vehicle which needs an external energy supply system and this external supply system (which can be, or not, covered by the ENE TSI, hence the term ‘other’). The term “others” defined in table 17 of this TSI refers to any other external energy supply covered by a fixed installation external to the vehicle. Internal electric traction sources such as batteries are not covered.

The design of RST for other additional systems “voltage and frequency” not described in the ENE TSI is not prohibited by the TSI.

If such additional system is the subject of a specific case in the ENE TSI, it is by consequence subject of a specific case in the LOC&PAS TSI (listed in section 7.3, with applicable rules described or to be notified).

If it only applies to the networks not in the scope of the TSIs, it should be covered by national rules.

2.4.42. Point 4.2.8.2.5: Maximum current at standstill

(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 principle expressed in point (3) of the TSI also applies to AC systems but, as the current is lower, the probability to cause heating of the contact wire is low, and given that the check for current at standstill is not necessary for AC systems, this hasn’t been specified in the TSI.

Note: the parameter 1.2.1.0.7 of the RINF, indicating a point at which an IM authorises charging of electric energy storage for traction purposes at standstill, is applicable to both AC and DC systems.

2.4.43. Point 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).

Further explanation is provided in application guide covering the ENE TSI and in particular its point 4.2.8.

2.4.44. Point 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, 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-authorized 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.

The aim of the requirements set out in this TSI and in the ENE TSI is to ensure that all Data Collecting Systems (DCS) shall be able to collect data from all on-board energy measurement systems (EMS).

The functions of the on-board energy measurement system and their data flow diagram are illustrated in the Figure 3 below. These functions can be performed by individual devices or may be combined in one or more integrated assemblies.

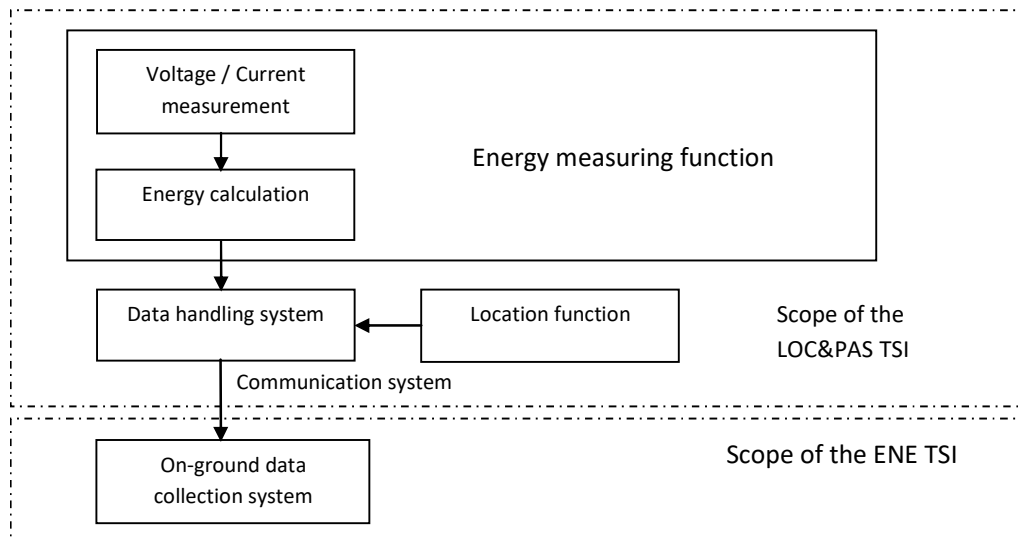


Figure 3 - functions of the on-board energy measurement system

It is permissible to access the data in the EMS for other purposes (e.g. feedback to the driver regarding the efficient operation of the train) provided that it can be demonstrated that the integrity of EMS functions and data are not compromised by these arrangements.

For the assessment of the EMS, NB-Rail proposes the following approach as a good practice.

Three different steps on two different stages are defined in LOC&PAS TSI and in EN 50463-5:2017 (referred to in Appendix J.1 of LOC&PAS TSI as index [59]) respectively and have to be considered.

The three different steps are:

- (1) assessment of the different parts of the EMS at functional element level,
- (2) assessment of the system made of the functional elements (integration), and
- (3) assessment of the installation of the system on a specific vehicle type

The two different stages are:

- a) functional element level and
- b) subsystem level.

In practice two different stages a) and b) are likely to be assessed in different procedures. Assessment a) is likely to be commissioned by the manufacturer of the functional elements (sensors, energy meter, data handler) and to be performed by the "EMS NoBo" and assessment b) is likely to be commissioned by the vehicle manufacturer who equips a specific vehicle type with an EMS and to be performed by the "Subsystem NoBo".

With these three steps on two stages the complete EMS and its assessment for installation on a specific vehicle type are covered.

The Figure 4 below shows an overview and the corresponding references between LOC&PAS TSI and EN 50463-5:2017:

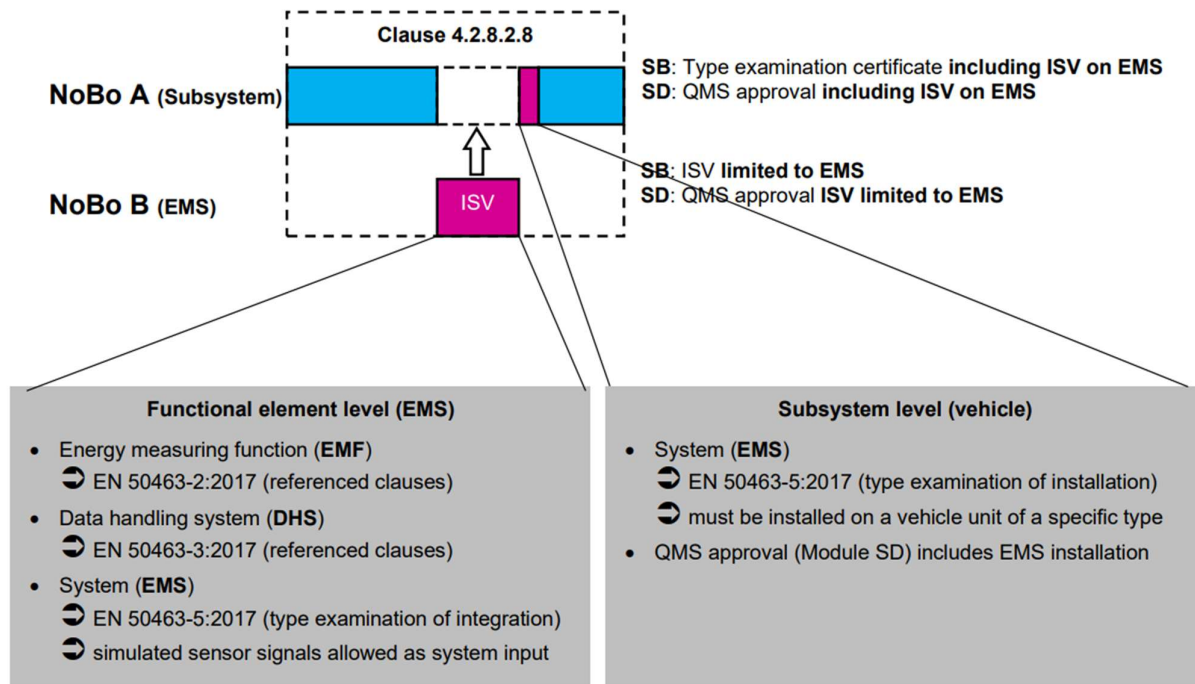


Figure 4 – assessment of the EMS

Note: It can be seen that there is no repeated metrological verification of the accuracy required on subsystem level, if the accuracy of the EMF is already verified by testing its functional elements CMF, VMF and ECF on ISV level, and then calculating the resulting overall accuracy.

Section 6.2.3.19a of the LOC&PAS TSI requires on subsystem level (installed on a specific vehicle type) only to verify the "correct functioning of the EMS" via testing by using the following methods as defined in EN 50463-5: 2017:

- 5.3.3 EMS integration type test
 - 5.3.3.2 - Visual inspection
 - 5.3.3.3 - Power-up
 - 5.3.3.4 - Power-down
 - 5.3.3.5 - Traction system change
 - 5.3.3.6 - EMS data flow test
- 5.5.4 Installation type tests
 - 5.5.4.2 Visual inspection
 - 5.5.4.3 EMS data flow test
 - 5.5.4.4 Data transfer through all communication channels

2.4.45. Point 4.2.8.2.8.2: Energy measurement function (EMF)

(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 clause 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.”*

Technical documentation will mention when parts of an EMS are only tested according to a limited set of requirements and thus might not fulfil the full requirements of 4.2.8.2.8.2. Energy settlement can differentiate between EMS compliant to full set of requirements and to EMS only compliant to limited set of requirements.

2.4.46. Point 4.2.8.2.9.2: Pantograph head geometry (IC level)

(1) For electric units designed to be operated on other track gauge systems than 1520 mm or 1600 mm system, at least one of the pantograph(s) to be installed shall have a head geometry type compliant with one of the two specifications given in the points 4.2.8.2.9.2.1 and 2 below.

The installation of other additional pantograph of different head geometry is not prohibited by the TSI. If such an additional pantograph is needed, specific cases on pantograph head geometry set out in section 7.3 of the LOC&PAS TSI cover both:

- OCL designs which are the subject of a Specific case in the ENE TSI, and
- non ENE TSI compliant OCL designs in existing lines

Note: networks outside of scope of TSIs, and Rolling Stock operated on these networks only are covered by national rules (e.g. networks with a power supply system of 600 VDC or 750 VDC).

Note: It is recommended that applicants take into account the information on pantograph head geometry available in RINF.

2.4.47. Point 4.2.8.2.9.4.2: Contact strip material

(1) Material used for the contact strips shall be mechanically and electrically compatible with the contact wire material (as specified in point 4.2.14 of the ENE TSI), in order to ensure proper current collection and to avoid excessive abrasion of the surface of the contact wires, thereby minimising wear of both contact wires and contact strips.

See also point 5.3.11 of the TSI defining the area of use of the IC contact strips.

See also point 6.1.3.8 specifying the conformity assessment procedure to be used; this point gives the possibility to the manufacturer to make an assessment of suitability for use.

The following EN standards cover this subject:

- EN 50367:2020/A1:2022: this standard deals with the interaction between contact line and pantograph; it indicates usual material for overhead contact lines and for contact strips; however, regarding contact strip material, the TSI gives more possibilities.
- EN 50405:2015 +A1:2016 : this standard deals with the assessment of contact strips.

Aspects defining the contact strips area of use (point 5.3.11 of the TSI) should be considered in the assessment procedure.

(2) Plain carbon or impregnated carbon with additive material shall be permitted.

Where a metallic additive material is used, the metallic content of the carbon contact strips shall be copper or copper alloy and shall not exceed a content of 35 % by weight where used on AC lines and of 40% where used on DC lines.

Pantographs assessed against this TSI shall be fitted with contact strips of a material mentioned above.

(3) Additionally, contact strips of other material or higher percentage of metallic contents or impregnated carbon with clad copper are allowed (if permitted in the infrastructure register) provided that:...

Contact strips covered by an EC declaration of conformity according to point (2) are allowed for applications corresponding to their area of use on the whole EU network, without any additional test of compatibility with a particular line. An infrastructure manager cannot refuse such contact strip and cannot impose to the railway undertaking to use a particular material.

Point (3) gives the possibility to use contact strips of other material, subject to agreement of the infrastructure management (via information in RINF).

Percentage of metallic content is calculated on the total weight of the contact strip.

Regarding the pantograph contact force and dynamic behaviour, the weight and size (thickness) of the pantograph head may have an impact on the test results; therefore, in case of use of different contact strips than those initially validated, it should be checked that the weight and size variations are not significant; the manufacturer of the pantograph should cover this aspect in the technical documents provided with the pantograph EC declaration of conformity.

2.4.48. Point 4.2.8.2.9.6: Pantograph contact force and dynamic behaviour

(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 is 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.

The pantograph is the component that ensures the current collection from the overhead contact line (OCL). The quality of the current collection depends on characteristics of the OCL, of the pantograph and of the rolling stock (including interaction between multiple pantographs simultaneously raised in a train); these three elements have a certain dynamic behaviour that has an impact on the final performance.

When a pantograph is designed, a set of characteristics regarding the OCL are taken into account, including the maximum operating speed of the rolling stock (which depends on the OCL and on the rolling stock); in addition, the design allows for the adjustment of the contact forces (static and dynamic), by different means (pressure, springs, deflector...).

A pantograph is not designed for a particular rolling stock, but for an OCL geometry ensuring compatibility with the pantograph head geometry and a maximum speed; the definition of the pantograph as an interoperability constituent (IC) is in line with this principle.

Tests performed for the assessment of the pantograph as IC aim at validating characteristics of the pantograph itself, for OCLs compliant to the ENE TSI, and for a certain maximum speed (area of use of the IC defined in the point 5.3.10 of the LOC&PAS TSI). The concept of IC allows the designer or manufacturer of the pantograph to issue an EC declaration of conformity independently of a particular use of the pantograph.

When this pantograph is integrated in a particular rolling stock, the applicant for this rolling stock has to make the necessary adjustments in order to get a mean contact force in the range specified in the TSI (e.g. adjusting aerodynamical components of the pantograph to a specific position).

See also the part of the Application guide covering the ENE TSI, and in particular its point related to “Assessment of Dynamic behaviour and quality of current collection”.

2.4.49. Point 4.2.8.2.9.7: Arrangement of pantographs (RST level)

(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 pre-defined formations of the assessed unit is less than the spacing shown in point 4.2.13 of the TSI Energy 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).

See the part of the Application guide covering the ENE TSI and in particular ENE TSI point 4.2.13.

The train formation(s) subject to the application of the TSI (as described in point 4.1.2 and defined by the applicant) should be considered.

The simulations made in order to identify and verify the poorest performing pantographs configuration (including simultaneous operation of consecutive pantographs) should be documented and justified

Condition (3) of section 4.2.8.2.9.7 of TSI should be met when the train is in running conditions (i.e. not in standstill). This will facilitate the use of multiple pantographs in situations such as a train equipped with electric energy storage for traction charging, at standstill, the electric energy storage for traction.

2.4.50. Point 4.2.8.2.9.8: Running through phase or system separation sections (RST level)

(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.

See the part of the Application guide covering the ENE TSI, and in particular its point 4.2.15 & 4.2.16.

The operational conditions for running through phase/system separation sections are set in ENE TSI with further information given in EN 50367: 2020/A1:2022 and EN 50388-1:2022. Additionally RINF gives details relating to the particular separation section.

(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 by 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.

The message about required operation (to be done on-board while passing through separation sections) is delivered to a vehicle through the signalling system. It can be a lineside signal informing a driver to perform specified actions manually or it can be that the specific actions are automatically triggered by the vehicle equipment, without driver’s intervention. The configuration on automatic or manual command shall be recorded in the technical documentation described in point 4.2.12.2.

2.4.51. Point 4.2.8.2.9.10: Pantograph lowering (RST level)

(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.

The automatic dropping device (ADD) functionality is specified in the TSI. The specified ADD is therefore accepted on all networks.

For electric units having a maximum speed lower or equal than 160 km/h, or lower or equal than 120 km/h in case of unit requiring more than one pantograph raised in operation, the option is with the applicant to equip or not the RST with the ADD functionality.

A train with two locomotives is not considered as an ‘electric unit’ in the context of this TSI, therefore requirement (5) does not apply to locomotives.

2.4.52. Point 4.2.9.1.1: Driver’s cab - General

(1) The driver’s cabs shall be designed to permit operation by a single driver.

The TSI requires that the design permits operation by a single driver. The design for operation by more than one driver is outside of scope of this TSI (however this is not prohibited).

2.4.53. Point 4.2.9.1.2.1: Access and egress in operating conditions

- (1) The driver's cab shall be accessible from both sides of the train from 200 mm below top of rail.
- (2) It is permissible for this access to be either directly from the exterior, using a cab external door, or through the area at the rear of the cab..."
- (3) The means for the train crew to access in and to egress out of the cab...

For access points (1) and (3), clauses 7.1, 7.2, and 7.3 of EN 16116-1:2022 may be used for conformity assessment. The 'area at the rear of the cab' may include a passenger compartment, a technical compartment, a vestibule, and/or a gangway.

- (8) For both driver's cab external doors and internal doors, in case they are positioned perpendicular to and against the side of the vehicle, it is allowed to have the clearance width in the upper part reduced (angle on the top-outer side) due to the gauge of the vehicle; this reduction shall be strictly limited to the gauge constraint in the upper part and shall not lead to a clearance width on top side of the door lower than 280 mm.

This requirements allow for a doorwidth lower than 280 mm for doors with a vertical clearance higher than 1750 mm as far as a minimum width of 280 mm is respected between the lower part of the door and a height of 1750 mm. (see Figure 5 below)

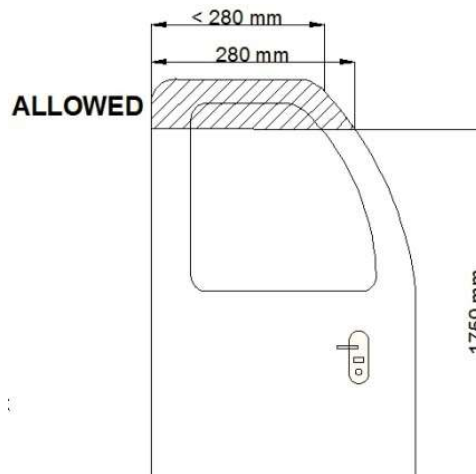


Figure 5 – allowed width and height of cab access door

2.4.54. Point 4.2.9.1.3.1: Front visibility

- (3) For locomotives with central cab and for OTMs, in order to ensure the visibility of low signals, it is permitted that the driver moves to several different positions in the cab in order to meet the above requirement; it is not required to meet the requirement from the seated driving position.

For locomotives with central cab, due to the nose structure in front of the cab, and for OTMs, due to the layout of the cab, the visibility of low signals at both sides of the track is not always possible from the seated driving position.

For locomotives with central cab and OTMs: if movements from the driver are required to enable him to see low signals then these movements within the cab are not to be hindered by equipment inside the cab.

For locomotives with central cab, the visibility of the low signals from the seated driving position is only required for the track side corresponding to the cab side from which the driver is operating the locomotive.

For OTMs, the requirements set out in clause 14.6 of EN 14033-1:2017 are an acceptable mean of compliance.

2.4.55. Point 4.2.9.1.5: Driver's seat

Requirements at component level:

(1) The driver's seat shall be designed in such a way that it allows him to undertake all normal driving functions in a seated position, taking into account the anthropometric measurements of the driver as set out in the Appendix E. It shall allow for correct posture of the driver from the physiological point of view.

(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.

(3) Ergonomics and health aspects shall be considered in the design of the seat, and its use by the driver.

Requirements for integration in the driver's cab:

(4) The mounting of the seat in the cab shall allow to meet external visibility requirements as specified in point 4.2.9.1.3.1 above by using the range of adjustment provided by the seat (at component level); it shall not alter ergonomics and health aspects and the use of the seat by the driver.

(5) The seat shall not constitute an obstacle for the driver to escape in case of emergency.

(6) The mounting of the driver's seat in locomotives, and in driving coaches in case these coaches are intended to also be operated by a driver in standing position shall allow adjustment to get the necessary free space needed for the standing driving position."

UIC 651 of July 2002, clause 5.1 (except clause 5.1.4) provides detailed guidance on the driver's seat design. Usage of Annex H of UIC 651 of July 2002 does not prevent to check the compliance to the TSI requirements.

2.4.56. Point 4.2.9.1.7: Climate control and air quality

(2) At the seated driving position (as defined in the point 4.2.9.1.3) of the driver's head and shoulders, there shall be no air flows caused by the ventilation system having an air velocity exceeding the limit value recognised to ensure a proper working environment.

An acceptable limit value for the air velocity is set out in EN 14813-1:2006+A1:2010, clause 9.5; the measurement procedure of air velocity is specified in EN 14813-2:2006+A1:2010, clause 6.2.

It is permitted to provide to the driver a means to adjust the air velocity and/or to direct the air flow for his own comfort; in that case, the acceptable limit should be reached for at least one position of the adjustment system.

There is no requirement in the TSI regarding the temperature in the cab, except when the applicant covers severe climatic conditions as described in point 4.2.6.1. In any case, real operating and working conditions

should be taken into account by the railway undertaking (user of the vehicle) and are outside of scope of this TSI.

2.4.57. Point 4.2.9.3.1: Driver's activity control function

(2) (...)

The system shall allow for the adjustment (at workshop, as a maintenance activity) of the time X within the range of 5 seconds to 60 seconds.

(5) Notes:

- *It is allowed to have the function described in this point fulfilled by the CCS Subsystem.*
- *The value of the time X has to be defined and justified by the railway undertaking (application of TSI OPE and CSM, and consideration of its current code of practice or means of compliance; outside of scope of the present TSI).*
- *As a transitional measure, it is also allowed to install a system of a fix time X (no adjustment possible) provided that the time X is within the range of 5 seconds to 60 seconds and that the railway undertaking can justify this fix time (as described above).*
- *A Member State may impose to the railway undertakings operating on its territory to adjust their rolling stock with a maximum limit for time X, if the Member state can demonstrate that this is needed to preserve the national safety level. In all other cases, Member States cannot prevent the access of a railway undertaking that is using a higher time Z (within the range specified).*

There is not a unique response time specified, but only a range, because this function has interfaces with operating rules and human factors; therefore, the RU may have its own code of practice regarding this response time.

For newly designed systems (most of the time software based), the requirement mandating the functionality of adjustment of the response time is part of the TSI specification; this does not represent any difficulty, and allows the use of the same system by different RUs; this functionality of adjustment has to be assessed by the notified body.

At operating level (not part of conformity assessment against this TSI), the RU should define and justify the response time X being used.

Until the newly designed systems are available, a note allowing the use of systems of existing design without the functionality of adjustment of the response time (which continue to satisfy the operational need in the current situation) has been inserted in the TSI.

In case of a train running in different MSs having a differing requirement of the maximum value of the time X for safety reasons, the RU has to select a value accepted by the different MS(s) (for example, the minimum one, which will be accepted because the MS can only ask for a maximum value); in case the MS(s) have no particular requirement, the RU may use a time X within the range specified in the TSI according to its own operating rules. It should be noted that the "roll away protection" is in the scope of the CCS TSI, and is not covered by the LOC&PAS TSI (even if the "driver's activity control" function is used for that purpose in existing applications).

2.4.58. Point 4.2.9.3.3: Driver display unit and screens

(2) For functions in the scope of this TSI, the information or commands to be used by the driver to control and command the train, and given by means of display units or screens, shall be designed to allow proper use and reaction from the driver.

This functional requirement is applicable to control and commands, whatever the technology used (cable, network, optical fibre, wireless...).

2.4.59. Point 4.2.9.3.4: Controls and indicators

(1) Functional requirements are specified with other requirements applicable to specific function, in the point describing that function.

The TSI does not impose any specific technology for the train control system (wired, IT solution, remote control). The technology used should be taken into account for compliance to TSI requirements (e.g. functional and safety requirements).

(4) In order to prevent any dangerous confusion with outside operational signalling, no green lights or green illumination are permitted in a driver's cab, except for existing class B cab signalling system (according TSI CCS)."

Green lights not visible (inside closed cubicles) are allowed.

(5) Audible information generated by on-board equipment inside the cab for the driver shall be at least 6 dB(A) above the noise level in the cab (this noise level taken as reference being measured under conditions specified in the TSI Noise)."

"Audible information" is all acoustical information generated by on-board equipments (e.g. a loudspeaker) intended to be handled by the driver.

The LOC&PAS TSI requires information to be given to the driver in some situations, as example :

- seize of an axle by the wheel rotation monitoring system (point 4.2.4.6.2);
- one or more passenger alarms have been activated (point 4.2.5.3.2);
- not functioning of the passenger alarm system (point 4.2.5.3.6);
- emergency opening of one or more doors (point 4.2.5.5.5);
- warning to the driver before triggering a lack of driver's activity (point 4.2.9.3.1);
- notification by the fire detection system (point 4.2.10.3.2).

Not all these information are required to be acoustic; when they are, the requirement is:

$$L_{pAFmax,signal} - L_{pAeq,T} \geq 6 \text{ dB(A)}.$$

The 'audible information generated by on board equipment' is evaluated by a measurement of 'the median received noise level' at the level of the driver's ear when audible information is generated by on board equipment. This measurement may be performed at different speeds in case the audible information generated is speed dependant.

An adaptive audible device may be used to fulfil the requirement above.

The assessment process of the interior cab noise and the test conditions are defined in the TSI noise, which refers to [EN ISO 3381:2021](#).

The simplified evaluation method set out in point 6.2.3 of the NOI TSI also applies to the assessment process of the interior cab noise and may be applied to assess the requirement above.

2.4.60. Point 4.2.9.3.5: Labelling

(2) Harmonised pictograms shall be used to mark controls and indicators in the cab.

Until it is agreed to refer to the relevant points of EN 16186-2:2017 and EN 16186-3:2022 in the TSI, this point may be partially covered by UIC 612-0:2009 Appendix H, UIC 612-01:2011 Appendix A and UIC 612-03:2011 clause 3.2.

ISO 3864-1:2011 is also applicable as it provides general guidance on safety colours and safety signs.

2.4.61. Point 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 the TSI WAG.

The fulfilment of points 4.2.9.3.7 and 4.2.9.3.7.a is not mandatory. However, the TSI requires locomotives intended to be compatible with the signals emitted by the DPF or DDF of the freight wagons fitted with such functions to fulfil the requirements set out in these points.

It might be, that EU legislation requires to fit some particular types of locomotives with this function at some point in time. In the meantime, the sole intention of the requirements of this TSI is to ensure safe and interoperable operation when they are equipped with means to process a DPF/DDF signal.

Note: In case of freight wagons which send the signal to the driver's cab of the locomotive via an electronic tool (e.g. a tablet) outside the scope of the LOC&PAS TSI, the requirements of signal processing set out in point 4.2.9.3.7 of this TSI do not apply.

2.4.62. Point 4.2.9.4: On-board tools and portable equipment

This point requires the availability of space in or near the driver's cab for the tools and portable equipment required by the TSIs plus relevant national rules; the presence of the tools themselves is not required.

Exceptions: fire extinguishers (requested in point 4.2.10.3.1 of the TSI) and self-rescue device in manned traction units of freight trains (requested in point 4.7.1 of the SRT TSI).

2.4.63. Point 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.

The data to be recorded are defined in point 4.2.3.5 of OPE TSI and in the related notified national safety rule(s) notified in accordance with appendix I of OPE TSI.

2.4.64. Point 4.2.10.2: Measures to prevent fire

The requirements of this point corresponding to diesel traction systems could be generalised to other thermal traction systems, such as liquefied natural gas. If this is not possible, e.g. due to lack of information in the relevant standards, the requirement should be covered via the 'innovative solution' described in article 10 of the enacting part of the TSI.

2.4.65. Point 4.2.10.2.1: Material requirements

(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 reviewed 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 behavior 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*

Test reports older than five years could be accepted if TSI requirements have not changed and it is demonstrated that the product manufacturing process and material characteristics remain unchanged. This demonstration should cover the complete supply chain involved in the product manufacturing process and consists in:

- checking the certification of the quality management system of original equipment manufacturers involved in the supply chain (e.g. via its certification against standards such as ISO 9001:2015, ISO/TS 22163:2017, IRIS, etc)
- sampling of additional evidences provided by the applicant (e.g. product configuration management, quality control, audits, etc)

In any case, the demonstration above needs to be performed every five years.

UNIFE manufacturer declaration on fire behaviour of supplied products (template available on the UNIFE webpage provides an acceptable mean of compliance with the requirement above.

2.4.66. Point 4.2.10.2.2: Specific measures for flammable liquids

(1) Railway vehicles shall be provided with measures preventing a fire from occurring and spreading due to leakage of flammable liquids or gases.

[...].

Compliance with EN 45545-7:2013 gives presumption of conformity.

Liquified gas used in some traction systems is not currently within the scope of EN 45545-7:2013. Where this is used it should be assessed under CSM against applicable codes of practice such as UNECE Regulation 110.

2.4.67. Point 4.2.10.3.1: Portable fire extinguishers

- (1) This point is applicable to units designed to carry passengers and/or staff.
- (2) The unit shall be equipped with adequate and sufficient portable fire extinguishers, in passenger and/or staff areas.
- (3) Water plus additive type fire extinguishers are deemed to be adequate for on-board rolling stock purposes.

This point also applies to freight locomotives and self-propelling units designed to carry payloads other than passengers/staff.

Fire extinguishers compliant to clause 6.3 of EN 45545-6:2013 have presumption of conformity.

2.4.68. Point 4.2.10.3.2: Fire detection systems

- (1) The equipment and the areas on rolling stock that intrinsically impose a fire risk shall be equipped with a system that will detect fire at an early stage.
- (2) Upon fire detection the driver shall be notified and appropriate automatic actions shall be initiated to minimize the subsequent risk to passengers and train staff.
- [...]

Compliance with EN 45545-6:2013, clause 5.2 and Table 1 gives presumption of conformity with point (1) above.

Compliance with EN 45545-6:2013, clause 5.3, 5.4 (except 5.4.5) gives presumption of conformity with point (2) above.

2.4.69. Point 4.2.10.3.3: Fire automatic fighting system for freight diesel units

- (1) This point is applicable to diesel powered freight locomotives and diesel powered freight self-propelling units.
- (2) These units shall be equipped with an automatic system capable of detecting a diesel fuel fire and of shutting down all relevant equipment and cutting off the fuel supply.

This system is intended to mitigate the effects of a diesel fuel fire, not to fight nor extinguish it.

Compliance with EN 45545-6:2013, Table 1, clauses 5.2 and 5.3 gives presumption of conformity for the detection system coupled with the automatic fire fighting system.

Compliance with EN 45545-6:2013, clause 5.4.2.2 and Table 2 gives presumption of conformity for the shutting down of equipment and cutting of fuel supply functions.

2.4.70. Point 4.2.10.3.4: Fire containment and control systems for passenger rolling stock

(3) The conformity with this requirement shall be deemed to be satisfied by the verification of conformity to the following requirements:

- The unit shall be equipped with full cross section partitions within passenger/ staff areas of each vehicle, with a maximum separation of 30 meters which shall satisfy requirements for integrity for a minimum of 15 minutes (assuming the fire can start from either side of the partition), or with other Fire Containment and Control Systems (FCCS)."

The requirement for "full cross section partitions within passenger/staff areas" shouldn't be misunderstood as "full cross section partitions ONLY within passenger/staff areas", neglecting the areas below the floor of the passenger/staff areas. This interpretation, which is pictured on Figure 6 below, would be wrong.

Situation to avoid

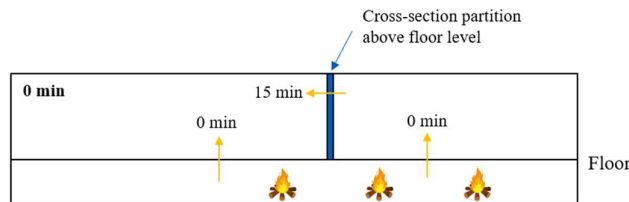
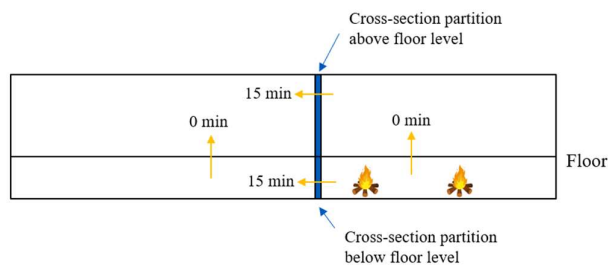


Figure 6 – Wrong understanding of a “full cross section partition”

There are several possible solutions to comply with the requirement of full cross-section partitions. In some cases (for instance where big equipment is located) it is possible to split the cross-section partition. The Figure 7 below shows two acceptable solutions.

Full cross section partitions



Fire resistant floor, cross section not aligned

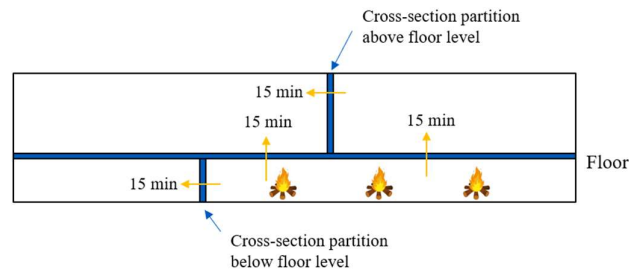


Figure 7 – Two acceptable “full cross section partitions”

The unit shall be equipped with fire barriers that shall satisfy requirements for integrity and heat insulation for a minimum of 15 minutes at the following locations (where relevant for the concerned unit):

- *Between the drivers cab and the compartment to the rear of it (assuming the fire starts in the rear compartment).*
- *Between combustion engine and adjacent passenger/staff areas (assuming the fire starts in the combustion engine).*
- *Between compartments with electrical supply line and/or traction circuit equipment and passenger/staff area (assuming the fire starts in the electrical supply line and/or the traction circuit equipment).*

In the TSI requirement above, compartments can be either inside the carbody or outside (roof, underfloor, ends...).

The need for a fire barrier should be established on the basis of an assessment of the risk of a fire starting from any equipment fitted in or on unit (inside or outside).

EN 45545-3:2013 provides guidance on the assessment of fire barriers. Tractions motors are considered as technical cabinets containing high power equipment whether they are installed on the bogie or not.

A new version of EN45545-3 is being drafted and will include guidance for the roof mounted equipment and for traction batteries.

(4) If other FCCS are used instead of full cross section partitions within passenger/staff areas, the following requirements shall apply:

- *They shall be installed in each vehicle of the unit, which is intended to carry passengers and/or staff,*
- *They shall ensure that fire and smoke will not extend in dangerous concentrations over a length of more than 30m within the passenger/staff areas inside the unit, for at least 15 minutes after the start of a fire.*

The assessment of this parameter is an open point.

Fire Containment and Control Systems (FCCS) are intended to contain a fire and the resulting smoke inside a limited space for 15 minutes.

The technical report CEN/TR17532:2020 provides guidance for the assessment of fire containment and control systems other than full cross-section partitions. Nevertheless, until a European standard is available,

national rules notified to cover this open point (e.g. water mist systems) may define the assessment method with pass/fail criteria.

This assessment method should be based on the results of a real test with a suitable fire load and it should be possible to test the FCCS regardless the train it will be fitted on.

If the system is activated automatically, the assessment method may cover the fire/smoke detection system coupled with the alternative FCCS system.

2.4.71. Point 4.2.10.4.4:Running capability

(1) This point is applicable to category A and category B passenger rolling stock (including passenger locomotives).

(2) The unit shall be designed so that, in the event of fire on-board, the running capability of the train will enable it to run to a suitable firefighting point.

(3) Compliance shall be demonstrated by application of the specification referenced in Annex J-1, index [33], in which the system functions impacted by a 'type 2' fire shall be:

- braking for rolling stock of fire safety category A: this function shall be assessed for a duration of 4 minutes.*
- braking and traction for rolling stock of fire safety category B: these functions shall be assessed for a duration of 15 minutes at a minimum speed of 80 km/h.*

The running capability both for traction and braking does not imply full redundancy. Several methods are defined in EN 50553:2012+A2:2020 to achieve running capability according to the following flowchart:

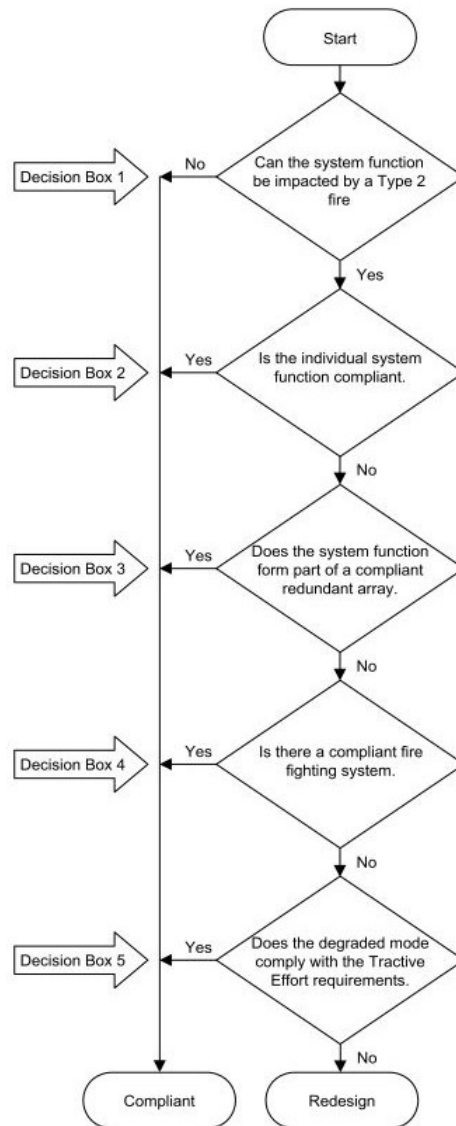


Figure 8 – Flowchart on acceptable solutions for running capability

Furthermore, The SRT TSI defines in its chapter 2.2 the three risk scenarios covered: hot incidents, cold incidents and prolonged stop. In case of a ‘hot’ incident:

“[...]For rolling stock of category B, the passengers in the affected area will move to a non-affected area of the train where they are protected from fire and fumes

Whenever possible the train leaves the tunnel. Passengers are evacuated, directed by the train crew, or by self-rescue, to a safe area in the open air.

If appropriate, the train may stop at a fire fighting point inside the tunnel. Passengers are evacuated, directed by the train crew, or by self-rescue, to a safe area.

If a fire extinguishing system can extinguish the fire, the incident will become a ‘cold’ incident.[...]”

This is consistent with the requirements of EN 50553:2012+A2:2020, which clarifies in its introductory part that compliance with running capability requirements for any relevant system function is derived from one or more of the following:

- Absence of relevant fire
- Assuring system function under fire
- Assuring system function of a redundant array under fire
- Extinguishing the fire
- Assuring sufficient remaining tractive effort under the fire.

Therefore, for diesel locomotives, if it is proven that in case of fire in the diesel engine, the fuel supply is cut off and the extinguishing system can extinguish the fire according to the test defined in EN 50553 EN 50553:2012+A2:2020, clause 6.5.3.2, the TSI does not impose a running capability of 15 minutes and allows for trains hauled by a single diesel locomotive to be classified as “category B”.

According to EN 50553 EN 50553:2012+A2:2020, the systems that are relevant for running capability are the following:

- Control & Communication
- Auxiliary equipment
- Fire detection and fighting
- Transformer and inductances
- Diesel fuel and other combustible fluids
- Pantograph and related equipment
- Luggage storage
- Cables
- Technical cabinets
- Vehicle body accessories
- Pneumatic and hydraulic equipment
- Driver protection

This point is also applicable to passenger trains hauled by a locomotive (diesel or electric).

2.4.72. Point 4.2.10.5.1: Passenger emergency exits

(1) This section is applicable to units designed to carry passengers.

Definitions and clarifications

(2) Through route: route through the train which can be entered and exited from different ends and which permits the movement of passengers and staff, along the longitudinal axis of the train without obstruction. Interior doors on the through route which are intended to be used by passengers in normal service and which can also be opened in case of power failure are considered not to obstruct the movement of passengers and staff.

[...]

Requirements

(6) Emergency exits shall be provided in sufficient quantity along through route(s) on both sides of the unit; they shall be indicated. They shall be accessible and sufficient in size to allow the release of persons.

(7) An emergency exit shall be able to be opened by a passenger from inside the train.

(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).

(9) Each vehicle designed to contain up to 40 passengers shall have at least two emergency exits.

(10) Each vehicle designed to contain more than 40 passengers shall have at least three emergency exits.

(11) Each vehicle intended to carry passengers shall have at least one emergency exit on each vehicle side.

Conformity with clause 4.3 (with the exception of 4.3.1.2 and 4.3.4) of EN 45545-4:2013 gives presumption of conformity with points 6 to 11 above.

(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.]

Normal operating conditions means that the physical test shall be carried out in front of an obstacle-free platform for which the vehicle is designed for (height of platform). This physical test shall determine the time to evacuate the train.

The test exercise should be at a sufficient scale to ensure that all equipment and procedures are fully evaluated. A real test of a 'part train' or 'part load' may be sufficient to validate assumptions about detrainment times and the effectiveness of emergency equipment, provided the results can be extrapolated by modelling or analogy to the full train situation.

The number of passengers to be evacuated corresponds at least to the load case 'design mass under normal payload' as defined in point 4.2.2.10 of the TSI.

The physical test does not provide the total evacuation time needed to evacuate all passengers from the train to area place of final safety. The total evacuation time is divided into the following steps:

1. Detection time: delay required to detect the fire, either by an automatic device or by people
2. Alarm time: delay for the alarm process to be launched and completed
3. Response time: delay for the people to understand the alarm signal, understand its importance, decide to leave their current activity and begin to evacuate
4. Movement of people from the train to the walkway (corresponding to the physical test mentioned above).
5. Travel time: movement of people from platform to a place of final safety.

The three minutes requirement only covers step 4 above. Moreover, in many emergency situations there will be no platform available or the platform height may not be suited to the height of the vehicle doors, thus increasing the time needed in step 4 well above the three minutes limit.

According to ERA Technical Opinion OPI-2020-11 (LOC&PAS TSI 1302/2014 potential deficiency – Evacuation tests), "analogies with a reference subsystem performed as specified in Annex 2 or numerical simulations performed as specified in Annex 3 constitute acceptable means of compliance to demonstrate conformity to point 4.2.10.5.1 (12) of the LOC&PAS TSI 1302/2104".

Analogy with reference subsystem

Annex 2 of the OPI-2020-11 specifies that, on the basis of a rolling stock subsystem having passed successfully the physical test (reference subsystem), it is possible to deduct by analogy that another rolling stock subsystem (subsystem under evaluation) is also compliant to the requirement on evacuation.

As a prerequisite, the reference subsystem and the subsystem under evaluation shall both have some characteristics in common. It is assumed that no analogy can be made between rolling stock subsystems that do not share at least these characteristics:

- Intended type of operation (commuter, regional, intercity, high speed, rolling stock with passenger compartments, etc.). The type of operation also defines the passenger capacity to take into account
- Number of bogies per vehicle (i.e. vehicle self-supported on its bogies or Jacobs bogies)
- Number of decks (single, double or a combination of both)

The other parameters influencing the evacuation time for which the analogy can be made are:

- Number of passengers under normal operating conditions
- Type, number and size of the passenger access doors, and the relative number of passengers per available length of door
- Number of steps from the vestibule to the platform
- Interior configuration (e.g. width of the vestibules and corridors, number of seats and seats per row, presence of toilets, luggage racks, bicycle racks or other specific areas requiring a change of direction, presence of internal steps or slopes, presence of internal doors and their type, gangways and gangway doors, presence of compartments, etc.)

That list isn't exhaustive and other specific parameters can exist for some rolling stock configurations.

The subsystem under evaluation can be considered compliant to the requirement when, based on a comparison of these parameters influencing the evacuation time, the applicant can demonstrate that the conditions for evacuation will be equivalent or better than those of the reference subsystem.

For example : compared to the reference subsystem, the subsystem under evaluation has the following characteristics:

- higher total length of exterior doors per side per passenger and/or
- less steps from the vestibule to the platform and/or
- the evacuation path for passengers is more favorable (less internal doors, less internal steps, larger corridor or vestibule, less changes of direction)

In case some characteristics are more favourable and some characteristics are less favourable, the demonstration of conformity by analogy shall be agreed with the Notified Body.

Simulations

Annex 3 of OPI-2020-11 specifies that in order to consider simulations as acceptable alternative evidence, the following shall be performed:

1. Verification of the simulation tool:
 - A tool verified for other applications than railway (e.g. ship or building evacuation) is acceptable without further verification
 - A tool developed in-house or not yet verified needs to be verified (for instance by the application of the procedure developed by the International Maritime Organisation or of the annex 1 of the Richtlinie für Mikroskopische Entfluchtungsanalysen – RiMEA Guidelines)
2. Verification and validation of the simulation model:
 - When using a tool verified for other applications than railway, comparable models need to be verified by comparison of the evacuation time with real physical tests of rolling stock (a difference of +/- 5% is acceptable)
 - When using a tool developed in-house or not yet verified, the model verification should include several different rolling stock architectures (for instance single deck and double deck).

The following elements should be included in the documentation:

- A simulation report including in particular:
 - A summary of the verification and validation of the simulation (tool and models),
 - The hypothesis and parameters used for the simulation (passengers data, walking speed, etc...), and
 - The results of an appropriate number of simulation runs allowing a statistically sound statement

2.4.73. *Point 4.2.10.5.2: Driver's cab emergency exits*

Requirements are specified in point 4.2.9.1.2.2 of the present TSI.

Conformity with clause 4.3.1.2 of EN 45545-4:2013 gives presumption of conformity to the point above.

2.4.74. *Point 4.2.11.2.2: Exterior cleaning through a washing plant*

(2) It shall be possible to control the speed of trains that are intended to be cleaned externally through a washing plant on level track at a value between 2 km/h and 5 km/h. This requirement is aimed at ensuring compatibility with washing plants."

A fixed speed value is to be selected as a setpoint by the applicant in the range of 2 to 5 km/h. When verifying the speed control, the applicant should define the tolerance to be applied. In order to grant compatibility with the existing washing plants (not compliant with INF TSI), the user of the vehicle or the applicant may adopt a design allowing several speed setpoints.

The speed setpoint(s) should be recorded in the technical documentation.

2.4.75. *Point 4.2.12: Documentation for operation and maintenance*

The TSI does not impose the format (paper, electronic file...) of the documentation to be provided.

2.4.76. *Point 4.2.12.1: General*

(1) This point 4.2.12 of the TSI describes the documentation requested in point 2.4(a) of Annex IV of Directive (EU) 2016/797 (point titled "Technical file"): "technical characteristics linked to the design including general and detailed drawings with respect to execution, electrical and hydraulic diagrams, control-circuit diagrams, description of data-processing and automatic systems, documentation on operation and maintenance, etc., relevant for the subsystem concerned."

(2) This documentation, being part of the technical file, is compiled by applicant and has to accompany the EC declaration of verification. It is kept by the applicant throughout the service life of the subsystem.

This point covers the following set of documents:

- Technical documents describing the Rolling Stock and its area of use.
- Technical documentation to allow the maintenance of the vehicle.
- Technical documentation to allow the operation of the vehicle.

2.4.77. Point 4.2.12.3: Documentation related to Maintenance

The following information necessary to undertake maintenance activities on rolling stock shall be provided:

(2) The maintenance design justification file: explains how maintenance activities are defined and designed in order to ensure that the rolling stock characteristics will be kept within acceptable limits of use during its lifetime.

The maintenance design justification file shall give input data in order to determine the criteria for inspection and the periodicity of maintenance activities.

(3) The maintenance description file: explains how maintenance activities are recommended to be performed.

The documentation to be provided by the applicant for the EC declaration of verification should contain the technical elements that are listed in this point 4.2.12.3 of the TSI.

The applicant is responsible for gathering this documentation in the technical file (including those that may be defined and provided by its subcontractors).

This documentation is in principle not related to a particular use of the rolling stock (the common use of the RST being defined by its category according to point 4.1.3 of the TSI, and by its technical characteristics), but it may include hypothesis regarding its use.

This documentation is not required to be the final documentation to be used by the Entity in Charge of Maintenance (ECM), who has to take into account real operating and maintenance conditions in order to issue maintenance procedures or manuals that are directly applied by workers in charge of maintenance. The language to be used for the final documentation should be defined by the user (not in the scope of this TSI). In case the ECM deviates from the technical elements provided, it is under its own responsibility.

2.4.78. Point 4.2.12.4, 5 and 6: Operating documentation, Lifting diagram and instructions and Rescue related descriptions

This documentation is not required to be the final documentation to be used by the driver, which has to take into account real operating conditions in order to issue operating procedures or manuals that are directly applied by the driver. The language to be used for the final documentation should be defined by the user (not in the scope of this TSI).

2.5. Interfaces with other subsystems.

2.5.1. Point 4.3: Functional and technical specification of the interfaces.

Interfaces with other subsystems are identified in this section. There is no verification to be performed in relation to TSIs covering other subsystems which are listed in this section during the conformity assessment against this TSI.

2.6. Interoperability constituent(s)

2.6.1. Point 5.3.5: WSP (wheel slide protection system)

(1) A brake system of pneumatic type.

Note: the WSP is not considered as an IC for other types of brake system such as hydraulic, dynamic and mixed braking systems, and this point does not apply in that case.

The concept of Interoperability Constituent (IC) for the WSP system is limited to WSP functions to be used only with a pneumatic brake system, and using dump valves to control the amount of air within the brake cylinder (definition given in EN15595:2018/AC:2021). In other cases (such as a WSP system controlling different braking systems), this concept has not been retained due to the complexity of the functional interfaces between the RST and the WSP system.

2.6.2. Point 5.3.9: Horns

(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.”

The sounding of signals (frequencies) do not depend on the integration of the horn on the rolling stock; they are checked only at the level of the IC; the assessment procedure is specified in the point 6.1.3.6 of the TSI, and includes the verification of both parameters simultaneously (frequencies and sound pressure level) by reference to the clause 6 of EN 15153-2:2020; for the sound pressure level measurement, the horn should be installed on a reference vehicle.

The sound pressure level defined in point 4.2.7.2.2 has also to be checked at rolling stock level for each application of the IC according to the assessment procedure specified in point 6.2.3.17, because the integration of the horn may lead to attenuations; however, they should be covered by the allowed range (8 dB).

2.6.3. Point 5.3.10: Pantograph

(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.

The assessment of the maximum current at standstill at the level of the pantograph (considered as IC) is made in accordance with section 6.1.3.7 of the TSI.

The note explains that when the pantograph is integrated in a RST, due to the required current at standstill, the pantograph may limit the area of use of the RST in terms of characteristics of the OCL; for example, the current needed at standstill by the RST may be compatible only with OCLs made of 2 wires in case the pantograph has a “maximum current at standstill per contact wire” lower than the maximum current at standstill draws from the OCL by the RST, but higher when weighted with a factor (between 1 and 2) applied for compatibility with an OCL made of two wires.

2.7. Conformity assessment and EC verification

2.7.1. Point 6.1.3.8 Contact strips (clause 5.3.11)

(3) In case of use of a material for which the manufacturer has 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)

Cases when there is no sufficient return of experience are when the material is neither plain carbon nor metallized carbon.

2.7.2. Points 6.1.4 and 6.2.4: Project phases where assessment is required (Appendix H)

(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.

The table given in Annex H gives an overview of the assessment to be performed in the different phases of development and production, both for interoperability constituents and rolling stock subsystem in the scope of this TSI. This table is not to be used as a stand-alone document; it is intended to be used with consideration of the requirements expressed in the section 4.2 and chapter 6 of the TSI, which sometimes specify different requirements for different types of RST.

For example, the following is not repeated in Annex H, but is applicable:

- requirements of the point 4.2.8.2 “Power supply” apply only to electric units,
- requirements of the point 4.2.9 “Driver’s cab” do not apply if the RST is not fitted with a driver’s cab,
- section 4.2 allows for exemption of tests in particular cases (for “strength of vehicle structure”, “rolling stock dynamic behaviour”...),
- certain types of RST are exempted of some of the requirements (for example OTMs are exempted of “passive safety” requirements).

Regarding the routine tests, their detailed content is not defined in the TSI; the Annex H mentions only the points where a routine test is to be performed, without prejudice to the conformity assessment procedures (modules) chosen by the applicant; for modules based on quality management system of the production process, the applicant is responsible for the definition of routine tests.

2.7.3. Point 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.

Whereas it is the applicant who's made responsible by Article 15(4) of Directive (EU) 2016/797 to compile the technical file, the Notified Body should verify that the documentation provided includes the requested information for operation and maintenance, as defined in point 4.2.12 of the TSI. The Notified Body is not required to verify the information contained in the documentation provided.

2.7.4. Point 6.2.3.5: Conformity assessment for safety requirements

(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 harmonized risk acceptance criterion associated to the severity level specified in the section 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 an 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 sub-system or an assessment body as defined in the CSM on RA.

The demonstration shall be recognized in all Member States;

EN 50126-1:2017 provides a methodology for safety studies.

The methodology to be used in order to demonstrate the compliance to the safety requirements expressed in the TSI may be the following:

- perform a safety analysis at the highest level of the system, with the use of adequate tools such as fault tree analysis, failure mode effects and criticality analysis, in order to identify critical parts or components of the system.
- identify the parts or components of the system for which the notion of 'reference system' or 'code of practice' is adequate to justify their reliability and safety performance.
- demonstrate for other parts or components of the system (if any) that their reliability and safety performance allow fulfilling the TSI requirement at system level.

As an example for the braking system, based on the return of experience available among manufacturers of braking systems and of RST, among RUs and among NSAs, some elements of the braking system which have been widely used may be considered as 'reference system', and some standards as 'code of practice' within the limit of their scope.

The national rules used before the entry into application of this TSI may also be considered as code of practice (provided that they satisfy the requirements of the CSM).

Reliability data related to components used in the braking system may also be determined from this return of experience.

In case of rolling stock fitted with braking systems based on the UIC technology, the integration of these brake systems may require some changes to the way they are controlled and commanded; this aspect has to be evaluated carefully not to hinder the safety performance of the complete brake system.

2.7.5. Point 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)

A unit intended for 'General operation' is defined in point 2.2.1 (h) of the TSI as "a unit [...] intended to be coupled with other unit(s) in a train formation which is not defined at design stage."

As the train formation is not defined when the unit for general operation is being authorised, some TSI requirements are either not fully assessed, or assessed for a 'reference train'.

The use of such unit in a train formation (composed by TSI compliant units or not) is under the responsibility of the railway undertaking, according to the following point 4.2.2.5.2 of the OPE TSI:

For example, the 'door-traction interlock' requirements are set out in point 4.2.5.5.7 of the LOC&PAS TSI for all RST. On top of these requirements, point 4.2.5.5.10 applies for units intended for general operation.:

"(1) Only functionalities that are relevant to the design characteristics of the unit (e.g. presence of a cab, of a crew interface system for door control, etc.) shall be considered.

(2) The signals transmission required between the unit and the other coupled unit(s) in a train for the door system to be available at train level shall be implemented and documented, taking into account functional aspects.

(3) This TSI does not impose any technical solution regarding physical interfaces between units."

Therefore, if the passenger locomotive or a passenger coach is operated in a train where all the units have compatible signal transmission, the door-traction interlock system works. Otherwise, it is up to the railway undertaking to define how to manage the situation in accordance with point 4.2.2.5 of the OPE TSI and its safety management system.

3. IMPLEMENTATION OF THE LOC&PAS TSI

3.1. Point 7.1: General rules for implementation - transition regime

3.1.1. Point 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’ below apply.

(2) Compliance with this Annex in its version applicable before 28 September 2023 is deemed equivalent to compliance with this TSI, except for changes listed in appendix L.”

The TSI package 2023 introduces new principles for the transition between TSIs. One of these principles is that the TSI assessment basis is no longer defined at the time of appointment of a NoBo (formerly known as the beginning of phase A).

With the new transition regime, the TSI assessment basis is defined at the time the NoBo delivers the EC type examination certificate (module SB) or the EC design examination certificate (module SH1). In order for an applicant to identify the changes between the TSIs in force at that time and the TSIs in force at the beginning of a project, those changes are identified and categorised as follows:

1. For some changes, compliance with the previous TSI systematically implies compliance with the revised TSI (for instance editorial changes, changes resulting in a softer requirement): those changes aren’t listed; the point (2) of the TSI quoted above covers those changes;
2. For some other changes compliance with the previous TSI does not systematically imply compliance with the revised TSI. Those changes are listed in Appendix L and are divided in two subcategories: changes with a generic transition regime and changes with a specific transition regime.

3.1.2. Point 7.1.1.2: Application to ongoing projects

(1) The application of the version of this TSI applicable from 28 September 2023 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⁽²⁴⁾).

For projects that are already in phase A (or in phase B), the application of the revised TSI isn’t mandatory. The consequence of not-applying the new TSI is that the type certificate will be delivered according to a previous version of the TSI and will have therefore a 7-year validity. The consequence of applying the new TSI is that the requirements listed in appendix L will be applicable to the project according to their transition regime, but then the validity of the type certificate will not be limited to seven years.

Note: In case of modification of Rolling Stock in operation, the same rules apply according to the definition in point 7.1.3.1.

Case of projects in phase B (type certificate issued before 28 September 2023):

A modification of the type certificate without modification of the type is to be considered as a correction, without the need to establish a new type certificate under the TSI 2023 framework. The limit of validity of the type certificate isn’t changed.

3.1.3. Point 7.1.3.1.1: Rules related to the EC type or design examination certificates – Definitions

(1) Initial assessment framework

The initial assessment framework is the set of TSIs (i.e. this TSI, the NOI TSI and the PRM TSI) 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 NOI TSI and the PRM TSI) 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 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 Commission Implementing Regulation (EU) 2019/779(25).

The 'design phase' as defined in the TSI can basically be compared to the former 'phase A' as it has the same starting point (appointment of the NoBo) and ending point (delivery by the NoBo of the EC type certificate or EC design examination certificate). There are however major differences that are:

1. The design phase isn't limited in time, while the phase A was limited to seven years,
2. All TSIs and amendments entering in force during the design phase shall be considered, there is no "freezing" of the requirements as for the former phase A; this is the reason for the categorisation of all TSI changes and of the transition regime defined per TSI change.

At the beginning of the design phase, the 'initial assessment framework' is determined, i.e. the set of applicable TSIs and amendments. This initial assessment framework is generally not the same as the 'certification framework' which is the set of TSIs and amendments applicable at the end of the design phase (note: both frameworks can be the same only if no applicable TSI or TSI amendment is published during the design phase). Changes made to the TSIs being categorised and listed with an associated transition regime, the evolution between the initial assessment framework and the certification framework can be traced and documented.

Note: the transition regime is set out in Appendix L of the TSI, it determines when the TSI changes become mandatory for project that were already at design phase when the TSI entered into force.

Similarly to the design phase, the ‘production phase’ can be compared to the former ‘phase B’ as it represents the period during which vehicles can be authorised in conformity to the type. However, there is a difference in its duration, as the production phase isn’t limited in time like the phase B was.

3.1.4. Point 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 Noise 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 clauses 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.*

To illustrate the principles of the new transition regime, several examples are illustrated below.

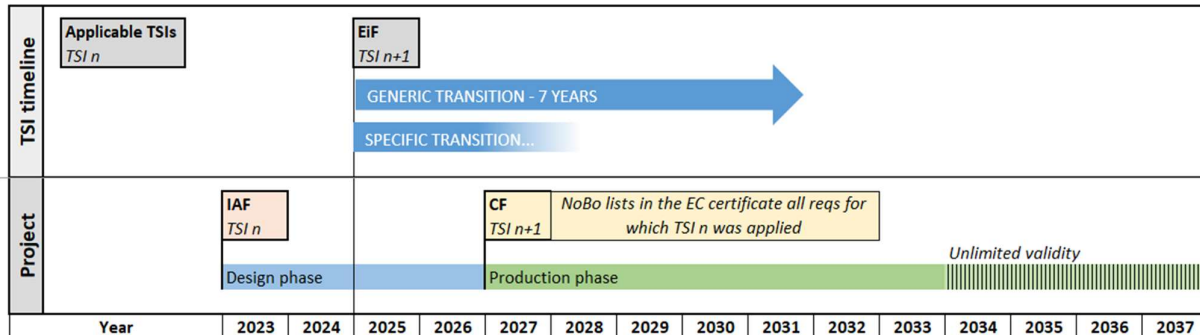
3.1.4.1. Example 1

In this example, a project starts in January 2023, and the set of TSIs applicable at that time are identified as TSI n; this is the initial assessment framework as defined in point 7.1.3.1.1 of the TSI.

During the design phase (after two years in the example below), new revisions of TSIs enter into force, identified as TSI n+1. These TSIs include a statement that compliance with TSI n implies compliance with TSI n+1 except for the requirements listed in Appendix L. Those requirements are of two categories: those with a generic transition and those with a specific transition. The first ones will be applicable to the project seven years after entry into force of TSI n+1 and the second ones will be applicable according to their specific transition regime.

In the example below, the design phase continues for another two years before the delivery of the EC type or design examination certificate. At that time, the certification framework is the set of TSIs n+1. As specified in the TSI point 7.1.3.1.2 (see point (1) above), the notified body shall issue the EC type or design examination certificate referring to the certification framework, i.e. TSI n+1, and list in the certificate all requirements for which TSI n was applied, as permitted by the transition regime.

In the example of Figure 9 below, for all requirements with a generic transition regime, the requirements of TSI n can still apply because the design phase is ending two years only after entry into force of TSI n+1.



EIF Entry into force
 IAF Initial assessment framework
 CF Certification framework

Figure 9 – example of transition between TSIs

3.1.4.2. Other examples can be added following return of experience (intentionally left empty)

3.1.4.3. Case of upgrade of EC type certificate to newest TSIs vs renewed authorisation:

An applicant can decide to upgrade existing certificates to the newest TSIs. In this case, the applicant should consider the possible impact on :

- vehicle authorisation, for example:
 - Is an authorisation needed, is the rolling stock type modified?
 - does the rolling stock modification affect safety or impacts a basic design characteristics, requiring a new authorisation?
- registers as ERADIS, ERATV.

Renewed authorisation : As referred in article 24(3) of Directive 2016/797, renewed authorisation is needed when changes to any relevant provisions in TSIs (or national rules) require that a vehicle type authorisation already granted needs to be renewed (further explanation can be found in the vehicle authorisation guideline).

3.1.5. Point 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.

The transitions defined for requirements in Appendix L apply at the level of the subsystems, but they may impact ICs. When a requirement of Appendix L impacts an IC, depending on the transition regime applicable at subsystem level, the applicant can either use an IC certified according to the previous TSI or an IC certified according to the new TSI.

In any case, when the IC type certificate expires, the IC needs to be reassessed according to the TSI in force at that time - see [ERA/OPI/2016-3 - Opinion of the European Union Agency for Railways to the European Commission regarding the question of NB-Rail QC-STR-009 concerning the certification according to withdrawn TSIs | European Union Agency for Railways \(europa.eu\)](#)

Note: the reassessment of the IC at the expiry of the type certificate validity doesn't impact ICs already manufactured. Existing ICs in stock may always be used in maintenance or ongoing renewals/upgrades of vehicles.

Only when there is no backward compatibility, an IC certified according a previous TSI can be used.

Example 1: Head lamps are specified in LOC&PAS TSI point 5.3.6:

- TSI 2020 refers to EN 15153-1:2013+A1:2016
- TSI 2023 refers to EN 15153-1:2020
- The change isn't listed in Appendix L, so compliance with TSI 2020 is deemed equivalent to compliance with TSI 2023

For a rolling stock project already in design phase, the IC manufacturer can deliver head lamps in conformity to a type compliant with TSI 2020 as long as the certificate is valid (5 years maximum). Once the certificate has expired, the IC manufacturer shall certify the head lamp according to the TSI 2023. The manufacturer of the subsystem already in design phase may equip its rolling stock with any of both types of IC.

Exemple 2: interface of the call for aid device, specified in TSI PRM point 5.3.2.6:

- TSI 2020 requires "a sign having a **green or yellow background** and a **white symbol**"
- TSI 2023 requires "a sign having a **yellow background** contrasting with a **black symbol**"
- The change is listed in Appendix P of the PRM TSI (analogue to Appendix L of the LOC&PAS TSI), compliance with TSI 2020 doesn't lead to compliance with TSI 2023

For a rolling stock project already in design phase, the IC manufacturer can deliver ICs in conformity to a type compliant with TSI 2020 as long as the certificate is valid (5 years maximum). Once the certificate has expired, the IC manufacturer may certify again the call for aid device vs the TSI 2020 for subsystems where it will be required (as there is no backward compatibility), with a type validity of 5 years

Rolling stock already in design phase may be certified during 7 years with a call for aid device compliant with TSI 2020.

3.1.6. Appendix L - Changes of requirements and transition regimes

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) imply compliance with this TSI applicable from 28 September 2023.

The tables in appendix L list all the changes made to the TSI for which the compliance with the previous version including all amendments does not systematically imply compliance with the new version. It means that, for all changes that aren't listed in appendix L, compliance with the new version of the TSI can be granted based on the compliance with the previous version.

3.2. Specific application and transition

3.2.1. Point 7.1.1.3: Application to special vehicle

(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 to in 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.

When the area of use of the special vehicle in running mode covers more than **one Member State**, the compliance with the LOC&PAS TSI and the NOI TSI is mandatory .

When the area of use of the special vehicle in running mode covers only **one Member State**, the compliance with the LOC&PAS TSI and the NOI TSI is not mandatory:

- the applicant may decide to apply the TSIs and use the conformity assessment process as described in the point 6.2.1 to establish an EC declaration of verification against this TSI and NOI TSI; this EC declaration of verification shall be recognised as such by all Member States.
- the applicant may choose not to apply the TSIs. In that case, the special vehicle may be authorised in accordance with Article 21 of Directive (EU) 2016/797 against national rules as regards the basic parameters of the TSIs. The following conditions apply:
 - o If national rules different to TSIs do not exist, the compliance with TSIs is mandatory. In other words, the LOC&PAS TSI or the NOI TSI can not apply as a national rule assessed by a DeBo, but always apply as a TSI assessed by a NoBo according to point 6.2.1 of LOC&PAS TSI.
 - o If national rules cover only partially the TSIs basic parameters, the application of TSIs is mandatory for the parameters not covered. In that case, the Notified Body will deliver a certificate of verification limited to the basic parameters assessed.
 - o In case national rules different to TSIs exist and the applicant chooses not to apply the 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.

When a special vehicle will have its area of use extended in accordance with article 14.1(c) of Commission Implementing Regulation (EU) 2018/545, the applicant can also decide to use national rules instead of the applicable TSI requirements if for the previous authorisation it also decided to apply national rules.

Note . the requirements related to Compatibility with train detection systems defined in point 4.2.3.3.1 are also applicable to special vehicles (as defined in point 2.2 and 2.3). These requirements refer to interface documents ERA/ERTMS/033281 and national rules on top of TSIs positively assessed.

Application to ongoing projects where national rules were applied instead of TSIs:

As defined in appendix L (table L1) , compliance with the previous TSI does not imply compliance with the version of this TSI:

- Projects already in design phase shall comply with the requirement of this TSI from the date of entry into force of this TSI + 7 years.
- Projects in production phase and rolling stock in operation are not affected by the TSI requirements listed in Table L.1.

For special vehicle where national rules were applied instead of TSIs, the design phase is the period starting once a Designated Body is contracted by the applicant and ending when the certificate of verification is issued.

(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.

The scope of TSIs covering only the running mode of special vehicles, this assessment is performed only for the special vehicles in running mode.

3.2.2. Point 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 clause 4.2.10.2.1 of the present TSI, to apply the verification of conformity to the material fire safety requirements using the appropriate operation category from EN 45545-2:2013+A1:2015.”

The date of 1st January 2026 is date of the fire safety certificate; the test according to EN 45545-2:2013+A1:2015 must have taken place by that date at the latest. From 2nd January, 2026, tests shall be carried out in accordance with EN 45545-2:2020.

Validity of the test reports is detailed in point 4.2.10.2.1 of the TSI, further information provided in point 2.4.65 of this guide.

3.2.3. Point 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.

The units to which point 7.1.1.5 can apply are defined in point 2.2.2(A)(3) and listed below :

- A Coach is a vehicle without traction in a fixed or variable formation capable of carrying passengers (by extension, requirements specified to apply to coaches in this TSI are deemed to apply also to restaurant cars, sleeping cars, couchettes cars, etc.).

- A Van is a vehicle without traction capable of carrying payload other than passengers, e.g. luggage or mail, intended to be integrated into a fixed or variable formation which is intended to transport passengers.
- A Car carrier is a vehicle without traction capable of carrying passenger motor cars without their passengers and which is intended to be integrated in a passenger train.
- A Fixed Rake of Coaches is a formation of several coaches 'semi-permanently' coupled together, or which can be reconfigured only when it is out of service

(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.

The conditions defined in point 7.1.1.5.1 and 7.1.1.5.2 applies to units **compliant** to this TSI, PRM TSI and NOI TSI. These can apply to:

- Newly developed vehicle design (first authorisation),
- Existing type/units when compliant with this TSI, PRM TSI and NOI TSI (new authorisation). Such type may need to be modified or not to comply with point 7.1.1.5.

Note.If the area of use include Switzerland, the compliance / non-compliance with the national rules related to Autonomous access to trains (NNTR CH-TSI-PRM-001 from July 2016) shall be recorded in the technical file.

(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. .

Conditions in point 7.1.1.5.1 for having a vehicle type authorisation and/or an authorisation for placing on the market of unit not limited to a particular area of use are applicable **to units intended to be used in predefined formation**. In accordance with point 4.1.2(3) , when a unit intended for use predefined formation(s) is assessed, the formation(s) for which such assessment is valid shall be defined by the party asking for assessment, and stated in the certificate of 'EC' verification.

(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..

Conditions in point 7.1.1.5.2 for having a vehicle type authorisation and/or an authorisation for placing on the market of unit not limited to a particular area of use are applicable **to units intended to be used in general operation**. Such conditions are applicable in additions to conditions in point 7.1.1.5.1.

3.2.3.1. Point 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.

The vehicle shall comply with following conditions:

- it correspond to rolling stock subsystem **only** without CCS onboard installed,
- it is not equipped with traction equipments (thermal or electric) that provide traction functions (see LOC&PAS TSI point 4.2.8 traction and electrical equipment)

(3) The unit shall be designed for operation on at least one of the following track gauges:

- (a) 1435 mm,*
- (b) 1668 mm.*

The following track gauges : 1520 mm, 1524 mm and 1600mm are excluded from the scope of application of the point 7.1.1.5.1.

(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).

Sleeping coaches of category A are not concerned by point 7.1.1.5.1(9)

Sleeping coaches of category B shall be equipped with other Fire Containment and Control Systems (FCCS) in accordance with point 4.2.10.3.4 (4). The assessment procedure of other FCCS an open point shall be assessed according to the notified **National Rules** and assessed by Designated Body.

(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].

An acceptable guidance on scenarios, calculation methods and boundary conditions for determining aerodynamic loads is available in the document from the NSA Germany entitled "Leitfaden zur Bestimmung von aerodynamischen Lasten für Schienenfahrzeuge", available on the website of the NSA:

https://www.eba.bund.de/SharedDocs/Fachmitteilungen/DE/2015/02_2015_Leitfaden_zur_Bestimmung_von_aerodynamischen_Lasten.html

(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 (dB μ A/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 subpoints (c) and (d), the unit shall be tested. The parameters of subpoints (a) and (b) can be determined by simulation, calculation or testing.

To facilitate the train composition covered in point 4.2.2.5 of OPE TSI, the applicant should provide in the technical documentation information on the following characteristics: power supply characteristics in Volts and Hertz of the coach. These characteristics are important to be able to interconnect the coaches to the locomotive. The applicant shall indicate compliance with one or several power supply line voltages (1 kV AC, 1,5 kV DC and 3 kV DC), and for each of them the maximum “single pole” power supply line current of the unit at standstill.

Regarding compatibility with train detection system (points 16(c) and 16(d)), in order to facilitate the route compatibility check to be performed after authorisation by an RU in accordance with point 4.2.2.5 and appendix D1 of OPE TSI, the applicant should provide the following information in the technical documentation:

For each band of the frequency management

- maximum interference current (A), and applicable summation rule,
- maximum magnetic field (dB μ A/m) both radiated field and field due to the return current, and applicable summation rule, and
- minimum vehicle impedance (Ohm).

The determination of the above characteristics are further explained in the application guide of the document ERA/ERTMS/033281 version 5.0.

In case of non compliance or if the checks do not include some bands of the frequency management, the unit should be excluded from the concerned network(s) of the area of use.

Pending the notification of specific cases referred to in Article 13 of CCS TSI, the notified national rules applies and are assessed by Designated Body.

Note. For unit intended to be used in general operation, demonstration of compatibility of the coach(es) with track circuits is to be combined with the emissions of other units. The train formation (Influencing Unit) shall meet the limit(s) defined in Appendix J-2 index [A]. The provisions of 6.2.7 of this TSI can be used for assessment of units intended to be used in general operation. The verification of compatibility of the train formation with the unit(s), for example a combination of locomotive(s) and coach(es), is the responsibility of the RU and is described in TSI OPE Annex D1.

(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 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.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

(g) 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.

(h) 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:

- $V \leq 160 \text{ km/h}$: $0.7 \leq \tan \gamma_e < 0.8$
- $160 \text{ km/h} < V \leq 200 \text{ km/h}$: $0.5 \leq \tan \gamma_e < 0.6$
- $V > 200 \text{ km/h}$: $0.3 \leq \tan \gamma_e < 0.4$

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.

(i) 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:

- $V \leq 160 \text{ km/h}$: $\tan \gamma_e \leq 0.8$;
- $160 < V \leq 230 \text{ km/h}$: $\tan \gamma_e \leq 0.5$;
- $V > 230 \text{ km/h}$: $\tan \gamma_e \leq 0.3$.

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..

The area of use is defined by the applicant, non compliance to requirements defined in point 7.1.1.5.1(20) can result into exclusions of some MSs from the area of use as requested by the application or additional conditions for use or restrictions :

- For units intended to operate in **Italy** :

- Non compliance with the specific case defined in point 7.3.2.8 **may not result into an exclusion of Italy** if the applicant defines appropriate conditions for use and other restriction (e.g. speed limitation).
- Non compliance with the specific case defined in point 7.3.2.20 **shall exclude Italy from the area of use**. In addition, as referred in point 7.3.2.20, fire containment and control systems shall be assessed according to the notified **National Rules about fire automatic extinguishing systems** (see RDD parameter : 10.1-Fire protection concept and protection measures) and are checked by Designated Body.
- For units intended to operate in **Channel tunnel**:
 - Non compliance with the specific case defined in point 7.3.2.21 **shall exclude Channel tunnel from the area of use**. In addition, as mentioned in point 7.2.2.21, the running capability of a Passenger rolling stock 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 can 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**. In this case, it is checked by Designated Body.
- For units intended to operate in **France** and / or in **Sweden**:
 - The specific case defined in point 7.3.2.3 apply to units which are not fitted with on-board axle bearing condition monitoring equipment. Non-compliance with the requirements **shall exclude France and/or Sweden** from the area of use.
- For units intended to operate in **Germany** :
 - Non compliance of the unit characteristic wind curve (CWC) with the limits defined in the document: „*Leitfaden Sicherstellung der technischen Kompatibilität für Fahrzeuge mit Seitenwindnachweis nach LOC&PAS TSI zu Anforderungen der Ril 807.04*“ shall exclude Germany from the area of use. The applicable document is the version dated from 07 September 2016 and available in NSA Germany website : [link](#).
Note. As referred in point 4.2.6.2.4 of this TSI, cross wind requirements applies to units of maximum design speed higher than 140 km/h.
 - For units intended to operate on lines with a gradient above 40 ‰, non-compliance of the unit with clauses XXX of the document, „*Ergänzungsregelung Nr. B017 zur bremsstechnischen Ausrüstung von Fahrzeugen zum Betrieb auf Steilstrecken*“ does not prevent the access of the unit to the national network, it should be listed as conditions for use and other restrictions.. The applicable document is the version 2 dated from 18 May 2021 and available in NSA Germany website : [link](#).
 - Non compliance of the unit with the requirements on emergency entry and exit windows with regard to fast and safe evacuation defined in the point 3.2 of the document: „*Verwaltungsvorschrift zur Prüfung von Notein- und Notausstiegfenstern (NEA) in Schienenfahrzeuge.*“ shall exclude Germany from the area of use. The applicable document is the version dated from 26 February 2007 and available in NSA Germany website: [link](#).
 - Non compliance of the units with the German network characteristics on wheel-rail contact geometry defined in point 7.1.1.5.1(20)(j) shall result in restriction of the speed listed as conditions for use and other restrictions.
- For units intended to operate in **Austria** :
 - Non compliance of the units with the Austrian network characteristics on wheel-rail contact geometry defined in point 7.1.1.5.1(20)(i) shall result in restriction of the speed listed as conditions for use and other restrictions.
-

(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.

See explanation in point 2.4.45 concerning point 4.2.6.1: Environmental conditions – general of this TSI

3.2.3.2. 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 clause 6.2.7. If the applicant selects this option, a notified body has to assess the compliance within the EC verification procedure. This shall be reported in the certificate and in the technical documentation.

The general provisions set out in point 6.2.7 also apply to vehicles fulfilling the optional point 7.1.1.5.2 and the guidance provided in point 2.7.5 above is also applicable.

Examples of further requirements to fulfil the point 4.2.2.5 of OPE TSI not covered by point 7.1.1.5.2 are the signal transmissions for:

- passenger alarm (including emergency brake overriding system)
- opening/closure of passenger doors
- passenger information system.

3.2.4. Point 7.1.2 Changes to an existing rolling stock or rolling stock type, point 7.1.2.1 Introduction

(2) [...] 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.

Each entity managing the change needs to ensure, that all relevant information for the intended changes are available before changing any existing rolling stock. If the holder of the type authorisation is not the same as the entity managing the change, the entity managing the change should request the holder of type authorisation all necessary information to perform the change. Contractual arrangements may be needed between the holder of the vehicle type and entity managing the change to facilitate the information needed.

Other possibilities (e.g. that the holder of type authorisation performs the change) are analysed in the guidance to Article 15 of Implementing regulation (EU) 2018/545.

Implementing regulation (EU) 2018/545 requires in case of changes of authorised vehicles that the changes shall be categorised according to its Article 15 (1). Even for the small changes it has to be checked if there is a “deviation from the technical files accompanying the EC declarations for verification for the subsystems”, see Article 15(1)(a) and (b). Therefore, each entity managing the change needs this technical file or all documents related to the change.

(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.

Further explanation is provided in the Guidance for the application of Regulation 2018/545: https://www.era.europa.eu/system/files/2022-11/application_guide_vehicle_authorisation_en_1.pdf

3.2.5. Point 7.1.2.2 Rules to manage changes in both rolling stock and rolling stock type

(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.

Further explanation are provided in section 3.3.3 of the Guidelines for the practical arrangements for the vehicle authorisation process ([Guidelines for the practical arrangements for the vehicle authorisation process \(europa.eu\)](https://www.era.europa.eu/guidelines-for-the-practical-arrangements-for-the-vehicle-authorisation-process))

(8) The safety judgement mandated in Article 21(12)(b) of Directive (EU) 2016/797 shall cover changes concerning basic parameters of the table of section 3.1, related to all the essential requirements, in particular the requirements “Safety” and “Technical compatibility”.

The general safety judgement mandated in Article 21(12)(b) of Directive (EU) 2016/797 should cover all aspects related to the change. Article 13 of the Commission Implementing Regulation (EU) 2018/545 further explains how the essential requirements ‘safety’ and ‘technical compatibility’ impacted by the change are to be dealt with.

(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.

An example of the paragraph above may be two units each consisting of two vehicles which need to be reconfigured, e.g. due to an accident (see Figure 10 below).

In this case, it may be possible to form a new unit from two vehicles of the different units and retain the vehicles' European Vehicle Numbers (EVNs) without requiring new authorisation.

The maintenance schedule of the resulting unit should be redefined.

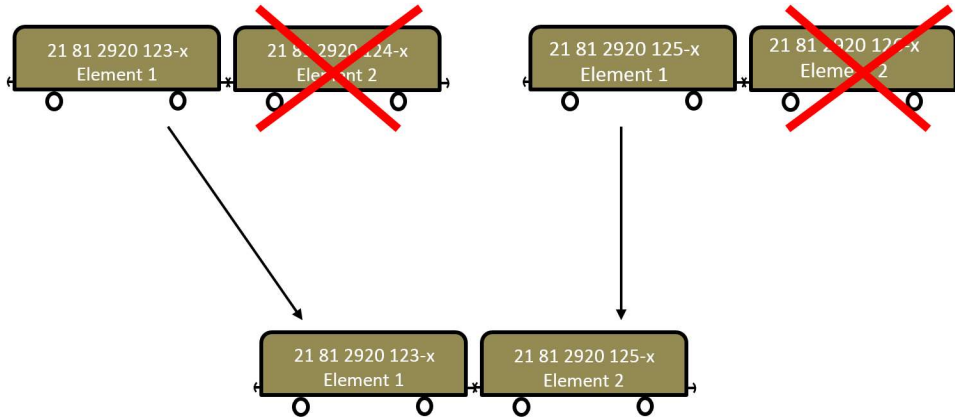


Figure 10 – Example of unit reconfiguration

(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).

Projects of changes in rolling stock or rolling stock type that are ongoing (i.e. in phase A) on 28 September 2023 are to be considered as ongoing projects as specified in the TSI point 7.1.1.2. Accordingly, the application of the revised TSI isn't mandatory.

The consequence of not-applying the new TSI is that the type certificate will be delivered according to a previous version of the TSI. The EC type examination certificate will be delivered according to that previous version of the TSI (rules in previous version of TSI LOC&PAS point 7.1.3).

When applying the new TSI for the modified parts, the EC type examination certificate will be delivered according to the TSI 2023 (rules in point 7.1.3), but its validity will be limited as specified in point 7.1.2.1 paragraph (11).

<i>Table 17b Basic design characteristics related to basic parameters set out in the TSI PRM</i>			
<i>TSI point</i>	<i>Related basic design characteristic(s)</i>	<i>Changes impacting the basic design characteristic and not classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797</i>	<i>Changes impacting the basic design characteristic and classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797</i>
<i>2.2.11. Step position for vehicle access and egress</i>	<i>Platform heights for which the vehicle is designed</i>	<i>N/A</i>	<i>Change of platform height the vehicle is compatible with</i>

A new authorisation is required only when there are structural changes to the carbody of the vehicle. In case the change of platform height the vehicle is compatible with doesn't require any structural modification to the carbody, the change can be considered as *not classified as defined by Article 21(12), point (a), of Directive (EU) 2016/797*. A version should be created.

3.2.6. Point 7.1.4 Rules for the extension of the area of use for existing rolling stock having an authorisation in accordance with Directive 2008/57/EC or in operation before 19 July 2010

3.2.6.1. Applicability of point 7.1.4 of LOC&PAS TSI to existing rolling stock

(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 Commission Decision 2007/756/EC (1) or in the European Vehicle Register in accordance with Commission Implementing Decision (EU) 2018/1614 (2) and maintained in a safe state of running in accordance with Commission Implementing Regulation (EU) 2019/779 (3).

The following provisions for extension of area of use apply also in combination with a new authorisation as defined in point (a) of Article 14(3) of Regulation (EU) 2018/545.

Point 7.1.4 applies to existing rolling stock that:

- has not been authorised in accordance with Directive(EU) 2016/797 and
- **is not compliant to the TSIs in force** (including all amendments) : PRM TSI 1300/2014, NOI TSI 1304/2014 and LOC&PAS TSI 1302/2014.

Note. Point 7.1.4 is not applicable to existing rolling stock compliant with the LOC&PAS TSI 1302/2014 as amended in 2020, it should have been authorised in accordance with Directive (EU) 2016/797: extension of area of use of such rolling stock should comply with provisions referred in regulation 2018/545 (article 30(2), article 39(4)).

Note. Regarding 7.1.4(1), please refer to Vehicle Authorisation guideline (sections 3.11.1.8 evidence concerning previous authorisations and/or 3.11.1.9 Evidence concerning the area of use of vehicles used under RIC/RIV agreements)

(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 Table 17a and 17b of this TSI, 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 clauses 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 as referred above;*
- (b) compliance with corresponding requirements set out in a previous TSI as referred above;*
- (c) compliance with alternative specifications deemed to have equivalent effect to the relevant requirements set out in this TSI as referred above;*
- (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).*

For the extension of area of use of rolling stock having an authorization in accordance with Directive 2008/57/EC or in operation before 19 July 2010, the basic parameters to be checked correspond mainly to technical compatibility between the rolling stock and the extended area of use.

The basic parameters to be checked are those referred to in point 7.1.4 (2) of LOC&PAS TSI, and the EC verification procedure shall cover the compliance with the requirements set out in this TSI, or with provisions having equivalent effect, for each basic parameter referred to in point 7.1.4 (2).

The table below provides the list of related TSIs basic parameters :

<i>TSI</i>	<i>Compliance with requirements defined in following TSIs basic parameters</i>
LOC&PAS 1302/2014 including all amendments	4.2.2.2.3 End coupling
	4.2.2.10 Load conditions and weighed mass
	4.2.3.2.1 Axle load parameter
	4.2.3.1 Gauging
	4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems
	4.2.3.3.2 Axle bearing condition monitoring
	4.2.3.4. Rolling stock dynamic behaviour
	4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets

TSI	Compliance with requirements defined in following TSIs basic parameters
	4.2.3.5.2.2 Characteristics of wheels
	4.2.3.5.2.3 Automatic variable gauge systems
	4.2.3.6. Minimum radius curve
	4.2.4.2.2 Braking — Safety requirements
	4.2.4.5.1 Braking performance — requirements General
	4.2.4.5.2 Braking performance – Emergency braking
	4.2.4.5.3 Braking performance – Service braking
	4.2.4.5.4 Braking performance – Thermal capacity
	4.2.4.5.5 Braking performance – Parking brake
	4.2.4.6.2. Wheel protection system
	4.2.4.8.2 Magnetic track brake
	4.2.4.8.3 Eddy current track brake
	4.2.5.3 Passenger alarm for area of use Italy
	4.2.5.3.5 Safety requirements for area of use Germany
	4.2.5.5.8 Safety requirements for clauses 4.2.5.5.2 to 4.2.5.5.7
	4.2.5.5.9 Door emergency opening
	4.2.6.1.1 Temperature
	4.2.6.1.2 Snow, ice and hail
	4.2.6.2.3. Maximum pressure variations in tunnels
	4.2.6.2.4. Cross wind
	4.2.6.2.5 Aerodynamic effect on ballasted track
	4.2.8.2.2 Operation within range of voltages and frequencies
	4.2.8.2.3 Regenerative brake with energy to the overhead contact line
	4.2.8.2.4 Maximum power and current from the overhead contact line
	4.2.8.2.5 Maximum current at standstill for DC systems
	4.2.8.2.7 System energy disturbances for ac systems
	4.2.8.2.9.1.1 Height of interaction with contact wires (RST level)
	4.2.8.2.9.2 Pantograph head geometry (IC level)
	4.2.8.2.9.4.2 Contact strip material
	4.2.8.2.9.6 Pantograph contact force and dynamic behaviour
	4.2.8.2.9.7 Arrangement of pantographs (RST level)
	4.2.8.2.9.8 Running through phase or system separation sections (RST level) (when running through phase or system separation sections is managed automatically)
	4.2.8.2.9.10 Pantograph lowering (RST level)
	4.2.9.2.1 Mechanical characteristics for area of use Germany
	4.2.9.3.1 Driver's activity control function
	4.2.9.6 Recording device
	4.2.10.1. General and categorisation
	4.2.12 Documentation for operation and maintenance
	4.2.12.2. General documentation — number of units in multiple operation
	4.2.12.2. General documentation – number of vehicles in a unit
	4.2.12.6 Rescue related descriptions
PRM 1300/2014 including all amendments	4.2.2.11. Step position for vehicle access and egress

The demonstration of compliance of rolling stock with the requirements defined in basic parameters referred to in point 7.1.4 (2) can be performed through one or a combination of the following:

- compliance with TSIs in force: in this case the checks are performed by a Notified Body (who shall establish the relevant EC certificates and accompanying file).
- compliance with previous TSIs: in this case, the checks are performed by a Notify Body (who shall establish the relevant EC certificates and accompanying file).
- compliance with alternative specifications deemed to have equivalent effect to the relevant requirements of this TSI: these alternative specifications are proposed by the applicant. They can refer to standards and/or specifications (e.g UIC 518 regarding running dynamics, UIC 505-1 for vehicle gauge ...). These alternative specifications may have been already used at the previous authorisation.
- 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 may be based on the information of the 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).

When the demonstration is not based on TSIs requirements (point 7.1.4(2)(c), point 7.1.4(2)(d)), the independent assessment of conformity is not carried out by a Notified body. In that case, when the applicant's demonstration of compliance is based on alternative specifications and/or equivalence of requirements for technical compatibility with the networks:

- The applicant applies the risk management process set out in annex I of regulation 402/2013, justifies and documents for every TSI basic parameter listed in point 7.1.4(2) of this TSI that the demonstrations proposed have an equivalent effect to the application of requirements of this TSI.
- The assessment body (CSM RA) assesses the evidences provided by the applicant for every TSI basic parameter listed in in point 7.1.4(2) of this TSI, and confirms the equivalent effect of compliance with alternative specifications and/or the equivalence of requirements for technical compatibility with the network.

Notes: in relation with annex I of regulation 402/2013:

- Alternative specifications correspond to "code of practices".
- Equivalence of requirements for technical compatibility with the networks correspond to "use of reference system".

This requirement on the assessment body (CSM RA) for assessing the capability of existing rolling stock, authorised in accordance with Directive 2008/57/EC or in operation before 19 July 2010, fully matches with both of the following :

- The definition in Article 3(14) and Article 6(1) of Regulation (EU) No 402/2013 on the CSM for risk assessment request the assessment body (CSM RA) to assess the applicant's risk management process and demonstration that existing rolling stock can be operated safely for the considered extension of the area of use;
- Article 13(1) and 13(3) of regulation 2018/545 regarding the independent assessment by the assessment body (CSM RA) of the applicant's process for vehicle requirement capture, including thus the applicant's demonstration of the safe integration of the rolling stock within an extension of the area of use.

Clause I.D of the recommendation for use N°03 (RFU 03) ensures that the assessment body (CSM RA), accredited, or recognised, according to Annex II of Regulation (EU) No 402/2013, has the necessary technical knowledge and competences for carrying out those assessments.

Point 6 in clause IV.E of RFU 03 addresses the capability of the assessment body (CSM RA) to independently assess the applicant's process for the vehicle requirement capture.

Point 3 of section I.D of RFU 03 explicitly requires that the assessment body (CSM RA) has "... access to a sufficient number of in-house or external railway technical experts, who are fully qualified to provide ... the safety specialists ..." of the assessment body (CSM RA) "... with railway technical opinions/advices on the quality and the robustness of the proposer's work".

Note . The task of the AsBo referred above is without prejudice to the AsBo responsibility to independently assess the applicant's compliance with Article 13(3) of Regulation 2018/545, regarding the applicant's

methodology for the requirements capture of the essential requirements 'safety' related to the vehicle and subsystems, as well as safe integration between subsystems.

(4) In addition to the requirements mentioned referred to in point 2 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 Noise (Regulation (EU) No 1304/2014), the TSI PRM (Regulation (EU) No 1300/2014) and CCS TSI (Regulation (EU) 2016/919);

(b) the national rules referred to in points (a), (c) and (d) of Article 13(2) of Directive (EU) 2016/797 as notified in accordance with Article 14 of that Directive. [...] 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.

The EC declaration of verification and the accompanying files shall also cover:

- The compliance with the relevant specific cases of the extended area of use. The compliance is subject to a Notify Body assessment when the specific cases are described in TSI. Regarding the specific cases in TSI CCS and in relation to point 7.1.4(4)(a), they are limited to train detection systems and can be found in point 7.7 of TSI CCS.
- The compliance with the national rules on top of TSIs related to:
 - Open points in the TSIs (article 13(2)(a) of Directive (EU) 2016/797),
 - Specific cases not described in the TSIs (article 13(2)(b) of Directive (EU) 2016/797),
 - Technical compatibility of the vehicle with existing network (Article 13(2)(d) of Directive (EU) 2016/797)

The corresponding national rules can be found in the Reference Document Database (RDD) through the report : [List of National Technical Rules - Detailed - Criteria - TSI](#). The national rules in addition to TSIs are identified in the column named : *"Applicable for authorisation of railway vehicles as defined in Art. 2 of Commission Regulation (EU) No 1302/2014 and Art. 2 of Commission Regulation (EU) No 321/2013"*.

The Designated Body assesses compliance of the rolling stock with the national rules referred above .

The applicant is responsible to compile the technical files accompanying the EC declaration of verification that should include evidences of compliance with point 7.1.4 of LOC&PAS TSI :

- NoBo certificates and accompanying files, when assessment is performed against TSIs,
- Justification and Documentation including AsBo report, when assessment is performed using alternative specification and/or the equivalence of requirements for technical compatibility with the network.
- DeBo certificates and technical files regarding assessment of national rules.

Note. The compliance with point 7.1.4 is under the responsibility of the applicant involving different conformity assessment bodies. Except for point 7.1.4 (a) and(b), there is no role of NoBo to check that the provisions of 7.1.4 have been demonstrated by the applicant.

(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

The Agency should make available through its website a report providing information on alternative specifications and on technical compatibility that may provide equivalent effect to TSI requirements defined in basic parameters referred to in point 7.1.4(2) of LOC&PAS TSI. The published information will be based on granted authorisations for the extended area of use delivered by the Agency. Information are provided for information purpose, this do not prevent the applicant, for its application, to justify and document the use of alternative specifications and / or equivalence of requirements for technical compatibility as required by points 7.1.4 of LOC&PAS TSI.

(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.

Non-applications of TSIs are exceptional measures and non-application decisions have to follow a procedure involving the MS(s) and the Commission. **Non-applications can only be granted for a defined scope** in relation to identifiable vehicles, a number of vehicles and a defined network of an area of use, in order to ensure compatibility with the non-application cases.

3.2.6.2. *Applicability of section 7.1.4 of LOC&PAS TSI to special vehicles such as On Track Machines (OTMs)*

Special vehicles as defined in sections 2.2 and 2.3 of LOC&PAS TSI, are in the scope of the LOC&PAS TSI. However, according to section 7.1.1.3 of the LOC&PAS TSI 1302/2014 **amended by regulation 2018/868, regulation 2019/776 and regulation 2020/387**, the application of the technical requirements laid down in the LOC&PAS TSI (i.e. chapters 4, 5 and 6) to OTMs is not mandatory.

When an applicant decided not to apply the technical requirements in LOC&PAS TSI, the EC verification procedure was performed against national rules notified in accordance with Article 14 of Directive (EU) 2016/797 as regards the basic parameters of the TSI.

For the extension of the area of use of an existing special vehicle not TSI compliant (application of national rules instead of TSIs) having an authorization in accordance with Directive 2008/57/EC or in operation before 19 July 2010, if applicant choose to apply national rules, the basic parameters to be checked are those referred to in section 7.1.4 of LOC&PAS TSI, and the EC verification procedure shall cover the compliance with the applicable national rules for each basic parameter referred to in:

- › column 1 of Tables 17a and 17b of LOC&PAS TSI, and
- › the following sections of LOC&PAS 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 :

- compliance with national rules against the basic parameters referred above (pursuant to section 7.1.4(2)(a) of LOC&PAS TSI);

- 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 may be based on the information of RINF (pursuant to section 7.1.4(2)(d) of LOC&PAS TSI).

In accordance with section 7.1.4(4)(b) of LOC&PAS TSI, the EC Declaration of Verification and the accompanying technical file shall also cover the compliance with the national rules for:

- › Open points in the TSIs, Article 13(2)(a) of Directive (EU) 2016/797
- › Specific cases in the TSIs, Article 13(2)(b) of Directive (EU) 2016, 797 and/or
- › Existing systems, Article 13(2)(d) of Directive (EU) 2016/797

Please note that these aspects may have already been covered in the evaluations pursuant to section 7.1.4(2).

The following table summarizes the applicability or not of point 7.1.4 to special vehicles compliant only with national rules:

Point	Applicability
7.1.4(1)	Applicable
7.1.4(2) (1 st paragraph)	Applicable part: 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 points mentioned in 7.1.4(2)
7.1.4(2)(a),(b), (c)	Not applicable as special vehicles comply with National rules assessed by DeBo (notified national rules are not alternative specifications)
7.1.4(2) (d)	Applicable
7.1.4(3) – alternative specification 7.1.4(2)(c)	Not applicable as special vehicles comply with National rules assessed by DeBo (notified national rules are not alternative specifications)
7.1.4(3) - equivalence of requirements for technical compatibility with the network 7.1.4(2)(d)	Applicable
7.1.4(4)(a)	Not applicable as special vehicles comply with National rules assessed by DeBo
7.1.4(4)(b)	Applicable
7.1.4(5) - equivalence of requirements for technical compatibility with the network 7.1.4(2)(d)	Applicable
7.1.4(6)	Not applicable as special vehicles comply with National rules assessed by DeBo
7.1.4(7)	Not applicable as special vehicles are not concerned by RIC

3.3. Point 7.5: Aspects that have to be considered in the revision process or in other activities of the Agency

3.3.1. Point 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 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 TC250 SC1 WG3 TG DIBRST 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 OPE TSI 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.*

The OPE TSI requires the national processes for vehicle/infrastructure route compatibility checks to be identified (see OPE TSI Appendix D.1, RINF parameter 1.1.1.1.2.4.4).

Research activities are ongoing in the following relevant topics:

- Further understanding of the technical basis for checking that a vehicle loading characteristics are covered by the bridge dynamic load model HSLM (High-Speed Load Model);
- extending the scope of HSLM to cover an extended range of high speed passenger vehicle characteristics;
- requirements for associated harmonised methods to check that the dynamic bridge loading characteristics of a vehicle comply with load model HSLM; and
- harmonised requirements for route compatibility checks taking into account the dynamic loading characteristics of a vehicle.

3.3.2. Point 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 point 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 on 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).

The Railway Undertaking must check whether the composed train meets the train detection requirements as described in the section 1.1.1.3.4 of table 1 of the RINF regulation.

This check is still complicated to perform. A simplified method for this will be published in the future.

At present, however, parameters from the locomotive and coaches technical files will have to be used to establish route compatibility.

Referring to the assessment of the unit, the limit(s) defined in Appendix J-2 index [A] of the LOC&PAS TSI are applicable for the Influencing Unit of which the unit is a part.

3.3.3. Point 7.5.2.3: Equipment of a rolling stock with places for bicycles - Impact of the Passenger Rights Regulation

(1) Article 6(4) of Regulation (EU) 2021/782 of the European Parliament and of the Council¹ 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.”;

The Regulation (EU) 2021/782 of the European Parliament and of the Council of 29 April 2021 on rail passengers’ rights and obligations (Passenger Rights Regulation - PRR) entered into force on 6 June 2021.

The article 6 (4) of the PRR will apply on 7 June 2025; it specifies that “when initiating procurement procedures for new rolling stock, or when performing a major upgrade of existing rolling stock resulting in the need for a new vehicle authorisation for placing on the market pursuant to Article 21(12) of Directive (EU) 2016/797 of the European Parliament and of the Council, railway undertakings shall ensure that train compositions, in which that rolling stock is used, are equipped with an adequate number of places for bicycles. This subparagraph shall not apply in relation to restaurant cars, sleeping cars or couchette cars.”

Being not related to the essential requirements in Annex III of the Interoperability Directive, the characteristics and number of places for bicycles are out of the scope of the TSI and therefore not assessed by a Notified Body or by a Designated Body.

When rolling stock is supplied as individual units intended to be used in general operation (as defined in point 2.2.1 (h) of this TSI), it is the responsibility of the railway undertakings to ensure that train compositions, in which those units are used, are equipped with an adequate number of places for bicycles as defined in Regulation (EU) 2021/782 Article 6(4).

4. APPLICABLE SPECIFICATIONS AND STANDARDS

4.1. Explanation of the use of the specifications and standards

For general use of standards in the TSI application guide please refer to the “Guide for the Application of TSIs”.

Standards of voluntary use which have been identified during the drafting process of the TSI are listed in the Annex 1, column “Voluntary ref to clause(s) of Standard N”¹; as far as possible, the clause of the standard which is relevant for the conformity assessment of the TSI requirement should be identified. In addition, the

¹ 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).

column “Voluntary ref – Purpose” should give a written explanation regarding the purpose of the reference to the standard.

Where relevant, an additional explanation is given in the chapter 2 above.

4.2. Appendix J - Technical specifications referred to in this TSI - J.1 Standards or normative documents

Appendix J.1 lists all the clauses of standards that are made mandatory by a direct reference in the TSI. Each natural index number (marked [n]) corresponds to one standard. All occurrences of that standard in the TSI are identified with the marking [n.m].

The version of the standard that is quoted in Appendix J.1 is the version that is mandatory to apply. When there is no difference between the quoted version and another one of the same standard for the mandatory clauses listed, the other version can be used instead (be it an earlier or a later version).

Note: when a revision of the TSI is published, changes to the previous revision are listed in a specific Appendix (Appendix L for LOC&PAS TSI, see point 3.1.6). It is possible that a change of version of a standard isn't listed in that appendix. Non-referencing a new version of a standard in Appendix L means that, for ongoing projects (see point 3.1.2), both versions of the standard are considered equivalent. However, for a new project starting after entry into force of the revised TSI, the application of the quoted version of the standard is mandatory unless there is no difference between the quoted version and another one of the same standard for the mandatory clauses listed.

Annex 1 List of standards

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Scope and definition of the subsystem	2.3.1(c)	EN 14033-1:2017 CEN TR 17498:2020.	definitions	
Safety aspects	4.2.1.3	EN 50126-1:2017, EN 50128:2011+A2 :2020, relevant clauses, EN+A1:2023 50657:2017 (
Structure and mechanical parts	4.2.2			
Inner coupling	4.2.2.2.2	EN15566:2022 , relevant clauses EN15551:2022 relevant clauses	Draw gear and screw coupling - Product definition and verification Buffers - Product definition and verification	
Rescue coupling	4.2.2.2.4	EN15020:2022		
Staff access for coupling and uncoupling	4.2.2.2.5	EN 16116-1:2022		
Gangways	4.2.2.3	EN 16286-1:2013 cl. 7.4, 7.9, 9.2 and 9.3		
Strength of vehicle structure	4.2.2.4 (8)	EN 15085-2:2020+A1:2023, EN 15085-4:2023 EN15085-5:2023	Quality Management System For verification of metallic joints.	
Passive safety	4.2.2.5	EN 15227:2020	For heavy haul locomotives with centre coupler	

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Lifting and jacking	4.2.2.6	EN 16404:2016		
Mechanical characteristics of glass (other than windscreens)	4.2.2.9	E-ECE 324/Rev.1/Add. 42/Rev.3, of August 2012 Regulation 43. Emergency glasses: Annex A3 (clauses 9.2 and 9.3) and Annex A5 (clauses 2 and 3.1). Non-emergency glasses: Annex A3 (clauses 9.2 and 9.3), Annex A5 (clauses 2 and 3.1), Annex A6 (clause 4.2) and Annex K. EN ISO 12543:2021 Parts 1 – 6. EN 12150-1 :2015+A1 :2019 EN 12150-2 :2004 ISO 22752:2021		
Track interaction and gauging	4.2.3			

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Gauging	4.2.3.1	EN 15273-2:2013+A1:2016	For definition of "intermediate gauges". For tilting trains running with $lp > lc$, the pantograph gauge verification. (clause A.3.13)	
		EN 15273 - 1 : 2013+A1:2016/AC:2017, Annex I	For widening the rolling stock as a function of the possibilities offered by the infrastructure due to tolerances.	
Axle load parameter	4.2.3.2.1	EN 15528:2021	For categorisation of RST according to line category.	RFS 033
Wheel load	4.2.3.2.2	EN 15654-2:2019 Clauses 4,5 annex A,B,C	Measurement of vertical forces on wheels and wheelsets	
Axle bearing condition monitoring	4.2.3.3.2	EN 15437-2:2012 +A1 2022	Track side system On-board system (open point)	
Safety against derailment running on twisted track	4.2.3.4.1			
Running dynamic behaviour	4.2.3.4.2			
Equivalent conicity	4.2.3.4.3			
Design values for new wheel profiles	4.2.3.4.3.1			
In-service values of wheelset equivalent conicity	4.2.3.4.3.2			

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Mechanical and geometrical characteristics of wheelsets - axles - assembly	4.2.3.5.2.1	EN 13261:2020 EN 12080:2017 12081:2017 EN 12082:2017+A1:2021 EN15313:2016 EN 13103-1-1:2017+A1:2022	Relevant clauses for product verification Relevant clauses for in service wheelset parameters Relevant clauses for calculation for verification (
Mechanical and geometrical characteristics of wheels	4.2.3.5.2.2	EN 13262:2020	Product design verification	

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Automatic variable gauge systems	4.2.3.5.2.3 6.1.3.1b	EN 15827:2011 EN 17069-1:2019 UIC 510-4, v.2, 2002	The methodology for the validation of bogie and running gear can be used for some aspects of the validation of the variable gauge systems. The validation plan defined in EN 17069-1:2019 could be used as a “code of practice” in order to perform the safety analysis resulting in the definition of the validation plan. The area and conditions of use of this validation plan should be taken into account.	
Minimum curve radius	4.2.3.6			
Life guards	4.2.3.7			
Braking	4.2.4			
Functional requirements	4.2.4.2.1			
Safety requirements	4.2.4.2.2	EN 50126-1:2017	Demonstration of safety requirements	
Type of brake system	4.2.4.3	EN 14198:2016+1A:2018+ A2:2021 EN 15179:2007 EN 15355:2019 EN 15611:2020 +A1:2022 EN 15612:2020 EN 15625:2021	Design principle of brake system Definition and verification of brake component of UIC brake system	
Emergency braking	4.2.4.4.1			
Service braking	4.2.4.4.2			

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Direct braking command	4.2.4.4.3			
Dynamic braking command	4.2.4.4.4			
Parking braking command	4.2.4.4.5			
Braking performance	4.2.4.5.1			
Emergency braking	4.2.4.5.2			
Service braking	4.2.4.5.3			
Calculations related to thermal capacity	4.2.4.5.4			
Parking brake	4.2.4.5.5			
Limit of wheel rail adhesion profile	4.2.4.6.1			
Wheel slide protection system	4.2.4.6.2	EN 15595:2018+A1:2023	Specific clause applicable to coaches.	
Dynamic brake - Braking systems linked to traction system	4.2.4.7			
Braking system independant of adhesion conditions	4.2.4.8			
General	4.2.4.8.1			
Magnetic track brake	4.2.4.8.2.			
Eddy current track brake	4.2.4.8.3			
Brake state and fault indication	4.2.4.9	EN 15220:2016	Product verification for brake indicators.	
Brake requirements for rescue purposes	4.2.4.10	EN 15807:2021	Half coupling definition and verification	
Passenger related items	4.2.5			
Audible communication system	4.2.5.2.(4)	IRS 50558:2017		

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Passenger alarm: functional requirements	4.2.5.3	EN 16334-1:2014+A1:2022, relevant clauses	Requirement for standard to CEN covering last developments, and interface with braking/braking override	
Passenger alarm: criteria for a train departing from a platform	4.2.5.3.4	EN 16334-1:2014+A1:2022, clause 6.5	Criteria to detect that a train has left the platform	
Passenger alarm: safety requirements	4.2.5.3.5	EN 16334-1:2014+A1:2022, clause 8		
Communication devices for passengers	4.2.5.4	EN 16683:2015, clause 5 and annex D		
Exterior doors: access to and egress from Rolling Stock	4.2.5.5	EN 14752:2019+A1:2021	Design of doors	
Exterior door system construction	4.2.5.6	EN 14752:2019+A1:2021	Design of doors	
Internal air quality	4.2.5.8	EN 13129 :2016,	Fresh air volume providing presumption of conformity to TSI. Measurement method of fresh air volume	
Environmental conditions and aerodynamic effects	4.2.6			
Environmental conditions	4.2.6.1	EN 50125-1:2014 clause 5 and 6 of CEN/TR 16251:2016	Guidance for environmental parameters not specified in the TSI Design and test of RST for severe conditions	
Cross wind	4.2.6.2.4	EN14067-6:2018	Guidance for aspects not specified in the TSI	
Traction and electrical equipment	4.2.8			
Contact strip material	4.2.8.2.9.4.2	EN 50405:2015 +A1:2016	For material of contact strips	
Insulation of pantograph from the vehicle	4.2.8.2.9.9	EN 50163:2004/A2:2020 EN 50124-1:2017	Design rules	

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Cab and operation	4.2.9			
Access and egress in operating conditions	4.2.9.1.2.1 (1) and (3)	EN 16116-1:2022 Point 7.1, 7.2 and 7.3		
Driver's cab emergency exit	4.2.9.1.2.2	EN15227:2020 , cl. 6.3	TSI requirement verification	
Front visibility	4.2.9.1.3.1	EN 16186-1:2014+A1:2018 cl. 5.2.2. EN 14033-1:2017 cl. 14.6		
Interior layout	4.2.9.1.4			
Driver's seat	4.2.9.1.5	UIC 651 of July 2002, clause 5.1 (except clause 5.1.4)	This UIC leaflet provide detailed guidance on the driver's seat design	
Climate control and air quality	4.2.9.1.7	EN 14813-1:2006+A1:2010 cl9.5 EN 14813-2:2006+A1:2010 cl6.2 UIC 651 cl 2.9.3	Air velocity (around head of driver)	
Internal lighting	4.2.9.1.8	EN 13272:2019 cl 6	Measurement of luminosity	
Driver display unit and screens	4.2.9.3.3	UIC 612 family EN 16186-2:2017 EN 16186-3:2022	Relevant sections for design rules	

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Controls and indicators	4.2.9.3.4	UIC 612 family EN 16186-2:2017 EN 16186-3:2022	Relevant sections for design rules	
Labelling	4.2.9.3.5	UIC 612-0 Appendix H, UIC 612-01 Appendix A, UIC 612-03 clause 3.2 ISO 3864-1:2011	The UIC leaflets provide detailed requirements for marking controls and indicators in the cab The ISO 3864-1 provides general guidance on safety colours and safety signs.	
Remote control function	4.2.9.3.6	EN 50239::2018	Design and assessment, including safety aspects	
Fire safety and evacuation	4.2.10			
Specific measures for flammable liquids	4.2.10.2.2	EN 45545-7:2013	Only prevention of leakage of flammable liquids	
Portable fire extinguishers	4.2.10.3.1	EN 45545-6:2013 cl 6.3	Portable fire extinguisher requirements and situation in the vehicle	
Fire detection systems	4.2.10.3.2	EN 45545-6:2013 Table 1 and 2, cl. 5.2, 5.3 and 5.4 (excluding 5.4.5)	Requirements for Fire detection systems and automatic actions.	
Automatic fire fighting system for freight diesel units	4.2.10.3.3	EN 45545-6:2013 Table 1, and 2, cl. 5.2, 5.3 and 5.4.2.2	Requirements for diesel fire detection system and cutting of fuel supply + shutting down equipment actions.	
Fire containment and control systems for passenger rolling stock	4.2.10.3.4	CEN/TR 17532:202 EN 45545-3:2013		RFS 045
Running capability	4.2.10.3.4	EN 50553:2012+A2:2020		

TSI		Standard		
Characteristics to be assessed		Voluntary ref to clause(s) of Standard N°	Purpose of the Voluntary ref	To be drafted
Element of the Rolling Stock sub-system	Point			
Passenger emergency exits	4.2.10.5.1	EN 45545-4:2013 cl. 4.3 (excluding 4.3.1.2 and 4.3.4)	Requirements for passenger emergency exits	
Driver's cab emergency exits	4.2.10.5.2	EN 45545-4:2013 cl. 4.3.1.2	Requirements for driver's cab emergency exits	
Servicing	4.2.11			
Cleaning of driver's cab windscreen	4.2.11.2.1			
Exterior cleaning through a washing plant	4.2.11.2.2			
Connection to toilet discharge system	4.2.11.3			
Water refilling equipment	4.2.11.4			RFS 014
Interface for water refilling	4.2.11.5			RFS 014
Special requirements for stabling of trains	4.2.11.6			
Refuelling equipment	4.2.11.7	EN 16507:2014	Guidance to interface	
Documentation for operation and maintenance	4.2.12			
General	4.2.12.1			
General documentation	4.2.12.2			
Documentation related to maintenance	4.2.12.3			
Operating documentation	4.2.12.4			
Lifting diagram and instructions	4.2.12.5			
Rescue related descriptions	4.2.12.6			

Annex 2: Table of speed conversions for UK -Northern Ireland and Ireland

INS, RST and ENE speed conversions	
km/h	Mph
2	1
3	1
5	3
10	5
15	10
20	10
30	20
40	25
50	30
60	40
80	50
100	60
120	75
140	90
150	95
160	100
170	105
180	110
190	120
200	125
220	135
225	140
230	145
250	155
280	175
300	190
320	200
350	220
360	225