Guidance on the Locomotives and Passenger Rolling Stock TSI

Synopsis

Guidance on the Locomotives and Passenger Rolling Stock TSI

Issue Record

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<tr>
<td>One</td>
<td>02/12/2012</td>
<td>Original document. Guidance on the Conventional Rail Locomotives and Passenger Rolling Stock TSI.</td>
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<td>Two</td>
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This document will be updated when necessary by distribution of a complete replacement.

Supply

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# Guidance on the Locomotives and Passenger Rolling Stock TSI

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Part 1 Introduction

1.1 Purpose

1.1.1 This document gives guidance on interpreting the requirements of the Locomotives and Passenger Rolling Stock Technical Specification for Interoperability (LOC&PAS TSI), Commission Regulation (EU) No. 1302/2014 for application to the Great Britain (GB) mainline railway. This document does not set out requirements.

1.1.2 This document is intended to provide clarification on the requirements set out in the LOC&PAS TSI for interoperability that can be misinterpreted due to ambiguity. This document also gives guidance to clarify terms that are particular to GB and indicates where there are specific cases.

1.1.3 This document is intended to assist project entities, railway undertakings (RUs), infrastructure managers (IMs) and conformity assessment bodies in understanding their responsibilities in relation to interpreting and applying the technical requirements of the LOC&PAS TSI. It does not constitute a recommended method of meeting any set of mandatory requirements. The LOC&PAS TSI is to be used in conjunction with National Technical Rules (NTRs) and other standards in order to meet the essential requirements set out in Directive 2008/57/EC. Clauses 25 to 37 in Commission Recommendation 2014/897/EU give further guidance on the essential requirements and how standards are used to meet them.

1.1.4 Directive 2008/57/EC permits Member States to draw up NTRs, in addition to the TSIs, under the following circumstances:
   a) To support a specific case.
   b) To fill an open point.
   c) For technical compatibility between legacy subsystems that do not conform to the requirements of the TSI.

1.1.5 The list of NTRs that support the LOC&PAS TSI can be found on the Department for Transport (DFT) website at https://www.gov.uk/government/publications/rail-interoperability-current-notified-national-technical-rules.


1.1.7 This document does not replicate existing guidance published by the European Union Agency for Railways in their Application Guide. Therefore the TSI Application Guide of the LOC&PAS TSI is also useful in conjunction with the LOC&PAS TSI. Attention has been drawn to some areas where the Application Guide is particularly relevant to GB but other areas may also be useful.

1.1.8 While this document provides guidance to those projects in GB that are required to comply with the LOC&PAS TSI, according to the Railways (Interoperability) Regulations 2011, the LOC&PAS TSI requirements can also be applied to other rolling stock projects not in scope of the Railways (Interoperability) Regulations 2011.

1.2 Structure of this document

1.2.1 Relevant requirements from the LOC&PAS TSI are reproduced with a grey background in this document.
1.2.2 Guidance is provided as a series of sequentially numbered clauses.

1.2.3 Sufficient TSI text is reproduced to put the guidance in context but not all the TSI respective text is included.

1.2.4 Text applicable to Interoperability Constituents (Chapter 5) and Assessment Requirements (Chapter 6) is also grouped with the technical requirements of Chapter 4 followed by relevant guidance.

1.2.5 Where GB specific cases are included in the LOC&PAS TSI, the text of these is included in this document immediately following the main clause to which the specific case refers and is then followed by any related guidance.

1.2.6 TSI clauses not referred to in this guidance note are still relevant, but are not reproduced as no guidance is applicable.

1.3 Approval and Authorisation

1.3.1 The content of this document was approved by Rolling Stock Standards Committee on 29 September 2016.

1.3.2 This document was authorised by RSSB on 22 November 2016.
Part 2 Guidance on the LOC&PAS TSI Chapters 1, 2, 3 and general topics

2.1 LOC&PAS TSI scope extension

2.1.1 Merging of two TSIs into one

2.1.1.1 As of the 01 January 2015 the LOC&PAS TSI now applies to all new rolling stock, and upgrades or renewals to existing rolling stock on the entire GB mainline rail system network in the scope of the Railway (Interoperability) Regulations 2011, and not just to rolling stock on the part of the network classified as part of the trans-European network (TEN), as in previous TSIs.

2.1.1.2 The DfT provides information on the precise scope (see https://www.gov.uk/government/publications/scope-of-rail-interoperability).

2.1.1.3 The LOC&PAS TSI now covers requirements for both high speed and conventional speed rolling stock. The high speed and conventional rail LOC&PAS requirements were previously contained in separate TSIs: the High Speed Rolling Stock TSI and the Conventional Rail Locomotives and Passenger Rolling Stock TSI. The updated LOC&PAS TSI effectively merges the technical scope of the two previous TSIs into one document.

2.1.1.4 Requirements applicable to freight rolling stock are still set out in a separate TSI, the Rolling Stock — Freight Wagons TSI (EU) No 321/2013. Further guidance on the WAG TSI is given in GMGN2688.

2.2 LOC&PAS TSI Chapter 2

2.2.1 Interfaces of LOC&PAS TSI with other TSIs

2.2.1.1 The LOC&PAS TSI has been developed by The European Union Agency for Railways to be in harmony with other TSIs. Key interfaces exist with the Infrastructure (INF), Control Command and Signalling (CCS), Energy (ENE) and Operation Traffic Management (OPE) TSIs.

2.2.1.2 Both the Persons with Reduced Mobility TSI (PRM TSI) and the Safety in Rail Tunnels TSI (SRT TSI) include requirements related to the rolling stock subsystem. They are known as ‘transverse TSIs’ as they include requirements applicable to more than one subsystem.

2.3 LOC&PAS TSI general topics

2.3.1 Numeric values

2.3.1.1 The LOC&PAS TSI uses the standard European notation for numeric values with ‘comma’ (,) as the decimal point and ‘space’ ( ) as the thousands delimiter. Thus, for example, 2.5 mm/m is to be understood as 2.5 mm/m and 1 435 mm is to be understood as 1435 mm.
Part 3  Guidance on LOC&PAS TSI Chapter 4 and UK (GB) Specific Cases in Chapter 7.3.2

3.1 TSI technical requirement clauses (Chapter 4)

LOC & PAS TSI
4 CHARACTERISATION OF THE ROLLING STOCK SUBSYSTEM

4.1 Introduction
4.1.1 General

(1) The Union’s rail system, to which Directive 2008/57/EC applies and of which the rolling stock subsystem is a part, is an integrated system whose consistency needs to be verified. This consistency must be checked in particular with regard to the specifications of the rolling stock subsystem, its interfaces with the other subsystems of the Union’s rail system in which it is integrated, as well as the operating and maintenance rules.

(2) The basic parameters of the rolling stock sub-system are defined in the present Chapter 4 of this TSI.

(3) Except where this is strictly necessary for the interoperability of the Union’s rail system, the functional and technical specifications of the subsystem and its interfaces described in Sections 4.2 and 4.3, do not impose the use of specific technologies or technical solutions.

(4) Some of the rolling stock characteristics that are mandated to be recorded in the ‘European register of authorised types of vehicles’ (according to the relevant Commission Decision) are described in Sections 4.2 and 6.2 of this TSI. Additionally, these characteristics are required to be provided in the rolling stock technical documentation described in point 4.2.12 of this TSI.

3.1.1 The LOC&PAS TSI Chapter 4 sets out the main technical requirements for rolling stock and is dealt with in detail, where guidance is necessary, within the following parts of this guidance note.

3.2 Main categorisation of the rolling stock

LOC & PAS TSI
4.1.3 Main categorisation of the rolling stock for application of TSI requirements

(1) A rolling stock technical categorisation system is used in the following clauses of this TSI to define relevant requirements applicable to a unit.

(2) The technical category(ies) relevant for the unit subject to the application of this TSI shall be identified by the party asking for assessment. This categorisation shall be used by the notified body in charge of the assessment, in order to assess the applicable requirements from this TSI, and shall be stated in the certificate of ‘EC’ verification.

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

— Unit designed to carry passengers
— Unit designed to carry passenger-related load (luggage, cars, etc.)
LOC & PAS TSI

— Unit designed to carry other payload (mail, freight, etc.) in self-propelling trains
— Unit fitted with a driver’s cab
— 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
— Freight locomotive: Unit designed to haul freight wagons
— Passenger locomotive: Unit designed to haul passenger carriages
— OTMs
— Infrastructure inspection vehicles.

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

3.2.1 The term ‘unit’, as described in the LOC&PAS TSI, is a method to describe the minimum formation of the rolling stock that can be assessed against this TSI. Typically, this would be a locomotive, a single coach (that can be attached to other vehicles to form a train) or vehicles in a fixed formation usually with a driving cab at each end and a means of self-propulsion and that can only usually be re-formed in a depot (these include formations known as a ‘multiple unit’).

3.2.2 The LOC&PAS TSI uses km/h in a number of clauses to differentiate between requirements. Strict mathematical conversion of these figures to mph would lead to inappropriate requirements for the GB mainline railway. For example, ‘speeds greater than 200 km/h’ would include 125 mph, which is not the intention. The European Union Agency for Railways Application Guide includes in Annex 2 a table of agreed values to convert from km/h to mph where the figures are used to differentiate requirements.

3.3 Categorisation of the rolling stock for fire safety

LOC & PAS TSI

4.1.4 Categorisation of the rolling stock for fire safety

(1) In respect of fire safety requirements, four categories of rolling stock are defined and specified in the TSI SRT.

— Category A passenger rolling stock (including passenger locomotive),
— Category B passenger rolling stock (including passenger locomotive),
— Freight locomotive, and self-propelling unit designed to carry other payload than passengers (mail, freight, infrastructure inspection vehicle, etc.),
— OTMs.

(2) The compatibility between the category of the unit and its operation in tunnels is set out in the TSI SRT.

(3) For units designed to carry passengers or haul passenger carriages, and subject to the application of this TSI, category A is the minimum category to be selected by the party asking for assessment; the criteria for selecting category B are given in the TSI SRT.
(4) This categorisation shall be used by the notified body in charge of the assessment, in order to assess the applicable requirements from the clause 4.2.10 of this TSI, and shall be stated in the certificate of ‘EC’ verification.

3.3.1 See separate guidance on fire categories set out in the guidance to section 4.2.10 of the LOC&PAS TSI.

3.4 End coupling

4.2.2.2.3 End coupling
(a) General Requirements
(a-1) Requirements on characteristics of end coupling
(1) Where an end coupling is provided at any end of a unit, the following requirements apply to all types of end coupling (automatic, semi-automatic or manual):
— End couplings shall incorporate a resilient coupling system, capable of withstanding the forces due to the intended operational and rescue conditions.
— The type of mechanical end coupling together with its nominal maximum design values of tensile and compressive forces and the height above rail level of its centre line (unit in working order with new wheels) shall be recorded in the technical documentation described in clause 4.2.12.
(2) Where there is no coupling at any end of a unit, a device to allow a rescue coupling shall be provided at such end of the unit.

3.4.1 The LOC&PAS TSI permits alternative arrangements for vehicle end coupling systems, automatic, semi-automatic, manual and no coupling.

3.4.2 End couplings need to be designed and maintained to allow for the range of movements when negotiating minimum radius plain and reverse curves, and vertical curves, encountered on the GB mainline railway, without developing high suspension forces that could cause derailments.

3.5 Rescue coupling

4.2.2.2.4 Rescue coupling
(1) Provisions shall be made to enable the recovery of the line in case of breakdown by hauling or propelling the unit to be rescued.
(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.
3.5.1 The LOC&PAS TSI does not mandate (but does permit) the provision of a rescue coupler on each unit; however, it does mandate that provision be made for a rescue coupler on board. Therefore, the decision not to install a rescue coupler on board is made by the RU in conjunction with the IM who, typically, has responsibility for clearing the line. In determining the provision of rescue couplers, account is taken of the time and need to make it available.

3.5.2 The LOC&PAS TSI sets out functional requirements for the design of the rescue coupler; in addition, the following points also need to be considered:

a) Allow for the range of movements when negotiating minimum radius plain and reverse curve, encountered on the GB mainline railway, without developing high suspension forces that could cause derailments. This particularly applies when interfacing with a ‘swing-head’ type coupling.

b) Recognise the layout of all brackets, hoses and cables encountered on typical GB locomotives that are used for rescue purposes.

c) Be able to withstand the loads encountered up to the determined maximum rescue speed, yet be capable of the safe lifting by personnel without injury. This limitation has the potential to lead to strength-to-weight conflicts. Alternatively, sub-assembly arrangements of the rescue coupler could be adopted together with operational limitations on tractive effort to be applied during rescue, particularly to freight locomotives together with fatigue limits included for rescue coupler maintenance purposes.

3.6 Staff access for coupling and uncoupling

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<tr>
<td>4.2.2.2.5 Staff access for coupling and uncoupling</td>
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<td>(2) To comply with this requirement, units fitted with manual coupling systems as per clause 4.2.2.2.3 shall comply with the following requirements (the ‘Bern rectangle’):</td>
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<td>- The required spaces shown in fig. A2 of Annex A shall be free of fixed parts. For this requirement the coupling gear components are in the central position laterally.</td>
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| 7.3.2.1 Specific case United Kingdom (Great Britain) (‘P’)
| Staff access for coupling and uncoupling (clause 4.2.2.2.5) It is permissible for units fitted with manual coupling systems (as per clause 4.2.2.2.3 b) to alternatively comply with the national technical rules notified for this purpose. |
| This specific case does not prevent the access of TSI compliant rolling stock to the national network. |

3.6.1 This requirement applies to all vehicles fitted with a manual coupling system and therefore the clearance requirements associated with the Berne rectangle apply. In GB, loco hauled coaches have typically been fitted with a semi-automatic coupling system (thus avoiding the need to meet the LOC&PAS TSI Berne rectangle provision).

3.6.2 The GB specific case allows flexibility in the approach chosen. GMRT2100 sets out the NTRs supporting this specific case.

3.7 Gangways

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<td>4.2.2.3 Gangways</td>
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(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 clause 4.2.5.7 ‘Passenger-related items — Inter-unit doors’.

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

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

3.7.1 The key safety hazards or risks to be mitigated are finger traps and tripping hazards. A European standard EN 16286:2013 has been published and provides a presumption of conformity with the requirements of the LOC&PAS TSI.

3.7.2 The PRM TSI sets out the minimum clearway from the vehicle entrance through the vehicle. This also applies for the minimum access size of gangways on passenger-carrying rail vehicles where the passage of wheelchairs is envisaged.

3.8 Strength of vehicle structure

4.2.2.4 Strength of vehicle structure

(3) The static and dynamic strength (fatigue) of vehicle bodies is relevant to ensure the safety required for the occupants and the structural integrity of the vehicles in train and in shunting operations. Therefore, the structure of each vehicle shall comply with the requirements of the specification referenced in Appendix J-1, index 7. The rolling stock categories to be taken into account shall correspond to category L for locomotives and power head units and categories PI or PII for all other types of vehicle within the scope of this TSI, as defined in the specification referenced in Appendix J-1, index 7, clause 5.2.

(7) The assumptions for aerodynamic loading shall be those described in clause 4.2.6.2.2 of this TSI (passing of 2 trains).

3.8.1 The scope of the standard referenced by the TSI (BS EN 12663) is strictly limited to the vehicle bodyshell. The effect of acceleration on the equipment is therefore limited to the points of attachment to the vehicle body.

3.8.2 It is accepted practice to use the vehicle body equipment acceleration proof, ultimate and fatigue loads for the design of the equipment or fitments (for example interior panelling) and in recognition of this GMRT2100 Part 3 sets out the requirements for such items that are consistent with the vehicle body requirements. The acceleration values are given in BS EN 12663-1 Tables 13, 14 and 15 for proof and Tables 16 and 17 for fatigue.

3.8.3 BS EN 12663 clause 6.6.5 specifies aerodynamic loading on the carbody in very general terms and does not give specific pressure loadings. The LOC&PAS TSI therefore directs the vehicle body design to apply the head pressure pulse specified in clause 4.2.6.2.2 of the LOC&PAS TSI. The resulting aerodynamic load is to be considered in the design, where relevant (for example, fairings, doors and windows).
3.8.4 Due to the closer track centre spacing used in GB, a specific case exists for a higher GB head pressure pulse limit (see guidance on clause 4.2.6.2.2 at 3.29.2).

3.8.5 It is also recommended that the quasi-static pressure loadings set out in GMRT2100 are also taken into account.

3.9 Passive safety

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<tr>
<td>4.2.2.5 Passive safety</td>
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<td>(1) The requirements specified in this clause apply to all units, except to units not intended to carry passengers or staff during operation and except to OTMs.</td>
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<td>(5) Passive safety is aimed at complementing active safety when all other measures have failed. For this purpose, the mechanical structure of vehicles shall provide protection of the occupants in the event of a collision by providing means of:</td>
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<td>— limiting deceleration</td>
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<td>— maintaining survival space and structural integrity of the occupied areas</td>
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<td>— reducing the risk of overriding</td>
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<td>— reducing the risk of derailment</td>
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<td>— limiting the consequences of hitting a track obstruction.</td>
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To meet these functional requirements, units shall comply with the detailed requirements specified in the specification referenced in Appendix J-1, index 8 related to crashworthiness design category C-I (as per the specification referenced in Appendix J-1, index 8, Table 1 Section 4), unless specified otherwise below.

The following four reference collision scenarios shall be considered:
- Scenario 1: A front end impact between two identical units,
- Scenario 2: A front end impact with a freight wagon,
- Scenario 3: An impact of the unit with a large road vehicle on a level crossing,
- Scenario 4: An impact of the unit into a low obstacle (e.g. car on a level crossing, animal, rock etc.).

These scenarios are described in table 2 of Section 5 of EN 15227:2008.

3.9.1 The LOC&PAS TSI uses the term passive safety; in GB this is more commonly known as the vehicle structural crashworthiness. GB standards, in particular GMRT2100, deal with both vehicle structural crashworthiness and also interior passive safety. Interior passive safety is addressed further in the LOC&PAS TSI in section 7.5.2.1.

3.9.2 The LOC&PAS TSI clause 4.2.2.5 sets out a number of open points with respect to heavy haul freight locomotives with centre couplers and also locomotives with centre cabs. For operation on the GB mainline railway there are no NTRs to close the open points. A revision to BS EN 15227:2008+A1:2010 is in preparation to close the open points.
3.10 Lifting and jacking

**LOC & PAS TSI**

4.2.2.6 Lifting and jacking

(7) The geometry of permanent built-in jacking/lifting points shall be compliant with the specification referenced in Appendix J-1, index 9, clause 5.3; the geometry of removable jacking/lifting points shall be compliant with the specification referenced in Appendix J-1, index 9, clause 5.4.

3.10.1 Since publication of the LOC&PAS TSI, BS EN 12663-1 has been revised and BS EN 16404:2016 published to provide a more consistent set of requirements that enable compliance with generic lifting regulations to be demonstrated.

3.11 Fixing of devices to car body structure

**LOC & PAS TSI**

4.2.2.7 Fixing of devices to car body structure

(3) Fixed devices including those inside the passenger areas, shall be attached to the car body structure in a way that prevents these fixed devices becoming loose and presenting a risk of passenger injuries or lead to a derailment. To this aim, attachments of these devices shall be designed according to the specification referenced in Appendix J-1, index 12, considering category L for locomotives and category P-I or P-II for passenger rolling stock.

Alternative normative documents may be used under the same conditions as defined in clause 4.2.2.4 above.

7.5.2.1 Additional requirements for security reason

7.5.2.1. Additional requirements for security reasons

The interior of vehicles interfacing with passengers and train crew should provide protection of the occupants in the event of a collision by providing means of:

— minimising the risk of injury due to secondary impact with such furniture and interior fixtures and fittings

— minimising those injuries that may preclude subsequent escape

Some EU research projects have been launched in 2006 to study the consequence of railway accidents (collision, derailment…) on passengers, to evaluate in particular the risk and level of injuries; the objective is to define requirements and corresponding conformity assessment procedures related to the railway vehicles interior layouts and components.

This TSI already provides a number of specifications in order to cover such risks, for example, Sections 4.2.2.5, 4.2.2.7, 4.2.2.9 and 4.2.5.

More recently, studies have been launched at Member State level and at European level (by the Commission joint research centre) regarding the protection of the passengers in the event of terrorist attack.
The Agency will follow these studies, and will consider their outcome to define if additional basic parameters or requirements covering the risk of injuries of passengers in case of accident or terrorist attack shall be recommended to the Commission. Where appropriate this TSI shall be amended.

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.

3.11.1 The issue of interior passive safety was introduced into the previous conventional rail (CR) LOC&PAS TSI by GB and discussed in the European Union Agency for Railways working party. European research has supported the GB view on the importance of interior passive safety.

3.11.2 In addition, a number of Member States have been investigating means of reducing the impact of terrorism attacks and whether rail relevant design can mitigate such effects.

3.11.3 The LOC&PAS TSI has therefore included an explanation of this work within chapter 7.

3.11.4 In accordance with LOC&PAS TSI clause 7.5.2.1, GMRT2100 sets out NTRs for this purpose, in particular Part 6 and its associated appendices. A supporting guidance note, GMGN2687, gives further background information on this topic.

3.12 Mechanical characteristics of glass (other than windscreens)

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 standards 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.

3.12.1 This is a hidden open point in the LOC&PAS TSI. The Comité Européen Normalisation (CEN) TC256 Working Group 49 has been created to develop standards in the areas of bodyside windows and interior glazing, and suitable standards will be published in due course.

3.12.2 Suitable standards setting out requirements to support this hidden open point are GMRT2100 (Part 5 for bodyside glazing and Part 6 for interior glazing) and, for on-track machines (OTMs), GMRT2400.

3.13 Load conditions and weighted mass

4.2.2.10 Load conditions and weighted mass

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

3.13.1 BS EN 15663:2009 was developed for passenger-carrying vehicles and therefore there are no mass definitions applicable to OTMs. Typically, the definition ‘design mass in working order’ is used for OTMs in...
GB to determine route availability (RA number) in accordance with GERT8006. For OTM this is the mass of the vehicle at its maximum design weight, as some OTM vehicles have a considerable load carrying capacity and such vehicles may be dealt with as if they were freight vehicles.

3.14 Gauging

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<td>4.2.3 Track interaction and gauging</td>
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<td>4.2.3.1 Gauging</td>
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(1) This clause concerns the rules for calculation and verification intended for sizing the rolling stock to run on one or several infrastructures without interference risk.

For units designed to be operated on other track gauge(s) than 1 520 mm system:

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

(3) The compliance of a unit with this intended reference profile shall be established by one of the methods set out in the specification referenced in Appendix J-1, index 14.

During a transitional period ending 3 years after the date of application of this TSI, for technical compatibility with the existing national network it is permissible for the reference profile of the unit to alternatively be established in accordance with the national technical rules notified for this purpose.

This shall not prevent the access of TSI compliant rolling stock to the national network.

(4) In case the unit is declared as compliant with one or several of the reference contours 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 14, compliance shall be established by the kinematic method as set out in the specification referenced in Appendix J-1, index 14.

The compliance to those reference contour(s) shall be recorded in the technical documentation defined in clause 4.2.12 of this TSI.

(5) For electric units, the pantograph gauge shall be verified by calculation according to the specification referenced in Appendix J-1, index 14, clause A.3.12 to ensure that the pantograph envelope complies with the mechanical kinematic pantograph gauge which in itself is determined according to Appendix D of TSI ENE, and depends on the choice made for the pantograph head geometry: the two permitted possibilities are defined in clause 4.2.8.2.9.2 of this TSI. The voltage of the power supply is considered in the infrastructure gauge in order to ensure the proper insulation distances between the pantograph and fixed installations. (6) The pantograph sway as specified in clause 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 14.

7.3.2.2 Specific case the United Kingdom (Great Britain) (‘P’)

For technical compatibility with the existing network it is permissible for the profile of the upper and the lower part of the unit together with the pantograph gauge to alternatively be established in accordance with the national technical rules notified for this purpose.

This specific case does not prevent the access of TSI compliant rolling stock to the national network.
3.14.1 Because of the need to exploit the maximum available gauge on the GB infrastructure, limited clearances are exploited. The more generous clearances provided by the method set out in BS EN 15273-3:2013 do not enable an economic solution and therefore a GB specific case exists.

3.14.2 The GB specific case references the use of NTRs to enable the use of alternative gauging methodologies (including absolute gauging and comparative gauging) not set out in BS EN 15273-3:2013. For the determination of the size of rolling stock and the method of determining compatibility with the mainline railway infrastructure, GMRT2173 sets out the methodology for this purpose combined with GERT8273 and GERT8073 and the relevant NTRs for application on the GB mainline network.

3.14.3 The LOC&PAS TSI does not mandate the size of the rolling stock; it only deals with the method of calculating compliance to the selected gauge profile. The statement ‘this specific case does not prevent the access of TSI compliant rolling stock to the national network’ does not prevent an entity / actor from calculating compliance to the GB national network using the method of Appendix J-1, index 14.

3.15 Axle load and wheel load

### LOC & PAS TSI

4.2.3.2 Axle load and wheel load

4.2.3.2.1 Axle load parameter

(1) The axle load is an interface parameter between the unit and the infrastructure. The axle load is a performance parameter of the infrastructure specified in clause 4.2.1 of the INF TSI and depends on the traffic code of the line. It has to be considered in combination with the axle spacing, with the train length and with the maximum allowed speed for the unit on the considered line.

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

— The mass per axle (for each axle) for the three load conditions (as defined and required to be part of the documentation in clause 4.2.2.10 of this TSI).

— The position of the axles along the unit (axle spacing).

— The length of the unit.

— The maximum design speed (as required to be part of the documentation in clause 4.2.8.1.2 of this TSI).

(3) Use of this 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 has to be defined by the railway undertaking as required in clause 4.2.2.5 of the TSI OPE, considering the expected load for the intended service (not defined when the unit is assessed). The axle load in load condition ‘design mass under exceptional payload’ represents the maximum possible value of the axle load mentioned above. The maximum load considered for the design of the brake system defined in clause 4.2.4.5.2 has also to be considered.

3.15.1 Rolling stock load conditions in the LOC&PAS TSI are used for many different purposes, related mainly to rolling stock design and its interface to infrastructure. For design purposes, load conditions, as set out in BS EN 15663:2009, are referred to throughout the LOC&PAS TSI. The load conditions are, for example, used to define dimensioning criteria for structural strength of the carbody, passive safety, running gear, traction and braking performance.
When it comes to the interface with infrastructure, the load carrying capacity of infrastructure gives the limiting value of the axle load of the rolling stock. This load is required to be the maximum load the infrastructure will be subject to. In Annex E of the Infrastructure (INF) TSI the limiting values used in the design of infrastructure are given as a combined parameter of speed / axle load with load models (axle spacing, unit length) as set out in BS EN 15528:2008+A1:2012.

For GB, the method to demonstrate compatibility between rolling stock and the infrastructure, in particular when operating over underline bridges, is set out in GERT8006 and will need to be applied when operating on the GB mainline network. GERT8006 is not a national rule applicable to rolling stock; however, it can be used as part of the route compatibility process in accordance with GERT8270. The INF TSI sets out a specific case to mandate the application of GERT8006, thus avoiding the need to reassess all bridges in accordance with BS EN 15528:2008+A1:2012.

### 3.16 Compatibility with train detection systems

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<td>4.2.3.3 Rolling stock parameters which influence ground based systems</td>
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<td>4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems</td>
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(1) For units designed to be operated on other track gauges than the 1 520 mm system, the set of rolling stock characteristics for compatibility with train detection target systems are given in clauses 4.2.3.3.1.1, 4.2.3.3.1.2 and 4.2.3.3.1.3.

Reference is made to clauses of the specification referenced in Appendix J-2, index 1 of this TSI (also referenced in Annex A, Index 77 of CCS TSI).

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

The set of parameters in order to be compatible with train detection systems, such as track circuits, axle counters and loop systems, has been identified in the LOC&PAS TSI with references to the Control Command and Signalling (CCS) TSI for each parameter and type of train detection system and their characteristics.

The rolling stock / control command and signalling interface requirements relating to train detection have been removed from the CCS TSI and replaced by a separate document ERA/ERTMS/033281 referenced as Index 77.

The LOC&PAS TSI requirement is for a declaration where the rolling stock complies with the criteria set out in Index 77. It is only those criteria where compliance is demonstrated which are to be recorded in the European Register of Authorised Types of Vehicles (ERATV). Rolling stock is permitted to be non-compatible with the Index 77 train detection specification.

However, there remains the requirement to demonstrate compatibility with all those train detection systems over which the vehicles will operate. Compliance with an NTR, if available, would be a means of demonstrating compatibility where it can also be demonstrated that the infrastructure is compatible with a reciprocal rule. GERT8270 sets out the process for demonstrating compatibility.
3.16.5 Vehicle characteristics for compatibility with a train detection system based on-track circuits on the existing GB mainline railway are set out in national rules contained within the following standards:

a) Vehicle geometric spacing of wheelsets covered by compliance with GMRT2173.

b) Vehicle design requirements for the electrical resistance of wheelsets covered by compliance with GMRT2466.

c) Isolating emission (avoiding rail head contamination) compatibility of sanding systems covered by compliance with GMRT2461.

d) Requirements associated with EMC interference levels arising from traction currents are set out in GERT8015. Note: GERT8015 is in the process of being withdrawn and replaced by GERT8076.

3.16.6 Vehicle characteristics for compatibility with a train detection system based on axle counters on the existing GB mainline railway are set out in national rules contained within the following standards:

a) Vehicle geometric spacing of wheelsets covered by compliance with GMRT2173.

b) Wheel geometric requirements covered by compliance with GMRT2466.

c) Vehicle design – wheel materials covered by compliance with GMRT2466.

d) Vehicle design – metal free spaces around wheels – there are currently no GB requirements. BS EN 50238:2003 contains Figure A.22 in informative Annex A.9 illustrating the area in which mechanical parts of vehicles may have an influence on wheel detectors.

e) Electromagnetic compatibility (EMC) interference levels for eddy current or magnetic track brakes – there are currently no GB requirements.

3.16.7 There are currently no GB compatibility requirements for train detection system based on loop equipment.
3.17 Axle bearing condition monitoring

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<td>4.2.3.3.2 Axle bearing condition monitoring</td>
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(1) Axle bearing condition monitoring objective is to detect deficient axle box bearings.

(2) For units of maximum design speed higher than or equal to 250 km/h, on board detection equipment shall be provided.

(3) For units of maximum design speed lower than 250 km/h, and designed to be operated on others track gauge systems than the 1 520 mm system, axle bearing condition monitoring shall be provided and be achieved either by on board equipment (according to specification in clause 4.2.3.3.2.1) or by using track side equipment (according to specification in clause 4.2.3.3.2.2).

(4) The fitment of on board system or/and the compatibility with track side equipment shall be recorded in the technical documentation described in clause 4.2.12 of this TSI.

4.2.3.3.2.2. Rolling stock requirements for compatibility with trackside equipment

(1) For units designed to be operated on the 1 435 mm system, the zone visible to the trackside equipment on rolling stock shall be the area as defined in the specification referenced in Appendix J-1, index 15.

7.3.2.3 Specific case the United Kingdom (Great Britain) (‘P’)

It is permissible to establish the compatibility with trackside equipment other than that defined in the specification referenced in Annex J-1, index 15. In such a case, the characteristics of the trackside equipment the unit is compatible with shall be described in the technical documentation (in accordance with point (4) of clause 4.2.3.3.2).

3.17.1 A target zone has been specified in the LOC&PAS TSI corresponding to the area detailed in BS EN 15437-1:2009.

3.17.2 The TSI sets out two methods of axle bearing deterioration detection, on-board (this being mandatory for units of maximum design speed higher than or equal to 250 km/h) or trackside. BS EN 15437-2:2012 sets out a suitable method for specifying an on-board detection system.

3.17.3 For units of maximum design speed lower than 250 km/h the choice of either on-board or trackside detection equipment is available. Where trackside detection equipment is selected, the TSI mandates the units shall be compatible with the requirements set out in BS EN 15437-1:2009.

3.17.4 However, the UK has a specific case to permit the use of alternative trackside detection equipment such as acoustic detection equipment. The current GB NTRs are set out in GERT8014 – these will be redrafted to include a set of compatibility rules for acoustic bearing detection. Until such rules are published, projects choosing to adopt such a system are required to determine their own rules.

3.18 Rolling stock dynamic behaviour

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The unit shall be designed to ensure safe running on twisted track, taking into account specifically the transition phase between canted and level track and cross level deviations.

(2) The conformity assessment procedure is described in clause 6.2.3.3 of this TSI.

This conformity assessment procedure is applicable for axle loads in the range of those mentioned in the clause 4.2.1 of the TSI INF and in the specification referenced in Annex J-1, index 16.

It is not applicable to vehicle designed for higher axle load, such cases may be covered by national rules or by the procedure for innovative solution described in article 10 and Chapter 6 of this TSI.

6.2.3.3. Safety against derailment running on twisted track (Clause 4.2.3.4.1)

(1) The demonstration of conformity shall be carried out in accordance with one of the methods specified in the specification referenced in Appendix J-1, index 83 as amended by the technical document referenced in Appendix J.2, index 2.

7.3.2.4 Specific case United Kingdom (Great Britain) ('P')

It is permissible for all units and cases to use Method 3 set out in EN14363:2005 clause 4.1.3.4.1. This specific case does not prevent the access of TSI compliant rolling stock to the national network.

3.18.1 The documents and clauses referenced in the TSI Annex J are:


3.18.2 BS EN 14363 has been extensively revised and the updated version was published in 2016. As the updated version was not available at the time of publication of the revised LOC&PAS TSI, the ERA published ERA/TD/2012-17/INT rev 3.0 (referenced as Annex J-2 index 2) to modify BS EN 14363:2005 to take into account the expected content of BS EN 14363:2016. Following reissue of BS EN 14363 it is anticipated that the ERA intends to withdraw ERA/TD/2012-17/INT rev 3.0 and update the references in the TSI to those relevant to BS EN 14363:2016. It would be appropriate to use BS EN 14363:2016 for future vehicle assessments.

3.18.3 There are three alternative methods described in BS EN 14363:2005 clause 4.1 (BS EN 14363:2016 clause 6.1.1) for the demonstration of derailment resistance when running on twisted track, and any one of the three provides evidence of compliance.

3.18.4 The limitation imposed on Method 3 in BS EN 14363:2005 clause 4.1.3.4.1 for the demonstration of derailment resistance when running on twisted track, is not applicable to GB. Great Britain has extensive experience of applying Method 3 to a range of vehicle, bogie and wheelset configurations. This specific case is a relaxation of the limitations imposed by the LOC&PAS TSI (that mandates the use of BS EN 14363:2005 clause 4.1.3.4.1) and is therefore not a barrier to interoperability.

3.18.5 The twist inputs specified in BS EN 14363:2005 Method 3 differ slightly from those specified in GMRT2141. This inconsistency has not been addressed by the revised BS EN 14363.

4.2.3.4.2 Running dynamic behaviour

4.2.3.4.2b) Requirements
This clause is applicable to units designed for a speed higher than 60 km/h, except to on-track machines for which the requirements are set out in Appendix C, clause C.3 and except units designed to be operated on the 1 520 mm track gauge for which the corresponding requirements are considered as ‘open point’.

The dynamic behaviour of a vehicle has a strong influence on running safety and track loading. It is an essential function for safety, covered by the requirements of this clause.

(a) Technical requirements

(3) 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 reference conditions set out in the technical document referenced in Appendix J-2, index 2.

This shall be assessed by verifying that limit values specified below in clauses 4.2.3.4.2.1 and 4.2.3.4.2.2 of this TSI are respected; the conformity assessment procedure is described in clause 6.2.3.4 of this TSI.

(4) The limit values and conformity assessment mentioned in point 3 are applicable for axle loads in the range of those mentioned in the clause 4.2.1 of the TSI INF and in the specification referenced in Annex J-1, index 16.

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

7.3.2.5 Specific case the United Kingdom (Great Britain) (‘P’)

For technical compatibility with the existing network it is permissible to use national technical rules amending EN 14363 and the ERA/TD/2012-17/INT requirements and notified for the purpose of running dynamic behaviour. This specific case does not prevent the access of TSI compliant rolling stock to the national network.

### 3.18.6 The documents and clauses referenced in the TSI Annex J are:


3.18.7 BS EN 14363:2005 has been extensively revised and the updated version was published in 2016. As the updated version was not available at the time of publication of the revised LOC&PAS TSI, the European Union Agency for Railways published ERA/TD/2012-17/INT rev 3.0 (referenced as Annex J-2 index 2) to modify BS EN 14363:2005 to take into account the expected content of BS EN 14363:2016. The European Union Agency for Railways intends to withdraw ERA/TD/2012-17/INT rev 3.0 and update the references in the TSI to those relevant to the updated BS EN 14363:2016. It would be appropriate to use BS EN 14363:2016 for future vehicle assessments.

3.18.8 The LOC&PAS TSI mandates that rolling stock is tested for its running dynamic behaviour according to the procedures set out in BS EN 14363:2005, but as modified by the technical report ERA/TD/2012-17/INT rev 3.0. Limit values for running safety include the transverse track shifting forces, quotient of the transverse and vertical forces of the wheel, the instability criterion and, in addition, the overturning criterion applicable to tilting trains (and other trains operating with higher than normal cant deficiency).

3.18.9 The LOC&PAS TSI prescribes that the process set out in BS EN 14363:2005 clause 5, but as modified by the technical report ERA/TD/2012-17/INT rev 3.0, is followed in order to verify the running characteristics of rolling stock.

3.18.10 The UK (GB) has a specific case that permits the use of national rules for the purpose of running dynamic behaviour.
3.18.11 ERA/TD/2012-17/INT rev 3.0 states that BS EN 14363:2005 allows ‘to deviate from the rules laid down if evidence can be furnished that safety is at least the equivalent to that ensured by complying with these rules’. This permitted deviation is included in BS EN 14363:2016. Both the 2005 version (amended by technical report ERA/TD/2012-17/INT rev 3.0) and BS EN 14363:2016 permit testing for acceptance by national rules if it is not possible to meet the complete suite of test conditions. Both versions state ‘If the combination of all target test conditions is not completely achievable, compliance shall be demonstrated by assessing the vehicle against some missing target test conditions of BS EN 14363:2005 also by other means than described in BS EN 14363:2005.’

3.18.12 RSSB undertook a study that was published in 2016 titled ‘Comparison of the dynamic running behaviour assessment in GMRT2141 and EN 14363’. The work was initiated as a result of the implementation of the Rolling Stock sub-system Technical Specifications for Interoperability (TSIs) which contain requirements on running dynamic behaviour. The TSIs refer to on-track tests specified in EN 14363:2005 as the method to assess running dynamic behaviour, but also includes a GB Specific Case related to the scope of the assessment method. In addition, there is a need to assess the compatibility of new rolling stock with existing GB track; the existing GMRT2141 standard is notified for this purpose. At the moment it is therefore necessary for vehicles to be tested using the methods set out in both GMRT2141 and EN 14363, which is not necessarily an efficient use of industry resources. It is considered that this report provides the evidence of demonstration of ‘equivalent safety’, backed up by empirical evidence of fitness-for-purpose. The report is published on the RSSB SPARK website and is available to RSSB members.

3.18.13 BS EN 14363:2005 requires different procedures for testing, these are:

a) For new types of rolling stock, which have not yet been subject to testing, the requirement is to perform a complete on-track test.

b) For rolling stock of a similar type previously subject to testing as described in a), a partial test is permitted. This requires the existence of a ‘Reference Vehicle’ to which the new vehicle is compared. ERA/TD/2012-17/INT rev 3.0 clarifies that this includes vehicles approved in accordance with BS EN 14363:2005 or an equivalent standard. GMRT2141 is considered to be an equivalent standard for this purpose.

c) If the criteria set out in BS EN 14363:2005 are met, a dispensation from testing is permitted. In this case, LOC&PAS TSI open points regarding test track are not applicable; this dispensation from testing applies in those Member States where the ‘initial acceptance’ (as defined in BS EN 14363:2005) has been used.

d) Extension of approval, where a vehicle’s operating conditions or design are changed, may also not require further testing. Again, the ‘Reference vehicle’ may include those approved in accordance with GMRT2141 and, in this case, the safety factor \( \lambda \) cannot be calculated directly but is assumed as >1.1.

Note: GMRT2141 is currently undergoing revision to align with EN 14363:2016.

3.18.14 There are two methodologies for performing complete or partial on-track tests. These are the normal and simplified measuring methods and are as follows:

a) The normal method requires measurement of track forces, using load measuring wheels.

b) The simplified method requires measurement of lateral axlebox forces or measurement of accelerations only. The choice of the parameters to be measured depends on fulfilment of the criteria set out in BS EN 14363:2005.

3.18.15 The test conditions set out in BS EN 14363:2005 Annex C deal with track geometry and track quality. The requirements for track geometry define the straight and curved track sections on which the rolling stock has to be tested, including required combinations of test speed and curve radii. It is recognised that it may not be practical to meet all the requirements and these have been modified by ERA/TD/2012-17/INT rev 3.0. Some key points are given here but the full document is relevant:

a) The track quality requirement is now expressed in accordance with BS EN 13848-5:2008+A1:2010 and it is noted that Tables 3 and 4 (of ERA/TD/2012-17/INT rev 3.0) contain requirements for international approval. For local, national or multinational operation the values may be varied. Normal GB track is
believed to meet the requirements of these tables but the exception for local or national operation could be used, if required.

b) Representative wheel-rail contact conditions are used during testing but no specific ranges of equivalent conicity are specified for the majority of tests. For the stability test, values of equivalent conicity are given and these are to be met or exceeded on the used track section.

c) ERA/TD/2012-17/INT rev 3.0 allows for the assessment criteria Y/Q to be evaluated by an alternative statistical method.

d) The Yqst criterion (quasi-static guiding force) has been defined differently in ERA/TD/2012-17/INT rev 3.0, taking into account the mean curve radii.

3.18.16 In order to fill the open points, GMRT2141 sets out the NTRs for this purpose. The open point applies specifically to the test conditions and the test track quality, but not the method of assessment of the gathered data. Traditionally, GB has specified within GMRT2141, Appendix D ‘representative’ track that is towards the lower end of the range of track conditions experienced on the GB mainline railway, which would typically include testing over sections of jointed track. The outputs of the EU funded DynoTrain project delivered requirements for track quality for on-track testing and these are now incorporated in the ERA/TD/2012-17/INT rev 3.0 and EN 14363:2016.

3.18.17 The analysis method set out in BS EN 14363:2005 is statistical and therefore requires a minimum number of track sections (lengths, as set out in BS EN 14363:2005) for the results to be statistically significant. BS EN 14363:2005 specifies four test zones:

a) Zone 1 straight track (defined as cant deficiency < 40 mm).

b) Zone 2 large radius curves (maximum speed and maximum cant deficiency - no radius range specified).

c) Zone 3 small radius curves (radii from 400 m to 600 m).

d) Zone 4 very small radius curves (radii from 250 m to 400 m radius).

3.18.18 The analysis is carried out separately in each zone and therefore a minimum number of sections are required to be available for each zone. ERA/TD/2012-17/INT rev 3.0 introduces an analysis method using multiple regression, which enables robust results to be obtained from a wider range of input conditions.

3.18.19 Great Britain has not in the past required testing on small radius curves, and the number of such curves of sufficient length on the mainline railway is low. ERA/TD/2012-17/INT rev 3.0 states that ‘Vehicles tested and assessed for a part of the test conditions specified may be verified for limited operation, in which case the operational limitations shall be clearly stated.’ Operation on the GB network could be such a limitation.

3.18.20 The speeds and cant deficiencies required are now addressed in the ERA/TD/2012-17/INT rev 3.0.

3.18.21 Where rolling stock of a similar design exists that meets the requirements of GMRT2141, the general interpretation is that the on-track element is permitted to be omitted due to the previous design having been tested over the GB representative track. A ‘similar design’ is defined within ERA/TD/2012-17/INT rev 3.0 and EN 14363:2016.

3.18.22 The track loading limit values are the quasi-static guiding forces, the quasi-static vertical wheel force and the maximum vertical wheel force. These are the main actions on the track, which has to withstand these loads. The safety and track loading limit values are only evaluated when performing a full test with instrumented wheelsets. The running safety in the simplified method is assessed using accelerometers or displacement transducers.

3.18.23 The methodology for gathering data of vehicle responses to running over a range of track conditions traditionally used in GB is different to that set out in BS EN 14363:2005. The methodology set out in GMRT2141 uses an alternative assessment: the ‘peak counting’ approach (commonly known as the ‘freight acceptance curve’). The approach used in BS EN 14363:2005 is a mean distribution assessment, where the ‘estimated maximum values’ are calculated from means and standard deviations (for one-
3.18.24 The LOC&PAS TSI requirement specifies the format of the track quality data. The test report is required to include the data regarding the track geometric quality as described in BS EN 13848-1:2003+A1:2008, together with the method used to collect this data.

3.18.25 Where it is necessary to perform an on-track test in order to verify the running characteristics of the rolling stock, the track quality the tests are performed on has to be recorded in the test report. This information is made available in the technical documentation. When a National Safety Authority (NSA) authorises the placing in service of the rolling stock, the NSA can request that the relevant IM and RU consult the information in order to deduce if further checks are necessary or if the rolling stock is compatible with the conditions that can be expected to be experienced on the specific network.

3.18.26 The Network Rail track recording vehicles routinely measure and record various parameters for the majority of the GB mainline railway. This data is in a format suitable for inclusion in the test report. The relevant parameters (see BS EN 13848-1:2003+A1:2008) are suggested as:

a) 1/8 mile (~200 m) standard deviations for 35 m top and alignment for lengths including the selected track sections.

b) Any level 2 exceedances in the relevant sections (noting that track far outside the normal can be excluded from the analysis).

Note: BS EN 13848-1:2003+A1:2008 uses the wavelength range from 3 m to 25 m; however, the Network Rail data is from 3 m to 35 m. There is an approximate scale factor in BS EN 14363:2005 Annex C to adjust for this difference and be shown in the test report, which range is reported.

3.18.27 It is not necessary to make a special track recording run as long as data is available within a reasonable timescale of the tests (before or after) and no significant track maintenance has been carried out and no significant deterioration would be expected. Ideally, track data should have been recorded within two weeks before or within two weeks after the test train was run, but a figure of two months before or after is more practical. This assumes that no significant work (grinding, tamping, renewal etc) has been carried out in between the measurement and test train running and confirmed by the IM.

### 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 clause 6.2.3.4 of this TSI, 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.

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 clause 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.
If the wheelset conicity complies with the maximum equivalent conicity the vehicle was designed and tested for, a joint investigation by the railway undertaking and the infrastructure manager shall be undertaken to determine the characteristics reason for the instability.

3.19.1 The wheel rail interface is fundamental for the running safety of a rail vehicle. The dynamic behaviour, especially the stability and the wheel rail forces, are driven by the equivalent conicity which depends on wheel and rail profiles as well as on the track gauge, the distance between the flange datum points and the rail inclination.

3.19.2 Design values are specified for the interface equivalent conicity of both wheel profile and track parameters, but the behaviour of this interface changes during the wheelset lifetime due to wear of wheel and rail profiles. Therefore, the interface has to be controlled by adequate maintenance measures on both infrastructure and rolling stock. Therefore, for GB, the NTRs are set out in GMRT2466. These technical rules contain wear limits for wheel profiles. Note: GMRT2466 is under revision to align with the TSI more closely.

3.19.3 The maintenance plan sets out the RUs or Entities in Charge of Maintenance (ECMs) procedures for maintaining wheelsets and wheel profiles. The procedures need to take account of the conicity ranges for which the vehicle is designed (see LOC&PAS TSI clause 4.2.3.4.3).

3.19.4 Wheelsets are required to be maintained to ensure (directly or indirectly) that the wheelset conicity remains within the approved limits for the vehicle. This is demonstrated when the wheelset is modelled passing over the representative samples of track test conditions (simulated by calculation) specified in the LOC&PAS TSI Table 1, which are relevant considering the local conditions of the network.

3.19.5 Normal GB practice is to monitor wheelsets in service for flange height and thickness and use these measurements, together with wheelset mileage, to manage (indirectly) the equivalent conicity for a given combination of vehicle and route.

3.19.6 If required, sample rail profile measurements can be requested from the IM, in order that equivalent conicity calculations of in-service conditions can be made.

3.19.7 In all cases, if ride instability is reported, it is appropriate for the RU to model the measured wheel profiles and distances between active faces of the wheels over the representative sample of track test conditions. These are specified in LOC&PAS TSI clause 6.2.3.6, which enables a check for compliance with the maximum equivalent conicity at which the vehicle is designed and certified to be stable.

3.19.8 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.

3.19.9 If both vehicle and track comply with the requirements of the LOC&PAS TSI and INF TSI, then a joint investigation by the RU and the IM is undertaken to determine the reason for the instability. This is normal GB practice.

3.20 Wheelsets

(1) For the purpose of this TSI, wheelsets are defined to include main parts ensuring the mechanical interface with the track (wheels and connecting elements: e.g. transverse axle, independent wheel axle) and accessories parts (axle bearings, axle boxes, gearboxes and brake discs).
(2) The wheelset shall be designed and manufactured with a consistent methodology using a set of load cases consistent with load conditions defined in clause 4.2.2.10 of this TSI.

4.2.3.5.2.1 MECHANICAL AND GEOMETRIC CHARACTERISTICS OF WHEELSETS

Mechanical behaviour of axles:

(2) The characteristics of the axle shall ensure the transmission of forces and torque.

The conformity assessment procedure is described in clause 6.2.3.7 of this TSI.


3.20.2 The wheel has been identified as an interoperability constituent (IC). Compliance with the requirements set out in LOC&PAS TSI clause 5.3.2 is deemed to be met by compliance with the referred clauses of BS EN 13979-1:2003+A2:2011. The LOC&PAS TSI clause 6.1.2.1 sets out the applicable assessment modules to demonstrate conformity.

3.20.3 The assessment of the IC wheel only (not the axle and hence not the wheelset) comprises several potential stages:

a) The first stage of the process is to perform a mechanical strength calculation and to evaluate against residual stress limit values.

b) The second stage, a bench test, is performed only when the residual stress determined by the mechanical strength calculation in stage one exceeds the residual stress limit values.

c) There is potentially a final third step to check the thermo-mechanical aspect, but under the condition that the wheel is intended to be used with tread brakes and wheel mounted brake discs.

d) The full-scale fatigue testing is required for the validation of the wheel material. This is only mandated by the LOC&PAS TSI when major changes are introduced in the process at the manufacture of the material or the wheel manufacturer changes the supplier of the material.

3.20.4 Only forged and rolled wheels are covered by the current published ENs. The TSI permits alternative standards for existing products using differing materials and GMRT2466 sets out the NTRs.

3.20.5 The LOC&PAS TSI mandates geometric dimensions for wheelsets. This provides a link to the CCS TSI to address two aspects. These are:

a) Detect ability of the train by train detection systems.

b) Compatibility with axle bearing condition monitoring equipment.

3.20.6 The LOC&PAS TSI and CCS TSI interface requirements relating to train detection have been removed from the CCS TSI and replaced by a separate document ERA/ERTMS/033281 referenced as Index 77. Index 77 is being incorporated into the revised CCS TSI. Currently Index 77 is written as a specification of target system(s) for train detection system(s) (track circuits, axle counters, loop equipment, sanding). Not all characteristics identified are required to be met for the safe operation of rolling stock on a line equipped with a particular train detection system. Therefore, the LOC&PAS TSI only mandates the recording of the
rolling stock characteristics in the ERATV; it does not mandate compliance with the requirements of Index 77.

3.20.7 For the type test, the LOC&PAS TSI requires that the wheelset dimensions are checked, in particular when the wheelset is subject to loading (the load conditions defined in LOC&PAS TSI clause 4.2.3.5.2). For this test, Annex H of the LOC&PAS TSI mandates that the dimensions are assessed only for one load case - design mass in working order.

3.21 Mechanical and geometric characteristics of wheels

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.3.5.2.1 MECHANICAL AND GEOMETRIC CHARACTERISTICS OF WHEELS</td>
</tr>
<tr>
<td>Geometrical dimensions of wheelsets</td>
</tr>
<tr>
<td>The dimensions AR and SR shall be complied with in laden and tare conditions. Smaller tolerances within the above limits may be specified by the manufacturer in the maintenance documentation for in-service values.</td>
</tr>
</tbody>
</table>

3.21.1 The values set out in the LOC&PAS TSI, for the dimensions, are the extreme values (limits). Maintenance limits are set to ensure that these extreme values are not exceeded.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.3.5.2.2 Mechanical and geometrical characteristics of wheels</td>
</tr>
<tr>
<td>Geometrical dimensions:</td>
</tr>
<tr>
<td>Table 2 text not reproduced</td>
</tr>
<tr>
<td>7.3.2.6 Specific case United Kingdom (Great Britain) ('P')</td>
</tr>
<tr>
<td>It is permissible for the geometrical dimensions of the wheels to alternatively be established in accordance with the national technical rule notified for this purpose.</td>
</tr>
<tr>
<td>This specific case does not prevent the access of TSI compliant rolling stock to the national network.</td>
</tr>
</tbody>
</table>

3.21.2 The minimum values mandated by the LOC&PAS TSI ensure compatibility, both with the use of axle counters and with points and crossings. GB experience shows that wheelsets can be operated to a minimum wheel rim width of 127 mm on the GB mainline network. All other limits mandated by the GMRT2466, in particular wheel diameter, apply to enable safe negotiation of obtuse crossing.

3.21.3 In addition, GMRT2466 sets out a methodology for maintaining compatibility of GB wheel profiles with obtuse crossing geometry.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>6.2.3.7. Mechanical and geometric characteristics of wheelsets (clause 4.2.3.5.2.1)</td>
</tr>
<tr>
<td>Wheelset:</td>
</tr>
<tr>
<td>(8) Particular case of wheelsets, axles and axle boxes/bearings manufactured according to an existing design:</td>
</tr>
</tbody>
</table>
In the case of products manufactured according to a design developed and already used to place products on the market before the entry into force of relevant TSIs applicable to those products, the applicant is allowed to deviate from the conformity assessment procedure above, and to demonstrate conformity with the requirements of this TSI by referring to design review and type examination performed for previous applications under comparable conditions; this demonstration shall be documented, and is considered as providing the same level of proof as module SB or design examination according to module SH1.

3.21.4 The LOC&PAS TSI permits the use of existing proven designs for wheelsets where no European standard exists. This was included to permit the use, for example, of inboard axle bearing assemblies, for which there is no European standard. BS 8535:2011 Railway applications – Wheelsets and bogies – Powered and non-powered axles with inboard bearings – Design method, is such a standard and provides a presumption of conformity to the TSI generic wheelset requirements. Similarly, the GB standard BS 5892:2014 Part 7: Specification for product and technical approval requirements for cast wheels, is a similar case and is also permitted under this clause.

3.22 Braking

This interface between Infrastructure and Rolling stock is covered by the clause 4.2.6.2 of the OPE TSI.

4.2.6.2 states

Braking performance and maximum speed allowed

(1) The infrastructure manager shall provide the railway undertaking with all relevant line characteristics for each route:

— signalling distances (warning, stopping) containing their inherent safety margins,
— gradients,
— maximum permitted speeds, and
— conditions of use of braking systems possibly affecting the infrastructure such as magnetic, regenerative and eddy-current brake.

(2) Additionally, the infrastructure manager may provide the following information:

(i) for trains able to run at a maximum speed higher than 200 km/h, deceleration profile and equivalent response time on level track;

(ii) for trainsets or for fixed train compositions, unable to run at a maximum speed higher than 200 km/h, deceleration (as above in (i)) or brake weight percentage;

(iii) for other trains (variable compositions of trains unable to run at a maximum speed higher than 200 km/h): brake weight percentage.
If the infrastructure manager provides the above mentioned information, it shall be made available to all RUs who intend to operate trains on its network. The braking tables already in use and accepted for the existing lines at the date of entry into force of the present regulation shall also be made available.

(3) The railway undertaking shall, in the planning stage, determine the braking capability of the train and corresponding maximum speed taking into account:

— the relevant line characteristics as expressed in point (1) above or, if available, the information provided by the infrastructure manager in accordance to point (2) above. If the infrastructure manager has provided the information of point (2), the railway undertaking has to express the braking capability by using the same information, and

— the rolling-stock-related margins derived from reliability and availability of the braking system.

Furthermore, the railway undertaking shall ensure that during operation each train achieves at least the necessary braking performance. The railway undertaking shall set up and implement corresponding rules and shall manage them within its safety management system.

In particular the railway undertaking has to set up rules to be used if a train does not reach the necessary braking performance during operation. In this case, the railway undertaking must immediately inform the infrastructure manager. The infrastructure manager may take appropriate measures to reduce the impact on the overall traffic on its network.

3.22.1 The braking performance of rolling stock needs to be compatible with the signal spacing of the infrastructure. In GB the braking performance requirements are set out by a compatible standard based on signalling distances.

3.22.2 For GB Class B signalling systems (non-European Rail Traffic Management System (ERTMS) equipped routes) the minimum signalling distances are set out in GKRT0075. This document sets out the rules to extend and reduce the signalling distances depending on the line gradient.

3.22.3 For compatibility with the GB signalling distances, GMRT2045 sets out the level track brake performance requirements for rolling stock.

3.22.4 GMRT2045 contains, within Appendix F, guidance on the braking requirements in the LOC&PAS TSI. For the avoidance of duplication, it is not included in this document.

3.22.5 Guidance is therefore only included where the LOC&PAS TSI references a GB specific case.

4.2.4.5.2 Emergency braking

Calculation of the deceleration:

(3) For all units, the emergency braking performance calculation shall be performed in accordance with the specification referenced in Appendix J-1, index 26; the deceleration profile and stopping distances at the following initial speeds (if lower than the maximum design speed of the unit) shall be determined: 30 km/h; 100 km/h; 120 km/h; 140 km/h; 160 km/h; 200 km/h; 230 km/h; 300 km/h; maximum design speed of the unit.

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

The specification referenced in Appendix J-1, index 25, clause 5.12 specifies how other parameters (brake weight percentage (lambda), braked mass) can be derived from the calculation of the deceleration or from the stopping distance of the unit.
7.3.2.7 Specific case United Kingdom (Great Britain) (‘P’)

It is permissible for units assessed in fixed or predefined formation of design maximum speed higher or equal to 250 km/h, for the stopping distance in case of ‘emergency braking performance in normal mode’ to deviate from the minimum values specified in point (9) of clause 4.2.4.5.2.

3.22.6 The compatibility assessment between the GB lineside signalling and rolling stock brake performance is carried out in terms of stopping distances, as set out in GKRT0075 and GMRT2045.

3.22.7 Currently, for units in general operation on the GB mainline railway, there is no need to determine the braked weight percentage. For compatibility with GERT8000 and the Total Operation Processing System (TOPS), GMRT2045 sets out the method to calculate the brake performance of units.

3.22.8 However, with the introduction of ERTMS, determination of Lambda (braked weight percentage) will be required for vehicles used in general operation. GMRT2045 specifically highlights the need to determine different braking data for ERTMS operation.

3.22.9 To support the GB Specific Case, the requirements set out in GMRT2045 are the GB NTRs.

3.23 Passenger alarm

4.2.5.3 Passenger alarm: functional requirements

(3) At the triggering of the passenger alarm, both visual and acoustic signs shall indicate to the driver that one or more passenger alarms have been activated.

(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.

(5) On the driver’s initiative, the system shall allow a communication link to be established between the driver’s cab and the place where the alarm(s) was/were triggered for units designed for operation without staff on-board (other than driver). For units designed for operation with staff on-board (other than driver), it is permitted to have this communication link established between the driver’s cab and the staff on-board. The system shall allow the driver to cancel this communication link on his initiative.

(6) A device shall enable the crew to reset the passenger alarm.

3.23.1 Since publication of the LOC&PAS TSI, BS EN 16334:2014 Railway applications – Passenger Alarm System – System requirements, has been published and compliance with this standard provides a presumption of conformity with the TSI.

3.23.2 Further guidance is given in GMRT2045.

3.24 Communication devices for passengers
(1) This clause applies to all units designed to carry passengers and units designed to haul passenger trains.

(2) Units designed for operation without staff on-board (other than driver) shall be equipped with a ‘communication device’ for passengers to inform a person who can take appropriate action.

(3) The requirements to the location of the ‘communication device’ are the ones applicable for the passenger alarm as defined in clause 4.2.5.3 ‘Passenger alarm: functional requirements’.

(4) The system shall allow the communication link to be requested on the initiative of the passenger. The system shall allow the person receiving the communication (e.g. driver) to cancel this communication link at his initiative.

(5) The ‘communication device’ interface to passengers shall be indicated by a harmonised sign, shall include visual and tactile symbols and shall emit a visual and audible indication that it has been operated. These elements shall be in accordance with the PRM TSI.

3.24.1 Since publication of the LOC&PAS TSI, BS EN 16683:2015 Railway applications — Call for aid and communication device — Requirements, has been published and compliance with this standard provides a presumption of conformity with the TSI.

3.24.2 The PRM TSI also contains requirements on call for aid and communication devices.

3.25 Exterior doors

4.2.5.5 Exterior doors: passenger access to and egress from rolling stock

4.2.5.5.1 General

(1) This clause applies to all units designed to carry passengers and units designed to haul passenger trains.

(2) Doors intended for staff and freight are dealt with in clauses 4.2.2.8 and 4.2.9.1.2 of this TSI.

(3) The control of external passenger access doors is a function essential to safety; the functional and safety requirements expressed in this clause are necessary to ensure the safety level required.

3.25.1 Since publication of the LOC&PAS TSI, BS EN 14752:2015 has been published. Compliance with this standard provides a presumption of conformity with the LOC&PAS TSI. To augment this document to provide additional requirements for the standardisation of door operation within the GB rail industry, RIS-2747-RST – Functioning and Control of Exterior Passenger Doors on Vehicles is being produced.

3.26 Inter-unit doors

4.2.5.7 Inter-unit doors

(1) This clause is applicable to all units designed to carry passengers.
(2) Where a unit is equipped with inter-unit doors at the end of coaches or at unit-ends, they shall be fitted with a device that allows them to be locked (e.g. where a door is not connected by a gangway for use of passengers to an adjacent coach or unit, etc.).

3.26.1 The LOC&PAS TSI sets out limited requirements applicable to inter-unit doors. GMRT2130 sets out a number of requirements in this area, primarily to ensure escape from a vehicle is not impaired. Further requirements applicable to forces related to door operation are set out in the PRM TSI, while the structural capability requirements for internal doors are documented in GMRT2100.

3.27 Internal air quality

4.2.5.8 Internal air quality

(1) The quantity and quality of air provided inside the area of vehicles occupied by passengers and/or staff shall be such that no risk is developed to the health of passengers or staff additional to those resulting from the external ambient air quality. This is achieved by complying with the requirements set up below.

A ventilation system shall maintain an acceptable interior CO2 level under operational conditions.

(2) The CO2 level shall not exceed 5 000 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 10 000 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 clause 6.2.3.12.

3.27.1 The carbon dioxide (CO2) level is set to a maximum 5 000 ppm for normal operating conditions in order not to jeopardize the health of passengers and staff. The method to control the internal air quality is not specified.

3.27.2 In GB, the Health and Safety Executive has published guidance (see EH40/2005) which indicates this is a worst case limit and symptoms of drowsiness and headaches can occur at these levels. It is therefore recommended that a lower level is set as a target to achieve. The same requirements set out in LOC&PAS TSI clause 4.2.5.8 are also mandated for the cab environment via clause LOC&PAS TSI clause 4.2.9.1.7.

3.27.3 It is permitted to use systems with active carbon dioxide concentration control. Such systems can reduce the volume of fresh air in periods of low passenger occupation and will increase the fresh air intake at times of high occupation. These systems can be made much more energy efficient than traditional systems, especially for rolling stock, which has large deviations in occupation during the day.

3.27.4 A conventional system with a set fresh air volume intake that achieves the values set out in BS EN 13129-1:2002 is deemed to fulfil the requirements of the LOC&PAS TSI for minimum fresh air flow. For information, the fresh air flow volumes required by BS EN 13129-1:2002 are between 10 m³/h/seat and 20
3.28 Environmental conditions

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.6 Environmental conditions and aerodynamic effects</td>
</tr>
<tr>
<td>4.2.6.1 Environmental conditions - general</td>
</tr>
<tr>
<td>(1) Environmental conditions are physical, chemical or biological conditions external to a product and to which it is subjected to.</td>
</tr>
<tr>
<td>(2) The environmental conditions to which rolling stock is subjected to influence the design of rolling stock, as well as this of its constituents.</td>
</tr>
</tbody>
</table>

3.28.1 The LOC&PAS TSI mandates a set of environmental conditions which the vehicle is required to be compliant with. It is not necessary to design all aspects of a vehicle to meet the requirements set out in the LOC&PAS TSI, but to ensure that the functionality specified within all the clauses of the LOC&PAS TSI can be met.

3.28.2 The range of environmental conditions has been reduced from that contained within the previous conventional rail LOC&PAS TSI.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.6.1.1 Temperature</td>
</tr>
<tr>
<td>(1) Rolling stock shall meet the requirements of this TSI within one (or several) of the temperature ranges T1 (– 25 °C to + 40 °C; nominal), or T2 (– 40 °C to + 35 °C) or T3 (– 25 °C to + 45 °C) as defined in the specification referenced in Appendix J-1, index 34</td>
</tr>
<tr>
<td>(2) The selected temperature range (s) shall be recorded in the technical documentation described in clause 4.2.12 of this TSI.</td>
</tr>
<tr>
<td>(3) The temperature to consider for design purpose of rolling stock constituents shall take into account their integration in the rolling stock.</td>
</tr>
</tbody>
</table>

3.28.3 For rolling stock intended for operation on the GB mainline railway the temperature range T1 (– 25 °C to + 40 °C), as set out in BS EN 50125-1:1999, is the appropriate design value.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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</thead>
<tbody>
<tr>
<td>4.2.6.1.2 Snow, ice and hail</td>
</tr>
<tr>
<td>(1) Rolling stock shall meet the requirements of this TSI when subject to snow, ice and hail conditions as defined in the specification referenced in Appendix J-1, index 35, which correspond to the nominal conditions (range).</td>
</tr>
</tbody>
</table>

3.28.4 The conditions set out in the LOC&PAS TSI refer to ‘severe’ and ‘normal’ snow, ice and hail conditions. The ‘severe’ conditions are those more typically experienced in Nordic countries, and for certain extreme conditions it is often more appropriate to address such degraded conditions in GB with operational rules. For GB, the operational rules are set out in GERT8000; the rules contain restrictions for train operation.
during floods and snow. Additionally, GEGN8628 provides more detailed guidance on managing the effects of operating during winter weather conditions in GB.

3.29 Aerodynamic effects

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.6.2 Aerodynamic effects</td>
</tr>
<tr>
<td>4.2.6.2.1 Slipstream effects on passengers on platform and on workers trackside</td>
</tr>
</tbody>
</table>

(1) Units of maximum design speed \( v_{tr} > 160 \text{ km/h} \), running in the open air at a reference speed specified in Table 4, shall not cause the air speed to exceed the value \( u_2 \sigma \) as indicated in the Table 4 as measured at a height of 0.2 m and 1.4 m above top of rail at a distance of 3.0 m from the track centre, during the passage of the unit.

3.29.1 Following studies from the AeroTRAIN EU research project, the measurement of this aerodynamic effect is now not related to specific platform height; hence, the need for a GB specific case has been removed.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.6.2.2 Head pressure pulse</td>
</tr>
</tbody>
</table>

(1) The passing of two trains generates an aerodynamic load on each of the two trains. The requirement on head pressure pulse in open air allows defining a limit aerodynamic load induced by the rolling stock in open air assuming a track centre distance for the track where the train is intended to be operated.

The track centre distance depends on the speed and the gauge of the line; minimum values of track centre distance depending on speed and gauge are defined as per the INF TSI.

(2) Units with a maximum design speed higher than 160 km/h and lower than 250 km/h, running in the open air at their maximum speed shall not cause the maximum peak-to-peak pressure of changes to exceed a value of 800 Pa as assessed over the range of height between 1.5 m and 3.0 m above the top of rail, and at a distance of 2.5 m from the track centre, during the passage of the head.

(5) The conformity assessment procedure is described in clause 6.2.3.14 of this TSI.

7.3.2.8 Specific case United Kingdom (Great Britain) ('P')

Head pressure pulse (4.2.6.2.2): Units with a maximum operating speed higher than 160 km/h and lower than 250 km/h, running in the open air at their maximum operating speed shall not cause the maximum peak-to-peak pressure of changes to exceed a value as indicated in the national technical rule notified for this purpose.

3.29.2 The GB specific case has been included to recognise the reduced track centre spacing in use on the GB mainline railway. It also aligns with the GB specific case set out in the INF TSI.

3.29.3 The requirements set out in GMRT2100 apply and are the GB NTRs.

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<th>LOC &amp; PAS TSI</th>
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<tr>
<td>6.2.3.14 Head pressure pulse (clause 4.2.6.2.2)</td>
</tr>
</tbody>
</table>
(1) Conformity shall be assessed on the basis of full-scale tests under conditions specified in the specification referenced in Appendix J-1, index 95, clause 5.5.2. Alternatively conformity may be assessed by means of either validated Computational Fluid Dynamics (CFD) simulations as described in the specification referenced in Appendix J-1, index 95, clause 5.3 or as an additional alternative conformity is permitted to be assessed by moving model tests as specified in the specification referenced in Appendix J-1, index 95, clause 5.4.3.

3.29.4 A GB specific case exists that specifies different acceptance values (see guidance given for clause 4.2.6.2.2).

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.) a requirement for the characteristic pressure variation shall be met. The requirements are given in the Table 5.

3.29.5 The requirements only apply to trains with a design operating speed above 200 km/h (125 mph) and therefore have limited application in GB.

3.29.6 For GB, GMRT2100 sets out transitional pressure pulse limits to ensure train crew do not experience extremes of pressure variations and thus affect their ability to undertake operational duties.

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 higher than 140 km/h and 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 37 and subsequently recorded in the technical file as per clause 4.2.12.

(3) For units of maximum design speed equal to or higher than 250 km/h the crosswind effects shall be evaluated according to one of the following methods:
(a) determined and complying with the specification of the HS RST TSI 2008 clause 4.2.6.3, or
(b) determined by the assessment method of the specification referenced in Appendix J-1, index 37. The resulting characteristic wind curve of the most sensitive vehicle of the unit under assessment shall be recorded in the technical documentation as per clause 4.2.12.

3.29.7 There are two ‘hidden open points’ related to the cross-wind aerodynamic performance as follows:

3.29.8 Firstly, no requirement exists for units with maximum speed lower than 140 km/h. To address this hidden open point, GMRT2142 sets out the NTRs to be used for vehicles with a maximum speed lower that 140 km/h.

3.29.9 Secondly, the LOC&PAS TSI requires the characteristic wind curve to be determined in accordance with BS EN 14067-6:2010 for rolling stock with designed operating speeds within the range 140 – 250 km/h and the results recorded. It does not however mandate application of such curves.
3.29.10 Therefore the LOC&PAS TSI does not contain pass / fail criteria for the resistance of a rail vehicle to overturning in crosswinds. The RU is required to supply the characteristic wind curves (CWCs) to the IM, but the process of determining acceptability of the crosswind aerodynamic performance is undefined.

3.29.11 Alternatively, the LOC&PAS TSI permits the use of the methodology set out in the withdrawn High Speed Rolling Stock TSI for trains with speeds above 250 km/h and complying with the limits set out there.

3.29.12 To maintain compatibility with operating on the GB mainline network, GMRT2142 sets out requirements applicable for crosswinds and are the GB NTRs that address this second hidden open point.

3.29.13 Following input from CEN TC256 WG6 (Aerodynamics) the European Union Agency for Railways is proposing to raise the threshold speed to 250 km/h. No action is therefore required for units operating on the GB mainline network.

3.30 Head lights

3.30.1 The LOC&PAS TSI and BS EN 15153-1:2013 refer to full beam or reduced (dimmed) beam headlamps. In GB the equivalent terms used are daytime and night-time headlamps. The continental practice is to dip the full beam headlamp when passing oncoming trains, whereas the GB operational practice is to determine the type of headlamp to be used dependent on the time of operation.

3.30.2 In addition, in GB the main purpose of front end warning lights is to provide visibility of an approaching train. GMRT2131 sets out further background on the use of front end headlamps in GB.

3.30.3 The assessment of the headlight as an IC applies only to the lamp colour and luminous intensity. It is necessary for the alignment to be assessed when the headlamp is installed in the rolling stock subsystem to determine that, if lamp covers have been used, they do not affect performance.
3.31 Warning horn

LOC & PAS TSI

4.2.7.2.1 Horn (audible warning device) General

(3) The notes of the audible warning horns are intended to be recognisable as being from a train and not be similar to warning devices used in road transport or as factory or other common warning device.

4.2.7.2.2 Warning horn sound pressure levels

(1) The C weighted sound pressure level produced by each horn sounded separately (or in a group if designed to sound simultaneously as a chord) when integrated on the unit shall be as defined in the specification referenced in Appendix J-1, index 41.

(2) The conformity assessment procedure is specified in clause 6.2.3.17.

7.3.2.9 Specific case United Kingdom (Great Britain) (‘P’)

Vehicle for national use only may be compliant with the horn sound pressure levels as stipulated in the national technical rules notified for this purpose.

Trains intended for international use shall be compliant with the horn sound pressure levels as specified in clause 4.2.7.2.2 of this TSI.

This specific case does not prevent the access of TSI compliant rolling stock to the national network.

3.31.1 GMRT2131 provides guidance on typical tones for audible warning devices when used on the GB mainline network.

3.31.2 The GB specific case has been included to recognise the lower sound pressure levels mandated for vehicles that only operate on the GB mainline railway. The GB specific case does not apply to vehicles used for international operation. GMRT2131 sets out the NTRs and the sound pressure level requirements for horns used on GB rolling stock.

LOC & PAS TSI

5.3.9 Horns

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

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

3.31.3 The sound pressure level defined in LOC&PAS TSI clause 4.2.7.2.2 (noting the GB specific case in LOC&PAS TSI clause 7.3.2.12) is also required to be checked at rolling stock level for each application of the IC. This is to ensure that, when installed, the horn is not affected by the installation arrangements.

LOC & PAS TSI

6.1.3.6 Horn (clause 5.3.9)

(1) Soundings of the warning horn shall be measured and verified in accordance with the specification referenced in Appendix J-1, index 76, clause 6.
(2) Sound pressure levels of the warning horn on a reference vehicle shall be measured and verified in accordance with the specification referenced in Appendix J-1, index 76, clause 6.

3.31.4 The assessment of the warning horn as an IC applies only to the fundamental frequencies. It is necessary for the sound pressure levels to be assessed when the warning horn is installed in the rolling stock subsystem.

3.31.5 A GB specific case applies to the sound pressure levels, see guidance given for clause 4.2.7.2.2 of the LOC&PAS TSI.

3.32 Power supply

4.2.8.2 Power supply
4.2.8.2.1 General

(1) Requirements applicable to rolling stock, and which interface with the Energy subsystem are dealt with in this clause; therefore, this clause 4.2.8.2 applies to electric units.

(2) The TSI Energy specifies the following power systems: AC 25 kV 50 Hz system, AC 15 kV 16.7 Hz system, DC 3 kV system and 1.5 kV system. As a consequence, requirements defined below are related to these 4 systems only, and references to standards are valid for these 4 systems only.

7.3.2.10 Specific case United Kingdom (Great Britain) (‘P’)

It is permissible for electric units to be designed only for operation on lines equipped with the electrification system operating at 600/750 V DC as set out in the TSI ENE clause 7.4.2.8.1 and utilising ground level conductor rails in a three and/or four rail configuration; in that case the national technical rules notified for this purpose shall apply.

3.32.1 The LOC&PAS TSI clauses in 4.2.8.2 provide the rolling stock requirements for trains required to operate exclusively over TSI compliant electrified lines. For LOC&PAS TSI compliant rolling stock, compatibility with the existing non-TSI conforming GB 25 kV electrified infrastructure, additional requirements (due to the larger voltage drop) are set out in GMRT2111.

3.32.2 The design of rolling stock for other additional systems ‘voltage and frequency’ not described in the Energy TSI (ENE TSI) is not prohibited by the LOC&PAS TSI.

3.32.3 The specific case set out in the LOC&PAS TSI permits the procuring of new rolling stock that is only capable of operating on the 3rd and / or 4th rail GB DC rail systems.

3.32.4 The requirements for the compatibility with the 600 / 750 volt 3rd and 4th rail systems used on GB infrastructure are set out in GMRT2113.

4.2.8.2.5 Maximum current at standstill for DC systems

(1) For DC systems, the maximum current at standstill per pantograph shall be calculated and verified by measurement.
(2) Limit values are specified in clause 4.2.5 of the TSI Energy.

(3) The value measured and measurement conditions regarding the material of the contact wire shall be recorded in the technical documentation defined in clause 4.2.12.2 of this TSI.

3.32.5 This requirement only applies to ENE TSI compliant 1.5 kV DC and 3 kV DC overhead contact line (OCL) systems and these systems do not exist on the GB mainline railway.

**LOC & PAS TSI**

4.2.8.2.7 System energy disturbances for AC systems

(1) An Electric unit shall not cause unacceptable overvoltage and other phenomena described in the specification referenced in Appendix J-1, index 45, clause 10.1 (harmonics and dynamic effects) on the overhead contact line.

(2) A compatibility study shall be done in accordance with the methodology defined in the specification referenced in Appendix J-1, index 45, clause 10.3. The steps and hypothesis described in Table 5 of the same specification have to be defined by the applicant (column 3 ‘Concerned party’ not applicable), with input data presented as in Annex D of the same specification; the acceptance criteria shall be as defined in clause 10.4 the same specification.

(3) All hypothesis and data considered for this compatibility study shall be recorded in the technical documentation (see clause 4.2.12.2).

3.32.6 All the hypotheses of the mandated compatibility assessment have not yet been harmonised. For the compatibility assessment for operation over the GB mainline railway, the worst case OCL impedance expected to be experienced by the vehicle during that vehicle’s life is obtained from the IM.

3.32.7 GERT8270 sets out a method for assessing route compatibility of vehicles and infrastructure and supports the compatibility study detailed in BS EN 50388:2012 Railway Applications – Power supply and rolling stock – Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability, clause 10.3.

3.33 Energy consumption measuring function

**LOC & PAS TSI**

4.2.8.2.8 Energy consumption measuring function

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

(2) On-board energy measurement systems shall comply with requirements of the Appendix D of this TSI.

(3) This system is suitable for billing purposes; the data provided by it shall be accepted for billing in all Member States.

(4) The fitment of an on-board energy measurement system, and of its on-board location function shall be recorded in the technical documentation described in clause 4.2.12.2 of this TSI; the description of on-board to ground communication shall be part of the documentation.
(5) The maintenance documentation described in clause 4.2.12.3 of this TSI shall include any periodic verification procedure, in order to ensure the required accuracy level of the on-board energy measurement system during its lifetime.

### 3.33.1 The LOC&PAS TSI Annex D does not provide a complete set of requirements to enable energy meters to be used for billing purposes in GB. Section 5 On-board to Ground Communications is an open point and additional GB requirements are set out in GMRT2132.

### 3.34 Requirements linked to pantograph

#### LOC & PAS TSI

4.2.8.2.9 Requirements linked to pantograph

5.3.10. Pantograph

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

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

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

2. One of the 3 pantograph head geometries specified in clause 4.2.8.2.9.2.

3. The current capacity, as defined in clause 4.2.8.2.4.

4. The maximum current at standstill per contact wire of the overhead contact line for DC systems.

Note: the maximum current at standstill, as defined in clause 4.2.8.2.5, shall be compatible with the value above, considering the characteristics of the overhead contact line (1 or 2 contact wires).

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

6. Range of height for dynamic behaviour: standard, and/or for 1 520 mm or 1 524 mm track gauge systems.

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

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

6.1.3.7 Pantograph (clause 5.3.10)

(3) The dynamic behaviour of the pantograph regarding current collection shall be assessed by simulation according to the specification referenced in Appendix J-1, index 80.

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

6.2.3.21 Arrangement of pantographs (clause 4.2.8.2.9.7)

(1) The characteristics related to the dynamic behaviour of the current collection shall be verified as specified in clause 6.2.3.20 above.
3.34.1 The LOC&PAS TSI clauses in 4.2.8.2.9 provide the pantograph requirements for trains required to operate exclusively over TSI compliant electrified lines. LOC&PAS TSI compliant rolling stock is not necessarily compatible with the existing non-TSI conforming GB 25 kV electrified infrastructure. Compatibility requires compliance with additional requirements applicable to pantographs, as set out in GMRT2111. For this reason, there are a number of GB specific cases.

3.34.2 In addition, the process set out in GERT8270 would also apply to address compatibility with the variety of existing electrified infrastructure.

3.34.3 In connection with testing the pantograph in accordance with 6.2.3.21 of the TSI, this relates to pantograph combinations. The worst case combination should be tested on OLE that is representative of where the pantograph will operate.

3.34.4 Pantographs may be certified as a GB Intermediate Statement of Verification (ISV) where they meet the GB specific cases 7.3.2.13 and 7.3.2.14 of the LOC&PAS TSI. An ISV is equivalent to an IC as stated in the procedure referenced in Part 4 of this guidance note.

3.34.5 The wide range of OCL equipment wire heights on the GB infrastructure has necessitated a GB specific case to ensure the pantograph can operate over the extended range.

3.34.6 Requirements set out in GMRT2111 are the GB NTRs.

### Extract from LOC & PAS TSI

<table>
<thead>
<tr>
<th>4.2.8.2.9.1 WORKING RANGE IN HEIGHT OF PANTOGRAPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>The installation of a pantograph on an Electric unit shall allow mechanical contact from at least one of the contact wires at heights between:</td>
</tr>
<tr>
<td>- 4800 mm and 6500 mm above rail level for tracks designed in accordance with the gauge GC.</td>
</tr>
<tr>
<td>- 4500 mm and 6500 mm above rail level for tracks designed in accordance with the gauge GA/GB.</td>
</tr>
<tr>
<td>7.3.2.13 Specific case United Kingdom (Great Britain) (‘P’).</td>
</tr>
<tr>
<td>For technical compatibility with existing lines, the installation of a pantograph on an electric unit shall allow mechanical contact of the contact wires at the extended range of wire heights in accordance with the national technical rules notified for this purpose.</td>
</tr>
</tbody>
</table>

3.34.7 When assessing the pantograph at an IC level, it is necessary to take into account the GB specific case set out in LOC&PAS TSI clause 4.2.8.2.9.1.

### LOC & PAS TSI

<table>
<thead>
<tr>
<th>4.2.8.2.9.2 WORKING RANGE IN HEIGHT OF PANTOGRAPH (IC LEVEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Pantographs shall have a working range of at least 2 000 mm.</td>
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<tr>
<td>(2) The characteristics to be verified shall be in accordance with the requirements of the specification referenced in Appendix J-1, index 46.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>4.2.8.2.9.2 PANTOGRAPH HEAD GEOMETRY (IC LEVEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) For electric units designed to be operated on other track gauge systems than 1 520 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 clauses 4.2.8.2.9.2.1 and 2 below.</td>
</tr>
</tbody>
</table>
(2) For electric units designed to be operated solely on the 1 520 mm system, at least one of the pantograph(s) to be installed shall have a head geometry type compliant with one of the three specifications given in the clauses 4.2.8.9.2.1, 2 and 3 below.

(3) The type(s) of pantograph head geometry that an Electric unit is equipped with shall be recorded in the technical documentation defined in clause 4.2.12.2 of this TSI.

(4) The width of pantograph head shall not exceed 0.65 metres.

(5) Pantograph heads fitted with contact strips having independent suspensions shall be compliant with the specification referenced in Appendix J-1, index 47.

(6) Contact between contact wire and pantograph head is permitted outside the contact strips and within the whole conducting range over limited line sections under adverse conditions, e.g. coincidence of vehicle swaying and high winds.

Conducting range and the minimum length of contact strip are specified below as part of the pantograph head geometry.

7.3.2.14 Specific case United Kingdom (Great Britain) (‘P’) For operation on the existing network, it is allowed to equip electric units with a pantograph having a head geometry of length 1 600 mm as depicted in EN 50367:2012, Annex B.2 figure B.6 (as alternative to requirement in clause 4.2.8.2.9.2).

3.34.8 The LOC&PAS TSI permits the installation of additional pantographs with different head geometry; this provides one means of achieving compatibility with both TSI compliant infrastructure and other parts of the GB mainline railway.

3.34.9 The GB specific case avoids the need to fit both a TSI compliant pantograph and also a pantograph compatible with the existing GB infrastructure. The typical GB arrangement for OCL feed can result in the need for the OCL equipment wire to use part of the pantograph horn assembly. For GB this requires a non-insulated horn as described in the GB specific case.

3.34.10 Requirements set out in GMRT2111 are the GB NTRs.

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 clause 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.

3.34.11 For compatibility with the GB 25 kV mainline railway, metalised carbon content compliant with ENE TSI clause 4.2.14 is preferred. Plain carbon materials compliant with ENE TSI clause 4.2.14 are not recommended due to the expectation of poor chipping performance when running on the existing GB 25 kV mainline railway. RSSB research project T876 ‘Testing of overhead line contact wire and collector strip’ concluded that there was no significant difference in wear of the carbon strips when using plain carbon strips.

3.34.12 The following ENs cover the contact strip material and associated assessment:

a) BS EN 50367:2012, which sets out the requirements for the interaction between contact line and pantograph, including material for contact strips.
b) BS EN 50405:2015, which sets out the requirements for the assessment of contact strips made of carbon.

**LOC & PAS TSI**

4.2.8.2.9.6 PANTOGRAPH CONTACT FORCE AND DYNAMIC BEHAVIOUR

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

(2) The factors which influence the mean contact force are the pantograph itself, its position in the train consist, its vertical extension, and the rolling stock on which the pantograph is mounted. L 356/298 EN Official Journal of the European Union 12.12.2014

(3) Rolling stock and pantographs fitted on rolling stock are designed to exert a mean contact force \( F_m \) on the contact wire in a range specified in clause 4.2.12 of the TSI Energy, in order to ensure current collection quality without undue arcing and to limit wear and hazards to contact strips. Adjustment of the contact force is made when dynamic tests are performed.

(4) The verification at interoperability constituent level shall validate the dynamic behaviour of the pantograph itself, and its capability to collect current from a TSI compliant overhead contact line; the conformity assessment procedure specified in clause 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 clause 6.2.3.20.

(6) According to the TSI Energy, the range of mean contact force \( F_m \) is not harmonised for overhead contact lines designed for speed higher than 320 km/h. Therefore electric units can only be assessed against this TSI regarding the dynamic behaviour of the pantograph up to the speed of 320 km/h.

For the speed range above 320 km/h up to the maximum speed (if higher than 320 km/h), the procedure for innovative solutions described in article 10 and Chapter 6 of this TSI shall apply.

7.3.2.16 Specific case United Kingdom (Great Britain) (‘P’)

For technical compatibility with existing lines, the verification at interoperability constituent level (clause 5.3.10 and 6.1.3.7.) shall validate capability of the pantograph to collect current for the additional range of contact wire heights between 4 700 mm and 4 900 mm.

3.34.13 The LOC&PAS TSI clauses in 4.2.8.2.9.6 provide the pantograph contact force and dynamic behaviour requirements for trains required to operate exclusively over TSI compliant electrified lines. Compatibility with the existing non-TSI conforming GB 25 kV electrified infrastructure requires compliance with additional requirements for the extended OLE wire height range.

3.34.14 For this reason there is a GB specific case, and requirements set out in GMRT2111 are the GB NTRs.

**LOC & PAS TSI**

4.2.8.2.10 PANTOGRAPH LOWERING (RST LEVEL)

(1) Electric units shall be designed to lower the pantograph in a period meeting the requirements of the specification referenced in Appendix J-1, index S1, clause 4.7 (3 seconds) and to the dynamic insulating distance according to the specification referenced in Appendix J-1, index S2 either by initiation by the driver or by a train control function (including CCS functions).
3.34.15 The LOC&PAS TSI sets out requirements for lowering of pantographs and leaves open the choice for the provision of automatic dropping device (ADD) equipment on electric units designed for a maximum speed lower or equal to 160 km/h.

3.34.16 For compatibility with the GB mainline network, GMRT2111 sets out a requirement for fitment of ADD to GB rolling stock.

3.35 Protection against electrical hazards

4.2.8.4 Protection against electrical hazards

(1) Rolling stock and its electrically live components shall be designed such that direct or indirect contact with train staff and passenger is prevented, both in normal cases and in cases of equipment failure. Provisions described in the specification referenced in Appendix J-1, index 54 shall be applied in order to meet this requirement.

3.35.1 For compatibility with the GB 600 / 750 V DC 3rd / 4th rail systems, GMRT2111 and GMRT2113 set out requirements for protection against electrical hazards and are the GB NTRs.

3.35.2 Previous versions of BS EN 50153 did not permit safety bonding at a single point, which is required for trains that derive their power from the 600 / 750 V DC 3rd / 4th rail systems; however, some relaxation has now been included in a Annex D of BS EN 50153:2014.

3.36 Driver’s cab

4.2.9.1.2.2 Driver’s cab emergency exit

(1) In an emergency situation, evacuation of the train crew from the driver’s cab and access to the interior of the cab by the rescue services shall be possible on both sides of the cab by using one of the following emergency exit means: cab external doors (access directly from the exterior, as defined in clause 4.2.9.1.2.1 above) or side windows or emergency hatches.
In all cases, the emergency exit means shall provide a minimum clearance (free area) of 2 000 cm² with a minimum inner dimension of 400 mm to allow the release of trapped persons. 12.12.2014 EN Official Journal of the European Union L 356/301

Front position driver’s cabs shall have at least an interior exit; this exit shall give access to an area of a minimum length of 2 metres, of a minimum clearance identical to those specified in clause 4.2.9.1.2.1, points (7) and (8), and this area (including its floor) shall be free of any obstruction to the escape of the driver; the above area shall be located on-board the unit, and can be an interior area or an area opened to the outside.

7.3.2.17 Specific case United Kingdom (Great Britain) ('P')

It is permissible for the interior exit to have a minimum access area and a minimum clearance of height and width, in accordance with the national technical rules notified for this purpose. This specific case does not prevent the access of TSI compliant rolling stock to the national network.

3.36.1 The GB specific case exists owing to the restricted loading GB gauge and the design of certain cabs where the exit from the cab is on to an external walkway. In such circumstances it is not always possible to achieve a full height and width doorway and therefore a smaller sized doorway is permitted when operating on the GB mainline network.

3.36.2 Specific requirements for such doorways are not currently set out in any GB NTRs.

4.2.9.1.3 External visibility
4.2.9.1.3.1 FRONT VISIBILITY

(1) The driver’s cab shall be designed to allow the driver at his seated driving position a clear and unobstructed line of sight in order to distinguish fixed signals set to both the left and right of a straight track, and in curves with a radius of 300 m or more, under the conditions defined in Appendix F.

(2) The above requirement shall also be met from the standing driving position under conditions defined in the Appendix F, on locomotives and on driving coaches, in case these coaches are intended to be also operated by a driver in standing position.

(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.

7.3.2.18 Specific case United Kingdom (Great Britain) ('P')

Instead of the requirements set out in 4.2.9.1.3.1, for rolling stock intended for operation in the UK, the following specific case shall be complied with. T

(1) The driver’s cab shall be designed to allow the driver at his seated driving position a clear and unobstructed line of sight in order to distinguish fixed signals in accordance with the national technical rule, GM/RT2161 ‘Requirements for driving cabs of railway vehicles’. This specific case does not prevent the access of TSI compliant rolling stock to the national network.

3.36.3 The constraints of the GB infrastructure gauge and the positioning of lineside signals means that it is not always possible to achieve the cab visibility requirements set out in the LOC&PAS TSI. The GB specific case exists to accommodate the worst case sight lines that can exist on the GB mainline railway, namely a cab fitted with a centre gangway arrangement. However, the GB specific case can be applied to all projects.
3.36.4 GMRT2161 sets out the GB NTRs. It sets out requirements for a range of sighting conditions, these being the minimum requirements.

### LOC & PAS TSI

4.2.9.1.6 Driver’s desk - Ergonomics

(4) If the traction and/or braking effort is set-up by a lever (combined one or separated ones), the ‘tractive effort’ shall increase by pushing the lever forwards, and the ‘braking effort’ shall increase by drawing the lever towards the driver.

If there is a position for emergency braking, it shall be clearly distinguished from those of the other positions of the lever (e.g. by a notch).

7.3.2.19 Specific case United Kingdom (Great Britain) (‘P’)

In case the requirements in clause 4.2.9.1.6, last paragraph, related to the direction of movement of the lever for traction and/or braking is incompatible with the safety management system of the railway undertaking operating in Great Britain, it is allowed to inverse the direction of movement for braking and traction respectively.

3.36.5 The LOC&PAS TSI aims to harmonise the direction of use of the traction / braking lever to limit the risk of incorrect operation in an emergency situation. The common practice in mainland Europe is to pull the handle towards the driver to apply the brake. This is in the opposite direction to that in general use on the GB mainline railway.

3.36.6 The GB specific case permits the operation of the traction / braking lever to be in the opposite direction to the LOC&PAS TSI requirements. The GB specific case is not a condition of access to the GB mainline railway and permits the selection of either arrangement. It is the responsibility of each duty holder to determine the appropriate arrangements, taking into account existing designs of rolling stock that they operate. Further guidance on this topic is given in GMRT2045.

### LOC & PAS TSI

4.2.9.1.7 Climate control and air quality

(1) The air in the cab shall be renewed to keep the CO2 concentration to the levels specified in the clause 4.2.5.8 of this TSI.

(2) At the seated driving position (as defined in the clause 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.

3.36.7 No additional guidance is associated with the above (see guidance on LOC&PAS TSI clause 4.2.5.8).

### LOC & PAS TSI

4.2.9.3 Driver machine interface

4.2.9.3.1 Driver’s activity control function

(1) The driver’s cab shall be equipped with a means to monitor the driver’s activity, and to automatically stop the train when a lack of driver’s activity is detected. This gives the on-board technical means for the railway undertaking to fulfil the requirement of clause 4.2.2.9 of TSI OPE.

(2) Specification of the means to monitor (and detect a lack of) the driver’s activity:
The driver’s activity shall be monitored when the train is in driving configuration and is moving (criterion for movement detection is at a low speed threshold); this monitoring shall be done by controlling the action of the driver on recognised driver interfaces such as dedicated devices (e.g. pedal, push buttons, sensitive touches…) and/or recognised driver interfaces with the Train Control and Monitoring System.

When no action is monitored on any of the recognised driver interfaces during more than a time of X seconds, a lack of driver’s activity shall be triggered.

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.

When the same action is monitored continuously for more than a time not higher than 60 seconds without any further action on a recognised driver interface, a lack of driver’s activity shall also be triggered.

Before triggering a lack of driver’s activity, a warning shall be given to the driver, in order for him to have the possibility to react and reset the system.

The system shall have the information ‘lack of driver’s activity triggered’ available for being interfaced to other systems (i.e. the radio system).

(3) Additional requirement:

The detection of the lack of the driver’s activity is a function that shall be subject to a reliability study considering the failure mode of components, redundancies, software, periodic checks and other provisions, and the estimated failure rate of the function (lack of driver’s activity as specified above not detected) shall be provided in the technical documentation defined in clause 4.2.12.

(4) Specification of actions triggered at train level when a lack of driver’s activity is detected:

A lack of driver’s activity when the train is in driving configuration and is moving (criterion for movement detection is at a low speed threshold) shall lead to a full service brake or an emergency brake application on the train.

In case of application of a full service brake, its effective application shall be automatically controlled and in case of non-application, it shall be followed by an emergency brake.

(5) Notes:

— It is allowed to have the function described in this clause 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).

3.36.8 A means to assess the driver’s vigilance is a requirement in the OPE TSI. GB historically used a combination of a short duration driver safety device in conjunction with a longer interval vigilance system to monitor the driver’s activity.
3.36.9 There is no unique response time specified in the LOC&PAS TSI. However, the upper time limit of 60 seconds for triggering a warning to the driver is shorter than that historically used for GB vigilance systems (two minutes). This shorter response time has previously been considered acceptable by human factors and operations specialists and therefore no GB specific case sought.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.9.4 On-board tools and portable equipment</td>
</tr>
<tr>
<td>A space shall be available in or near the driver’s cab to store the following equipment, in case they are needed by the driver in emergency situation:</td>
</tr>
<tr>
<td>— Hand-lamp with red and white light</td>
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<tr>
<td>— Short circuiting equipment for track-circuits</td>
</tr>
<tr>
<td>— Scotches, if the parking brake performance is not sufficient depending on track gradient (see clause 4.2.4.5.5 ‘Parking brake’).</td>
</tr>
<tr>
<td>— A fire extinguisher (to be located in the cab; see also clause 4.2.10.3.1).</td>
</tr>
<tr>
<td>— On manned traction units of freight trains: a self-rescue device, as specified in the SRT TSI (see SRT TSI clause 4.7.1).</td>
</tr>
</tbody>
</table>

3.36.10 Further requirements relating to the provision of on-board tools and equipment, including those necessary when working over electrified lines, are set out in GMRT2130.

<table>
<thead>
<tr>
<th>LOC &amp; PAS TSI</th>
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<tbody>
<tr>
<td>4.2.9.6 Recording device</td>
</tr>
<tr>
<td>(1) The list of information to be recorded is defined in the TSI OPE.</td>
</tr>
<tr>
<td>(2) The unit shall be equipped with a means to record this information, complying with the following requirements:</td>
</tr>
<tr>
<td>(3) Functional requirements specified in the specification referenced in Appendix J-1, index 57, clauses 4.2.1, 4.2.2, 4.2.3 and 4.2.4 shall be met.</td>
</tr>
<tr>
<td>(4) Recording performance shall be according to class R1 of the specification referenced in Appendix J-1, index 57, clause 4.3.1.2.2.</td>
</tr>
<tr>
<td>(5) The integrity (consistency; correctness) of the recorded and extracted data shall be according to the specification referenced in Appendix J-1, index 57, clause 4.3.1.4.</td>
</tr>
<tr>
<td>(6) Data integrity shall be safeguarded according to the specification referenced in Appendix J-1, index 57, clause 4.3.1.5.</td>
</tr>
<tr>
<td>(7) The level of protection that applies to the protected storage medium shall be ‘A’ as defined in the specification referenced in Appendix J-1, index 57, clause 4.3.1.7.</td>
</tr>
</tbody>
</table>

3.36.11 GMRT2472 sets out the NTRs and the full range of functions to be recorded for compatibility with GB operational rules.

3.36.12 It also replicates the requirements set out in EN IEC 62625-1:2013 as referenced in the LOC&PAS TSI.
3.37 Fire safety and evacuation

LOC & PAS TSI

4.2.10 Fire safety and evacuation
4.2.10.1 General and categorization
(1) This clause applies to all units.
(2) Rolling stock shall be designed such that it protects passengers and on-board staff in case of hazard fire on board and to allow an effective evacuation and rescue in case of emergencies. This is deemed to be fulfilled by complying with the requirements of this TSI.
(3) The category of the unit regarding fire safety considered for its design, as defined in clause 4.1.4 of this TSI shall be recorded in the technical documentation described in clause 4.2.12 of this TSI.

SRT TSI
7.2.4 Operation of new rolling stock in existing tunnels
(a) The category of new rolling stock intended to be operated in existing tunnels shall be selected according to clause 4.4.6 (a).
(b) However, a Member State may allow operation of new rolling stock of category A in existing tunnels longer than 5 km under the condition that the operation of such new rolling stock offers an equivalent or improved level of fire safety compared to the operation of previous rolling stock. The equivalent or improved level of safety to passengers and staff shall be demonstrated using the Common Safety Method on risk assessment.

3.37.1 Safety in case of fire is highly dependent on the track environment where the train operates. Two categories (A and B) have been defined, consistent with the Safety in Rail Tunnels TSI (SRT TSI). These are the basic parameters aimed at ensuring that the same level of safety, with respect to fire protection, is applied when placing in service a vehicle on any part of the mainline railway. The lowest category A applies to all rolling stock within the scope of the LOC&PAS TSI; category B applies only to rolling stock intended to operate in tunnels of more than 5 km length.

3.37.2 There are two tunnels on the GB railway that exceed the 5 km limit - the Severn and Totley tunnels.

3.37.3 However, the SRT TSI provides specific exclusions from complying with the higher Category B requirements for such tunnels by permitting new Category A rolling stock that offers an equivalent or improved level of fire safety. In order to facilitate application of the CSM risk evaluation and assessment requirement (see 7.2.4 (b) of the SRT TSI), compliance with the Category A fire performance requirements, set out in 4.2.10 of the LOC&PAS TSI, could provide much (or all) the justification that the hazard risks are acceptable.

3.37.4 An amendment to GMRT2130 was issued in June 2016 that provides further clarification and will remain in force until such time that GMRT2130 is reissued.

3.37.5 GMRT2130 identifies that ‘elevated structures’ have the same operational category requirements as tunnels with the same length and access characteristics.

LOC & PAS TSI

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

(2) Materials used to construct the rolling stock unit shall comply with the requirements of the specification referenced in Appendix J-1, index 58 for the ‘Operation Category’ as defined below:

— ‘Operation Category 2’ for Category A passenger rolling stock (including passenger locomotive)
— ‘Operation Category 3’ for Category B passenger rolling stock (including passenger locomotive)
— ‘Operation Category 2’ for freight locomotives, and self-propelling units designed to carry other payload (mail, freight, etc.).
— ‘Operation Category 1’ for OTMs, with requirements limited to areas which are accessible to staff when the unit is in transport running configuration (see Section 2.3 of this TSI).

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

— the certificate 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 requirements (TSI), it is not required to perform new testing of this material; the certificate needs only to be updated regarding its date of issue.

LOC&PAS TSI

7.1.1.5. Transitional measure for fire safety requirement

(1) During a transitional period ending three years after the date of application of this TSI, 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 of the notified national rules (using the appropriate operation category) from one of the following sets of standards:

(2) The British standards BS6853, GM/RT2130 issue 3.
(7) The Spanish standard DT-PCI/5A.

(8) During this period, it is permitted to substitute individual materials by materials which are compliant with EN 45545-2:2013 (as specified in clause 4.2.10.2.1 of the present TSI).

3.37.6 During the drafting of the LOC&PAS TSI, it was recognised that work was underway to further develop and complete the EN 45545 series of European standards relating to the fire performance of vehicles, in particular the requirements applicable to materials and components.

3.37.7 Clause 7.1.1.5 has been included in the LOC&PAS TSI to permit alternative national standards to be used and the UK registered GMRT2130 and BS 6853 as alternative standards. While GMRT2130 issue three has been listed, it is recognised that subsequent up-issues of GMRT2130 are also suitable for use.

3.37.8 GB had a specific concern relating to the testing requirements for seats and the non-discriminatory nature of these tests and therefore it is recommended that GMRT2130 is followed for such tests. prEN 16989 is under development and will provide a suitable method for whole seat testing.
3.37.9 The transitional period runs for three years from the application of the LOC&PAS TSI (01 January 2015) and therefore it is permitted to use GMRT2130 through until the end of 2017. It is anticipated that a revised set of European standards will be available before this date.

3.37.10 GMRT2130 provides clarity on operation categories and also provides the linking between the categorisation used in BS EN 45545 and BS 6853. This linking identifies that ‘irrespective of Operation Category, vehicles with berths or seating intended for sleeping passengers or traincrew shall be assumed to be OC3 vehicles and meet the requirements for BS 6853:1999 Category 1b’ and goes on to clarify that ‘OC3 corresponds to TSI Category B’.

### LOC & PAS TSI

#### 4.2.10.3.4 Fire containment and control systems for passenger rolling stock

1. This clause is applicable to units of category B passenger rolling stock.

2. The unit shall be equipped with adequate measures to control the spread of heat and fire effluents through the train.

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 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).
   - The test shall be carried out in accordance with the requirements of the specification referenced in Appendix J-1, index 60.

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 30 m 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.

3.37.11 In GB there is no national rule to close out the open point regarding the assessment parameter for other fire containment and control systems when used in Category B rolling stock instead of full cross-section partitions within passenger/staff areas. Therefore, where such systems are used, projects will be required to develop their own technical rules.

3.37.12 The UK is actively participating in CEN TC256 Working Group 1, which is developing a specification for assessment of other fire containment and control systems.
### 3.38 Servicing

**LOC & PAS TSI**

#### 4.2.11.5 Interface for water refilling

1. This clause is applicable to units equipped with a water tank supplying water to sanitary systems covered by the clause 4.2.5.1 of this TSI.
2. The inlet connection for water tanks shall comply with figure 1 of the specification referenced in Appendix J-1, index 64.

#### 3.38.1

The requirements set out in the LOC&PAS TSI differ from current practice (push fit hose) in use on the GB mainline railway.

**LOC & PAS TSI**

#### 5.3.15 Inlet connection for water tanks

1. A inlet connection for water tanks is designed and assessed without any limitation concerning its area of use.
2. A inlet connection for water tanks shall comply with requirements concerning the dimensions as defined in clause 4.2.11.5. These requirements shall be assessed at IC level.

#### 3.38.2

A specific type of connection is mandated by the LOC&PAS TSI. This arrangement is different to that typically in use in GB.

**LOC & PAS TSI**

#### 4.2.11.6 Special requirements for stabling of trains

1. This clause is applicable to units intended to be powered while stabled.
2. The unit shall be compatible with at least one of the following external power supply systems, and shall be equipped (where relevant) with the corresponding interface for electrical connection to that external power supply (plug):
   3. Power supply contact line (see clause 4.2.8.2.9 ‘Requirements linked to pantograph’).
   4. ‘UIC 552-type’ train power supply line (AC 1 kV, AC/DC 1.5 kV, DC 3 kV),
   5. Local external auxiliary power supply 400 V that can be connected to socket type ‘3P+ground’ according to the specification referenced in Appendix J-1, index 65.

7.3.2.24 Specific case the United Kingdom (Great Britain) (‘P’)

It is permissible for the local external auxiliary power supply 400 V to be provided in accordance with the national technical rules notified for this purpose.

#### 3.38.3

Requirements set out in GMRT2111 support the GB specific case and are the GB NTRs for 25 kV AC traction and rolling stock interfaces.

**LOC & PAS TSI**

#### 4.2.11.7 Refuelling equipment
LOC & PAS TSI

(1) This clause is applicable to units equipped with a refuelling system.

(2) Trains using diesel fuel in accordance with Annex II of Directive 2009/30/EC of the European Parliament and of the Council (1) shall be equipped with refuelling couplings on both sides of the vehicle, at a maximum height of 1 500 mm above rail level; they shall be circular with a minimum diameter of 70 mm.

(3) Trains using another type of diesel fuel shall be equipped with a foolproof opening and fuel tank to prevent inadvertent refuelling with a wrong fuel.

(4) The type of coupling for refuelling shall be recorded in the technical documentation.

3.38.4 Since publication of the LOC&PAS TSI, BS EN 16507:2014 has been published and this provides, within Annex A, details of equipment specifications compatible with systems currently in use in GB.

3.39 Documentation related to maintenance

LOC & PAS TSI

4.2.12.3 Documentation related to maintenance

(1) Maintenance is a set of activities intended to keep a functional unit in, or to restore it to, a state in which it can perform its required function, ensuring continued integrity of safety systems and compliance with applicable standards.

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 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 shall be performed.

3.39.1 The LOC&PAS TSI clause relates to maintaining compliance with the basic parameters identified in this LOC&PAS TSI during the lifetime of the rolling stock. Consideration also needs to be given to documenting maintenance activities and inspection criteria to ensure the rolling stock continues to satisfy all other applicable in-service requirements.

3.40 European register of authorised types

LOC & PAS TSI

4.8 European register of authorised types of vehicles

(1) The characteristics of the rolling stock that must be recorded in the ‘European register of authorised types of vehicles’ are listed in Commission Implementing Decision 2011/665/EU of 4 October 2011 on the European register of authorised types of railway vehicles (2).
## LOC & PAS TSI

(2) In accordance with Annex II of this decision on the European register and with Article 34(2a) of Directive 2008/57/EC, the values to be recorded for the parameters related to the technical characteristics of the rolling stock shall be those of the technical documentation accompanying the type examination certificate. Therefore, this TSI requires that the relevant characteristics are recorded in the technical documentation defined in the clause 4.2.12.

(3) In accordance with Article 5 of the Decision referred to in the above point (1) of this clause 4.8, its application guide includes for each parameter a reference to the clauses of the technical specifications for interoperability that state the requirements for this parameter.

3.40.1 This register contains the vehicle data that is recorded in the European Register of Authorised Types of Vehicles (ERATV). For compatibility with GB operating systems, GMRT2453 sets out the rolling stock data to be recorded in the Rolling Stock Library (now part of R2).
Part 4 Guidance on LOC&PAS TSI Chapter 5 Interoperability Constituents

4.1 Interoperability constituents (Chapter 5)

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<tr>
<th>LOC &amp; PAS TSI</th>
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<tr>
<td>5.1 Definition</td>
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<tr>
<td>(1) According to Article 2(f) of Directive 2008/57/EC, the interoperability constituents are ‘any elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem upon which the interoperability of the rail system depends directly or indirectly.’</td>
</tr>
<tr>
<td>(2) The concept of a ‘constituent’ covers both tangible objects and intangible objects such as software.</td>
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<tr>
<td>(3) Interoperability constituents (IC) described in Section 5.3 below are constituents:</td>
</tr>
<tr>
<td>— Whose specification refers to a requirement defined in Section 4.2 of this TSI. The reference to the relevant clause of the Section 4.2 is given in Section 5.3; it defines how the interoperability of the rail system depends on the particular constituent.</td>
</tr>
<tr>
<td>When a requirement is identified in Section 5.3 as being assessed at IC level, an assessment for the same requirement at sub-system level is not required.</td>
</tr>
<tr>
<td>— Whose specification may need additional requirements, such as interface requirements; these additional requirements are also specified in Section 5.3.</td>
</tr>
<tr>
<td>— And whose assessment procedure, independently of the related subsystem is described in Section 6.1.</td>
</tr>
<tr>
<td>(4) The area of use of an interoperability constituent shall be stated and demonstrated as described for each of them in Section 5.3.</td>
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According to Article 2(f) of Directive 2008/57/EC, the interoperability constituents are ‘any elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem upon which the interoperability of the trans-European conventional rail system depends on directly or indirectly.’

The concept of a ‘constituent’ covers both tangible objects and intangible objects such as software.

4.1.1 The LOC&PAS TSI has followed these principles:

- **a)** Interoperability constituents (IC) apply when a LOC&PAS TSI requirement is assessed at component (or sub-assembly) level independently from the rolling stock subsystem.
- **b)** The LOC&PAS TSI sets out only requirements in relation to interoperability; therefore, the specification of an IC in the LOC&PAS TSI does not describe a complete product.
- **c)** As a consequence, two constituents compliant to the IC specification are not necessarily interchangeable.
- **d)** The characteristics of the IC are consistent with the characteristics of the rolling stock subsystem defined when used as an IC.
- **e)** The use of an IC holding an EC declaration is mandatory for the rolling stock subsystem to get an EC declaration of verification. When a feature is declared as an IC, the use of such an IC is the only way permitted to meet the requirement.
4.1.2 The LOC&PAS TSI allows a transition period during which it is permitted to use ICs not holding an EC declaration (see LOC&PAS TSI clause 6.3); in this case the LOC&PAS TSI requirements are verified at the subsystem level.

4.1.3 For some projects seeking an authorisation for the placing in service of vehicles, potential difficulties have been encountered in the conformity assessment process regarding ICs. The LOC&PAS TSI contains specific cases for the requirements of the IC (either described in the TSI itself or in a national rule). Notified bodies have identified issues in certifying components as an IC where they are built according to the specific case. The two main issues / questions that were identified are:

a) Whether the constituent, if built to the requirements of a specific case and not necessarily fully compliant with the main part of the TSI (chapters 4 and 5), may be considered as an IC, as the latter is meant to have an EU-wide application, and not only in one Member State.

b) How the assessment and authorisation might be carried out in the case where the specific case requirements are fully described in the TSI, or where the specific case in the TSI refers to the NTRs.

4.1.4 The UK requested the European Union Agency for Railways to issue a technical opinion on how interoperability constituents are certified when they need to meet the requirements resulting from a specific case.

4.1.5 The response from the European Union Agency for Railways, and the process to apply, is described in a paper published on the RSSB website and has been developed in order to address the problem and gives projects a way of dealing with this issue. The paper and the process to follow can be found at http://www.rssb.co.uk/Library/standards-and-the-rail-industry/2015-09-standards-national-procedure-assessment-and-certification-of-interoperability-constituents.pdf
5.1 Guidance on LOC&PAS TSI Chapter 6 Assessment and Verification

5.1.1 The conformity assessment procedures are set out in the 2008/57/EC Directive (as modified) Annexes IV, V, and VI.

5.1.2 The conformity assessment modules are described separately and are generic in their application to the different subsystems; Commission Decision 2010/713/EU describes the requirements within each of the modules.

5.1.3 In order to keep pace with technological progress and encourage modernisation, innovative solutions may be permitted or promoted and their implementation, under certain conditions, allowed.

5.1.4 Innovative solutions may relate to the rolling stock subsystem, its parts and its interoperability constituents.

5.1.5 Where an innovative solution is proposed, the manufacturer or their authorised representative is required to state how it deviates from or how it complements the relevant section of the TSI. Guidance from the Member State (DfT for GB) may be sought before submitting an innovative solution proposal.
5.1.6 The innovative solution is assessed by the Commission and the Commission may request the opinion of the European Union Agency for Railways on the proposed innovative solution. If this assessment is positive, the European Union Agency for Railways is required to devise the functional and interface specifications of the innovative solution and develop the relevant assessment methods. These will need to be included in future versions of the TSI in order to allow the use of the innovative solution.
Part 6 Guidance on LOC&PAS TSI Chapter 7 Implementation

6.1 Guidance on LOC&PAS TSI Chapter 7 Implementation

LOC & PAS TSI

7.1.1.2. Transition phase

7.1.1.2.1 Application of the TSI during transition phase

(1) A significant number of projects or contracts, which started before the date of application of this TSI, may lead to the production of rolling stock which does not fully comply with this TSI. For rolling stock concerned by those projects or contracts, and in accordance with point (f) of Article 5(3) of Directive 2008/57/EC, a transition phase is defined, during which the application of this TSI is not mandatory.

(2) This transition phase applies to:
—— Projects at advanced stage of development, as defined in the clause 7.1.1.2.2
—— Contracts in course of performance, as defined in the clause 7.1.1.2.3
—— Rolling stock of an existing design, as defined in clause 7.1.1.2.4.

(3) The application of this TSI to rolling stock which falls under one of the three cases above is not mandatory if one of the following conditions is met:
—— In case the rolling stock is in the scope of the HS RST TSI 2008 or of the CR LOC&PAS TSI 2011, the relevant TSI(s), including implementation rules and period of validity of the ‘type or design examination certificate’ (7 years) are applied.
—— In case the rolling stock is in the scope of neither the HS RST TSI 2008 nor the CR LOC&PAS TSI 2011: the authorisation for placing in service is delivered during a transition period ending 6 years after the date of application of this TSI.

(4) During the transition phase, if the applicant chooses not to apply this TSI, it is reminded that the other TSIs and/or notified national rules apply according to their respective scopes and implementation rules for the authorisation to place in service in accordance with Articles 22 to 25 of Directive 2008/57/EC. In particular, TSIs to be repealed by this TSI continue to apply, under the conditions stated in Article 11.

7.1.1.2.2 Definition of Projects at advanced stage of development

(1) Rolling stock is developed and produced under a project at an advanced stage of development in accordance with the definition in Article 2(t) of the Directive 2008/57/EC.

(2) The project shall be at an advanced stage of development at the date of application of this TSI.

7.1.1.2.3 Definition of Contracts in course of performance

(1) Rolling stock is developed and produced under a contract which is signed before the date of application of this TSI.

(2) The applicant has to bring evidence of the date of signature of the original contract applicable. The date of any addenda in the form of changes to an original contract shall not be taken into account when defining the date of signature of the contract in question.

7.1.1.2.4 Rolling stock of an existing design

(1) Rolling stock is produced according to a design developed before the date of application of this TSI, and which therefore has not been assessed according to this TSI.

(2) For the purpose of this TSI, a rolling stock can be qualified as ‘built according to existing design’ when one of the two following conditions is met:
— The applicant can prove that the newly built rolling stock will be produced according to a documented design that has already been used to produce a rolling stock which has been authorised to be placed into service in a Member State before the date of application of this TSI.

— The manufacturer or the applicant can prove that the project was in pre-production phase, or in series production at the date of application of this TSI. In order to prove this, at least one prototype shall be in assembly phase with an existing identifiable body shell, and components already ordered from sub-suppliers shall represent 90% of the total value of components.

The Applicant shall demonstrate to the NSA that the conditions spelled out under the respective bullet point in this clause (depending on the situation at hand) are met.

(3) For modifications to an existing design, the following rules apply until 31 May 2017:

— In case of design modifications strictly limited to those necessary to ensure the technical compatibility of the rolling stock with fixed installations (corresponding to interfaces with infrastructure, energy, or control-command and signalling subsystems), the application of this TSI is not mandatory.

— In case of other design modifications, the present clause related to 'existing design' does not apply.

6.1.1 This section sets out the implementation provisions that may apply to certain projects already underway before the new TSI entered into force, and also where it is permitted to continue placing into service rolling stock according to a design assessed before this new TSI.

6.1.2 7.1.1.2.4(3) permits modifications to be made to an existing design that concern technical compatibility between rolling stock and fixed installations (infrastructure) to be made without application of this TSI. This dispensation runs until June 2017.

6.1.3 These provisions help enable manufacturers to develop standard types of rolling stock for which customers currently do not exist and would be found during or after the development process. The LOC&PAS TSI includes some tangible requirements to define whether the project could be considered to be of an existing design, and permits certain modifications when they are necessary to ensure technical compatibility with the infrastructure.

6.1.4 For GB, an existing design is likely to have been authorised against a set of NTRs for which some could have been changed or up-issued. Additionally, there may be other transitional measures to consider for NTRs. The ORR has published guidance for projects on applicable notified NTRs which can be found on their website: www.orr.gov.uk (currently located at http://orr.gov.uk/__data/assets/pdf_file/0016/18412/rgd-2015-02-guidance-for-projects-on-applicable-notified-national-technical-rules.pdf)

7.1.1.3 Application to mobile equipment for railway infrastructure construction and maintenance

(1) The application of this TSI to mobile railway infrastructure construction and maintenance equipment (as defined in Sections 2.2 and 2.3) is not mandatory.

(2) The conformity assessment process as described in the clause 6.2.1 may be used by applicants on a voluntary basis in order to establish an EC declaration of verification against this TSI; this EC declaration of verification shall be recognised as such by Member States.

(3) In case the applicant chooses not to apply this TSI, the mobile railway infrastructure construction and maintenance equipment may be authorised in accordance with Article 24 or 25 of Directive 2008/57/EC.
6.1.5 Directive 2008/57/EC Annex I states ‘mobile railway infrastructure construction and maintenance equipment may be included’. The LOC&PAS TSI sets out design requirements applicable to OTMs, but only for running mode (working mode is not in scope of the LOC&PAS TSI).

6.1.6 The LOC&PAS TSI sets out requirements specific to OTMs and takes into account ENs developed for OTMs.

6.1.7 While OTMs, in running mode, are in scope of the LOC&PAS TSI, the application of the LOC&PAS TSI and the EC declaration of verification process is voluntary, with no derogation required, when the process is not applied.

6.1.8 GMRT2400 sets out the GB NTRs if the option of non-conformity to the LOC&PAS TSI is adopted.

### LOC & PAS TSI

7.1.2 Renewal and upgrade of existing rolling stock

7.1.2.1 Introduction

(1) This clause provides information which relates to Article 20 of Directive 2008/57/EC.

6.1.9 Where a project entity is unsure if their project is considered an upgrade or renewal of existing rolling stock according to the Railway (Interoperability) Regulations 2011 (as amended), the Member State (DfT for GB) can determine whether or not it is an upgrade or renewal, and therefore whether the TSI is applicable.

### LOC & PAS TSI

7.3 Specific cases

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6.1.10 The LOC&PAS TSI sets out a number of specific cases applicable to GB. These are identified as ‘specific case UK for Great Britain’. These exclude those specific cases applicable to the railway network of Northern Ireland that are separately identified as 'specific case UK for Northern Ireland' and those for the Channel Tunnel that are separately identified as 'Specific case Channel tunnel'.

6.1.11 Each specific case has been developed on the grounds that either LOC&PAS TSI compliant rolling stock would not be compatible with the existing GB infrastructure or is a relaxation of the requirements mandated by the LOC&PAS TSI.

6.1.12 The respective GB specific cases have been inserted into the relevant clause of this guidance note.

### 6.2 TSI Annexes

### LOC & PAS TSI

ANNEX H ASSESSMENT OF THE ROLLING STOCK SUBSYSTEM

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6.2.1 This Annex provides a set of requirements related to assessment of the various stages of the development of the rolling stock and needs to be read in conjunction with the applicable assessment modules. It indicates when an assessment of each stage is required: at design review, at type test phase and
when each individual element is required to be assessed for each production unit. It also indicates where a specific assessment requirement is set out in LOC&PAS TSI Chapter 6.

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<th>LOC &amp; PAS TSI</th>
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<tr>
<td>ANNEX I ASPECTS FOR WHICH THE TECHNICAL SPECIFICATION IS NOT AVAILABLE (OPEN POINTS)</td>
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6.2.2 This Annex provides a summary of all the open points set out in the LOC&PAS TSI. For the GB mainline railway, the relevant NTRs are detailed against the specific requirements in the main guidance of this document.
Definitions

Basic Parameter
Any regulatory, technical or operational condition which is critical to interoperability and is specified in the relevant TSIs.

Conformity
Compliance with applicable requirements of a product, process, service, system, person or body.

Conformity assessment
The process demonstrating whether specified requirements relating to a product, process, service, system, person or body have been fulfilled. Article R1(12), Annex 1 of Decision 768/2008/EC.

Contact force
Vertical force applied by the pantograph to the OCL. BS EN 50367:2006.

Contact Line System
The system that distributes the electrical energy to the trains running on the route and transmits it to the trains by means of current collectors.

Contracting Entity
Any entity, whether public or private, which orders the design and / or construction or the renewal or upgrading of a subsystem. This entity may be a railway undertaking, an infrastructure manager or a keeper, or the concession holder responsible for carrying out a project. Article 2 (r) of Directive 2008/57/EC.

Current Collector
Equipment fitted to the vehicle and intended to collect current from a contact wire or conductor rail. IEC 60050-811, definition 811-32-01.

Derogation
According to Article 9 of Directive 2008/57/EC, it corresponds to a certain circumstance by which projects can be exempted from having to comply with all or part of a TSI or TSIs (Member State (MS) has to notify the national rules that apply instead). The documents to be submitted for derogation requests are set out in Annex IX of Directive 2008/57/EC.

DynoTrain
A European Commission funded research project to provide synchronised test data of track geometry, contact geometry and vehicle / track interaction of different types of rolling stock; to provide on-track and stationary test results according to BS EN 14363:2005.

European Register of Authorised Types of Vehicles (ERATV)
The Register of Types of Vehicle authorised by EU Member States for placing in service is referred to in Article 34 of Directive 2008/57/EC, now addressed by Commission Decision 2011/665/EU. It contains the technical characteristics of vehicles’ types as defined in the relevant TSIs, the manufacturer’s
name, dates, references and Member State granting authorisations, restrictions and withdrawals.

GB mainline railway

Mainline railway has the meaning given to it in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) and the associated exclusions. GB Mainline Railway is the mainline railway network excluding any railway in Northern Ireland; the Channel Tunnel; the dedicated high speed railway between London St Pancras International Station and the Channel Tunnel; and any other exclusions determined by the member state.

Infrastructure Manager (IM)

Any ‘body’ or undertaking that is responsible in particular for establishing and maintaining railway infrastructure, or part thereof, as defined in article 3 of Directive 91/440/EEC, which may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings. Article 3 (b) of Directive 2004/49/EC.

Interoperability constituents

An elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem. Interoperability constituents are placed on the market with an intended area of use and are assessed for conformity independently of the subsystem.

Level crossing

An intersection at the same elevation of a road, footpath or bridleway and one or more rail tracks.

Mean contact force

Statistical mean value of the contact force. BS EN 50367:2006.

Member State

The role of the government of a Member State of the European Union, typically the DfT for rail in Great Britain.

Notified body

The bodies responsible for assessing the conformity or suitability for use of the interoperability constituents or for appraising the EC procedure for verification of the subsystems. Article 2 (j) of Directive 2008/57/EC.

Open Point

Parameters that have been formally identified as in scope of a TSI or Railway Group Standard for which no common requirement has been agreed.

Overhead Contact Line (OCL)

Contact line placed above (or beside) the upper limit of the rail vehicle gauge and supplying vehicles with electric energy through roof-mounted current collection equipment. IEV ref 811-33-02) (ENE TSI.
Note: where this includes, in addition to all current-collecting conductors, the following elements: reinforcing feeders; cross-track feeders; disconnectors; section insulators; overvoltage protection devices; supports that are not insulated from the conductors; insulators connected to live parts; along-track feeders; conductors connected permanently to the contact line for supply of other electrical equipment; earth wires and return conductors.

Placing in service

All the operations by which a subsystem or a vehicle is put into its design operating state. Article 2 (q) of Directive 2008/57/EC.

Railway Undertaking (RU)

Any private or public undertaking the principal business of which is to provide rail transport services for goods and/or passengers, with a requirement that the undertaking must ensure traction; this also includes undertakings which provide traction only. Article 3 (a) of Directive 2004/49/EC.

Reference contour

A contour, associated to each gauge, showing the shape of a cross-section and used as a basis to work out the sizing rules of the infrastructure, on the one hand, and of the vehicle, on the other hand.

Renewal

Any major substitution work on a subsystem or part subsystem, which does not change the overall performance of the subsystem. Article 2 (n) of Directive 2008/57/EC.

Specific Case

Any part of the rail system which needs special provisions in the TSIs, either temporary or definitive, because of geographical, topographical or urban environment constraints or those affecting compatibility with the existing system. This may include, in particular, railway lines and networks isolated from the rest of the European Community, the loading gauge, the track gauge or space between the tracks and vehicles strictly intended for local, regional or historical use, as well as vehicles originating from or destined for third countries. Article 2 (l) of Directive 2008/57/EC.

Static contact force

Mean vertical force exerted upwards by the pantograph head on the OCL, and caused by the pantograph-raising device, while the pantograph is raised and the vehicle is at a standstill. BS EN 50367:2006.

Subsystem

One of the subsystems (of the European railway system) identified by the Interoperability Directive. Subsystems can be structural or functional.
Guidance on the Locomotives and Passenger Rolling Stock TSI

Suitability for use

Ability of an interoperability constituent to achieve and maintain a specified performance during its period of use. 01/16 - DV-EN09 September 2004

Technical file

The file that has to accompany the EC declaration of verification of the subsystem, containing, for example, all the necessary documents relating to the characteristics of the subsystem and, where appropriate, all the documents certifying conformity of interoperability constituents.

Technical Specification for Interoperability (TSI)

A TSI is a specification adopted in accordance with the Railway Interoperability Directive 2008/57/EC by which each subsystem or part subsystem is covered in order to meet the essential requirements and ensure the interoperability of the rail system.

Trans-European network (TEN)

Rail networks that have been defined by legislation as being designated railway lines for defining where interoperability regulations apply. There are two types of network: high speed and conventional.

Upgrade

Any major modification work on a subsystem or part subsystem, which improves the overall performance of the subsystem. Article 2 (m) of Directive 2008/57/EC.
Abbreviations

ADD  Automatic dropping device.
AWS  Automatic warning system.
CCS TSI  Control Command and Signalling Technical Specification for Interoperability.
CEN  Comité Européen Normalisation – European Committee for Standardization.
CNG  Compressed natural gas.
CR ENE TSI  Conventional Rail Energy Technical Specification for Interoperability.
CSM  Common Safety Method.
DfT  Department for Transport.
ECM  Entity in Charge of Maintenance.
EN  Euronorm.
ERA  European Railway Agency; now known as the European Union Agency for Railways.
ERATV  European Register of Authorised Types of Vehicles.
ERTMS  European Rail Traffic Management System.
FMECA  Failure mode, effects, and criticality analysis.
GB  Great Britain.
HS RST TSI  High Speed Rolling Stock Technical Specification for Interoperability.
HS1  High Speed Rail Link; the railway between St Pancras in London and the Channel Tunnel owned by HS1 Ltd.
IC  Interoperability constituent.
IM  Infrastructure manager.
LPG  Liquefied petroleum gas.
MS  Member State.
NSA  National Safety Authority.
OCL  Overhead contact line.
ORR  Office of Rail and Road.
Guidance on the Locomotives and Passenger Rolling Stock TSI

OTM On-track machine.
PRM TSI Persons of Reduced Mobility Technical Specification for Interoperability.
RAMS Reliability, availability, maintainability, and safety.
RGS Railway Group Standard.
RSSB Rail Safety and Standards Board.
SRT TSI Safety in Rail Tunnels Technical Specification for Interoperability.
TC Technical Committee.
TEN Trans-European Network.
TMS Train monitoring system.
TOPS Total Operation Processing System.
TPWS Train protection and warning system.
UIC Union internationale des chemins de fer – International Union of Railways.
WG Working group.
WSP Wheel slide protection.
Yqst Quasi-static lateral guiding force.
Guidance on the Locomotives and Passenger Rolling Stock TSI

References

The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from http://www.rssb.co.uk/railway-group-standards.

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

Railway Group Standards

GERT8064 European Train Control System: The Management of Packet 44
GIRT7033 Lineside Signs
GMRT2045 Compatibility Requirements for Braking Systems of Rail Vehicles
GMRT2100 Requirements for Rail Vehicle Structures
GMRT2130 Vehicle Fire, Safety and Evacuation
GMRT2472 Requirements for Data Recorders on Trains
GMRT2473 Power Operated External Doors on Passenger Carrying Rail Vehicles (superseded by RIS-2747-RST)
GORT3437 Defective On-Train Equipment

RSSB documents

GEGN8577 Guidance on the Application of Selective Door Operating Systems
GEGN8578 Guidance on the Use of On-Train Satellite Positioning Technology Based Locator for Railway Applications
GOGN3637 Guidance on Defective on-Train Equipment
RIS-2795-RST Rail Industry Standard for Track to Train RFID Compatibility

Other references

BS EN 12663-1:2010 Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)
BS EN 13272:2012 Electrical lighting for rolling stock in public transport systems
BS EN 14752:2015 Bodyside entrance systems for rolling stock
Guidance on the Locomotives and
Passenger Rolling Stock TSI

Guidance Industry
Guidance Note
GMGN2615
Issue: Two
Date: December 2016

BS EN 61373:2010
Railway applications - Rolling stock equipment - Shock and vibration tests

CSM RA

Interoperability Directive
DIRECTIVE 2008/57/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 on the interoperability of the rail system within the Community

LOC & PAS TSI
Locomotives & Passenger Rolling Stock TSI regulation number 1302/2014

PRM TSI
Passengers with Reduced Mobility TSI regulation number 1300/2014

prEN 16186-2:201X
Railway applications - Driver’s cab Part 2: Integration of displays, controls and indicators

RAIB Report on West Wickham

Railway Safety Directive

ROGS
Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS)

RVAR

T769

UNISIG Subset 36
ERTMS/ETCS FFFIS for Eurobalise http://www.era.europa.eu/Pages/Home.aspx

UNISIG Subset 40