Department for Transport

National Technical Specification Notice

Rolling Stock – Freight Wagons (WAG)

Issue 2

Date of publication: 2nd May 2025

Rail Interoperability – The Railways (Interoperability) Regulations 2011

Notice to all:

- Manufacturers and distributors of railway equipment
- Infrastructure managers and railway undertakings
- Railway infrastructure and train: builders, designers, operators, owners and managers
- Certifying authorities, approved bodies, designated bodies, recognised organisations and railway consultants

This Notice has been published by the Secretary of State for Transport pursuant to regulation 3B of the Railways (Interoperability) Regulations 2011 (RIR 2011).

Summary

1. Objectives and target outcomes of rail interoperability in Great Britain

RIR 2011 supports the railway to function as one modern integrated system through rail equipment meeting common baseline requirements of technical compatibility, reliability and availability, accessibility, environmental protection, health, and safety (See Schedule 2 to the RIR 2011 'Essential Requirements' for further details). By taking a long-term whole-system view, it seeks to progressively improve Britain's railway in the following ways:

- More consistently reliable, efficient and accessible services for rail customers;
- Reduced technical barriers for the railway to adapt to meet changing customer demand for passenger and freight services;
- Increased choice of potential rolling stock and service routes for operators;

- Reduced industry production, delivery and maintenance costs through use of standardised products and economies of scale;
- An open and competitive supply chain for rail projects;
- Increased potential for international passenger and international and domestic freight services;
- Reduced environmental impact.

2. Function of this National Technical Specification Notice (NTSN)

RIR 2011 requires new, upgraded or renewed rail vehicles, infrastructure and some components to meet minimum specifications linked to the six 'Essential Requirements' of interoperability: i.e. technical compatibility, reliability and availability, accessibility, environmental protection, health, and safety. NTSNs set these minimum specifications for different 'subsystems' of Great Britain's (GB) rail system, and key components defined as 'interoperability constituents'. In some cases, NTSNs codify international standards (e.g. European Standards set by CEN-CENELEC) or refer out to supplementary National Technical Rules to set these minimum requirements. NTSNs also set rules for third party assessment of conformity to the 'Essential Requirements', the placing of interoperability constituents on the GB market, and operation and maintenance of railway 'subsystems'.

This NTSN covers the rolling stock — freight wagons 'subsystem' and associated 'interoperability constituents' (See article 1 'Scope' for details). See Table 1 of Section 3 of this NTSN for a breakdown of the basic parameters corresponding to each of the six 'Essential Requirements'.

3. How this NTSN should be read

This NTSN consists of two parts: the Articles and the Annex. The Articles set out information concerning scope, application and key definitions. The Annex sets the technical specifications, codified standards and assessment criteria for meeting the 'Essential Requirements' of RIR 2011.

Rail projects that will introduce or re-introduce freight wagon rolling stock on the GB railway should check article 1 'Scope' and article 2 'Application' of this NTSN to identify whether they are legally obliged to apply requirements in the Annex. Projects in scope should review the applicable requirements in the Annex at the earliest stage of project development and factor these into cost benefit analyses on designs and procurements specifications so that implementation, or a need for an exemption to apply alternative measures, can be planned accordingly (See Summary subsection 7 'Exemptions from this NTSN').

4. Changes from Issue 1 published on 1 January 2021

NTSNs were created for EU Exit to take the place of EU regulations called Technical Specifications for Interoperability (TSIs). Issue 1 of the WAG NTSN substantially reproduced Commission Regulation (EU) No 321/2013 – the Rolling Stock - Freight Wagons (WAG) TSI – which applied in Britain until 31 December 2020.

Changes from Issue 1 to 2 of this NTSN primarily focus on sections where the WAG TSI was amended in 2023 by Commission Implementing Regulation (EU) 2023/1694 and sections where the British rail sector or Government identified a need for change and agreed solutions. Changes to technical content, including decisions on whether to maintain alignment with the WAG TSI, were made on the principles that mandatory requirements in NTSNs should be strictly necessary for achieving interoperability in GB, outcome focused where appropriate, supported by GB-focused analysis, and tested with those who will be obliged to apply them. To support use of the NTSN in line with these principles, Issue 2 also contains a substantial redraft of the Summary and Articles section to improve clarity, reflect Government NTSN policy, and align application with the objectives and target outcomes of rail interoperability in GB.

The core structure and format of the NTSN has not changed in this Issue 2 update and still reflects that of the WAG TSI. It still contains parts labelled as 'Open Points' or 'Specific Cases' where the 'Essential Requirements' are to be met either through application of bespoke requirements, supplementary National Technical Rules, or a choice of NTSN or National Technical Rule specifications.

There are also various provisions that are still labelled 'left intentionally blank'. This has been done to preserve consistency of clausal reference points within this NTSN and with other interfacing NTSNs, recognising that the changes from Issue 1 to 2 are limited to specific sections.

5. Relationship with rail safety obligations

Conformity to this NTSN to meet obligations under the RIR 2011 does not guarantee that safety obligations under the Railways and Other Guided Transport Systems (Safety) Regulations 2006, the Health and Safety at Work Act 1974, or other legislation pertaining to rail safety are met. Some NTSN specifications are intended to fulfill the safety 'Essential Requirement' of interoperability, ensuring a common baseline of safe design. However, meeting these requirements alone does not mean that a railway subsystem is safe. Rail safety law, which focuses on controlling risk 'as low as reasonably practicable' (ALARP) to assure system safety, requires entities making significant changes to the railway to apply the Common Safety Method for Risk Evaluation and Assessment in determining risk controls, and in all cases to identify hazards and apply appropriate mitigations for the circumstance. This may identify that additional or alternative measures to the standardised safety 'Essential Requirements' are needed to ensure the safety of the subsystem.

6. Relationship with other rail standards

Entities that are obliged to apply this NTSN may have other obligations concerning the application of standards covering the same topics. Within the context set out in article 1 'Scope' and article 2 'Application', this NTSN's mandatory requirements take precedence over all other rail technical standards covering the same topics, including those set by individual companies or cross-industry bodies, unless otherwise indicated within this NTSN's Annex (e.g. there is an applicable UK Specific Case or transitional provision), the National Implementation Plan for this NTSN, a formal exemption granted by the Department for Transport as 'competent authority' (See Summary subsection 7 'Exemptions from this NTSN', or – in the case of international rail services – the Convention Concerning International Carriage by Rail (COTIF) Uniform Technical Prescriptions (UTPs) apply.

7. Exemptions from this NTSN

The UK Government recognises that the specifications set in the Annex may not always be the most effective way of achieving the 'Essential Requirements' of RIR 2011 or its objectives and target outcomes. For example, cost benefit analysis, customer insights and safety risk assessments may identify that alternatives more appropriate to the project budget, value for money, customer need, and identified safety hazards and risks, can deliver the same intended result as an applicable NTSN provision. Government also recognises that technology may change faster than standardised requirements, necessitating flexibility to benefit from innovation.

Under regulation 14 of RIR 2011 'Exemption from need to conform with NTSNs (exemptions)', the Department for Transport as 'competent authority' has the power to exempt rail projects in scope of RIR 2011 from NTSN requirements in the following circumstances:

- The project is at an advanced stage of development (i.e. its *"…planning or construction stage has reached a point where the impact of a change in technical specifications would present a significant legal, contractual, economic, financial, social or environmental impediment to the project concerned"*) or the project is the subject of a contract in the course of performance when the applicable NTSN is published.

- The project concerns the renewal or upgrading of an existing subsystem, where the loading gauge, track gauge, space between tracks or electrification voltage in the applicable NTSN is not compatible with those of the existing subsystem.

- Any proposed renewal, extension or upgrading of an existing subsystem where the application of an applicable NTSN would compromise the economic viability of the project or the compatibility of the project with the rail system.

- Following an accident or natural disaster, where the conditions for the rapid restoration of the network do not economically or technically allow for partial or total application of an applicable NTSN.

- A project which employs innovative solutions which either do not comply with the relevant NTSNs or to which the assessment methods in those NTSNs cannot be applied.

Under regulation 13 of RIR 2011 'Authorisation requirements for the renewal of upgrading of subsystems', the Department also has the power to decide whether an authorisation to place into service is needed for an upgraded or renewed subsystem, and the extent to which NTSN requirements apply for authorisation.

Where projects identify that alternatives to this NTSN's requirements may better deliver the NTSN's intended outcomes in their circumstance without compromising safety or the interoperability of the railway, and one of the above circumstances applies, they should contact the Department to enquire whether an exemption may be possible. Exemption requests should be made in writing using the template published on Gov.uk and sent to interoperability@dft.gov.uk

Requests must cover the mandatory criteria in regulation 14A of RIR 2011 'Application for exemptions' and offer an evidence-based explanation of how proposed alternative arrangements would be at least as effective as the NTSN requirements in meeting the NTSN's objectives. They must also give due consideration to the 'Essential Requirements', objectives and target outcomes of Great Britain's rail interoperability framework. Where requests concern safety requirements, they must be accompanied by risk assessment evidence. Where they concern accessibility requirements, they must be accompanied by evidence from any equality impact assessments and consultation with user groups, including impacts on consistency of rail passenger or staff experience on the GB network.

Requests should be made at the earliest phase of a rail project, and not after completion of the design phase. In order to permit equal levels of due diligence, including consultation as appropriate, to make informed and balanced policy decisions on exemptions, applicants should allow four months for a decision from the Department for Transport.

Rolling Stock – Freight Wagon

National Technical Specification Notice

Articles

Article 1

Scope

1. The geographic scope of this NTSN is the GB railway system (including conventional and high-speed mainline networks) and the UK section of the Channel Tunnel, except for parts named on the approved list of exclusions published by the Secretary of State pursuant to regulation 3(2) or described in regulation 3(5) of RIR 2011. TSIs continue to have direct effect in Northern Ireland.

2. This NTSN covers the Rolling Stock - Freight Wagon subsystem of the railway (See Chapter 4 'Characterisation of the subsystem' for further details) and associated interoperability constituents.

3. The interoperability constituents covered by this NTSN are:

    - Running Gear
    - Wheelset
    - Wheel
    - Axle
    - Friction Element for wheel tread brakes
    - Automatic variable gauge system
    - Rear end signal

    See point 5.3 of the Annex for further details.

Article 2

Application

1. This NTSN principally applies to rail projects that require an authorisation to be placed into service as per regulation 4 of the RIR 2011 'Requirement for

authorisation', concerning freight wagons with a maximum operating speed lower than or equal to 160 km/h and a maximum axle load lower than or equal to 25 t, and which are intended to be operated on the following nominal track gauges: 1 435 mm.

2. The NTSN shall apply to all new freight wagon rolling stock of the GB rail system, taking into account Chapter 7 of the Annex.

3. The NTSN shall also apply to existing freight wagon rolling stock:

   a) when it is renewed or upgraded in accordance with point 7.2.2 of the Annex to this NTSN; or

   b) with regard to specific provisions, such as the traceability of axles in point 4.2.3.6.4 and the maintenance plan in point 4.5.3.

   The detailed technical scope of this NTSN is set out in Chapter 2 of the Annex.

4. Operators of Rolling Stock - Freight Wagon subsystems that were authorised to be placed into service against this NTSN are required to operate and maintain the subsystem in conformity with this NTSN or subsequent updated versions, as per regulation 20 'Continuing duty on operator in relation to standards' of the RIR 2011.

5. Operators of Rolling Stock - Freight Wagon subsystems authorised against Issue 1 of this NTSN or a version of the WAG TSI that preceded it may voluntarily choose to apply this NTSN to their operation and maintenance of the subsystem, unless otherwise specified in the corresponding National Implementation Plan.

6. For the purpose of point 7.1.1(1) 'Application to ongoing projects' of the Annex, phase A starts once an approved body, which is responsible for UK verification, is appointed by the applicant and ends when the UK type or design examination certificate is issued. The phase B period defines the period of validity of the UK type or design examination certificate once it is issued by the approved body. During this time, units may be UK certified on the basis of conformity to type.

Article 3

Verification of conformity to this NTSN

1. A Rolling Stock - Freight Wagon subsystem's conformity to the requirements of this NTSN shall be confirmed by a UK Declaration of Verification following the procedures set out in Schedule 4 'UK verification assessment procedure for subsystems' and Schedule 5 'UK declaration of verification of subsystems' to the RIR 2011.

2. The procedures specific to this NTSN for assessment of conformity, suitability for use and UK verification are set out in Chapter 6 of the Annex and shall be based on the modules established in the NTSN concerning modules for the procedures for

assessment of conformity or suitability for use and UK verification (the 'Modules NTSN'). Chapter 6 of the Annex specifies the modules from the 'Modules NTSN' that can be applied to assess conformity to this NTSN.

3. It is the responsibility of the applicant for an authorisation to place a subsystem into service to choose the conformity assessment module(s) that are to be applied by the Approved Body from the options listed in Chapter 6 of the Annex. The applicant should consider which module is most proportionate and cost effective for the project.

4. An interoperability constituent's conformity to the requirements of this NTSN shall be confirmed by a UK declaration of conformity or suitability for use. This is required for placing these constituents on the market in Great Britain. Where interoperability constituent specifications in the WAG TSI are equivalent to those of this NTSN, an EC declaration of conformity or suitability for use is valid for demonstrating compliance with this NTSN and for placing these interoperability constituents on the market.

5. With regard to UK specific cases set out in point 7.3 of the Annex, the conditions to be met for the verification of the 'Essential Requirements' of RIR 2011 shall be those laid down in point 7.3 of the Annex or those laid down by National Technical Rules.

6. Until the expiry of their current approval period, 'friction element for wheel tread brakes' interoperability constituents listed in Appendix G of the Annex do not need to be covered by an EC or UK declaration of conformity. During this period, 'friction elements for wheel tread brakes' listed in Appendix G of the Annex shall be deemed to be compliant with this NTSN.

7. After their current approval period expires, 'friction element for wheel tread brakes' interoperability constituents listed in Appendix G of the Annex shall be covered by an EC or UK declaration of conformity. Notwithstanding the provisions in point 6.3 of the Annex, a UK certificate of verification may be issued for a subsystem containing components corresponding to the 'friction element for wheel tread brakes' interoperability constituent that does not have an EC or UK declaration of conformity during a transition period of 10 years after the expiry of the approval period of the interoperability constituent, if the following conditions are met:

    a) the component was manufactured before the expiry of the approval period of the interoperability constituent; and

    b) the interoperability constituent has been used in a subsystem that had been approved and placed in service or placed on the market in at least one EU Member State or placed in service in the UK before the expiry of its approval period.

8. The production, upgrade or renewal of any subsystem using non-certified interoperability constituents shall be completed, including granting authorisation

for placing in service of the subsystem, before the transition period set out in paragraph 7 expires.

9. During the transition period set out in paragraph 7:

   a) the reasons for non-certification of any interoperability constituents shall be properly identified in the verification procedure for the subsystem referred to in paragraph 7; and

   b) the Safety Authority shall report in their annual report, as referred to in Regulation 20 of the Railways and Other Guided Transport Systems (Safety) Regulations 2006, on the use of non-certified 'friction element for wheel tread brakes' interoperability constituents in the context of authorisation procedures.

Article 4

Approved Composite Brake Blocks

1. The Safety Authority shall publish on its website the list of fully approved composite brake blocks used in international transport that are fully approved in the UK referred to in Appendix G of the Annex, having regard to any equivalent list published by the EU Agency for Railways, for the period in which these brake blocks are not covered by EC or UK declarations.

ANNEX

National Technical Specification Notice for the 'rolling stock — wagons' subsystem

CONTENTS

1. INTRODUCTION

A National Technical Specification Notice (NTSN) is a specification that covers a subsystem (or part of it) as defined in regulation 2 of the Railways (Interoperability) Regulations 2011 in order:

— to ensure the interoperability of the GB rail system, and

— to meet the essential requirements.

1.1. TECHNICAL SCOPE

The technical scope of this NTSN is defined in Article 1(2) of the NTSN.

1.2. GEOGRAPHICAL SCOPE

The geographical scope of this NTSN is defined in Article 1(1) of the NTSN.

1.3. This provision has been left intentionally blank

2. SCOPE AND DEFINITION OF SUBSYSTEM

2.1. SCOPE

This NTSN is applicable to “freight wagons including vehicles designed to carry lorries” taking into account the exclusions as set out in regulation 3(2) and 3(5) of the Railways (Interoperability) Regulations 2011. In the following this part of the subsystem rolling stock is referred to as “freight wagon”. The subsystem rolling stock is defined in Schedule 3 to the RIR 2011 .

Self-propelling thermal or electric trains, thermal or electric traction units or passenger carriages are excluded from the scope of this NTSN; this is especially the case for:

(a) Special vehicles such as on-track machines;

(b) vehicles designed to carry:

— motor vehicles with their passengers on board, or

— motor vehicles without passengers on board but intended to be integrated in passenger trains (car carriers);

(c) vehicles which

— increase their length in loaded configuration, and

— their payload itself is part of the vehicle structure.

Note: See also point 7.1 for particular cases.

2.2. DEFINITIONS

In the present NTSN the following definitions are used:

(a) A “unit” is the generic term used to name the rolling stock. It is subject to the application of this NTSN, and therefore subject to the UK verification procedure.

A unit can consist of:

— a “wagon” that can be operated separately, featuring an individual frame mounted on its own set of wheels, or

— a rake of permanently connected “elements”, those elements cannot be operated separately, or

— “separate rail bogies connected to compatible road vehicle(s)” the combination of which forms a rake of a rail compatible system.

(b) A “train” is an operational formation consisting of several units.

(c) The “design operating state” covers all conditions under which the unit is intended to operate and its technical boundaries. This design operating state may go beyond the specifications of this NTSN in order that units may be used together in a train on the network under the safety management system of a railway undertaking.’

3. ESSENTIAL REQUIREMENTS

The GB rail system, its subsystems and their interoperability constituents shall meet the relevant essential requirements. The ‘Essential Requirements’ are set out in Schedule 2 to the RIR 2011.

Table 1 indicates the basic parameters specified in this NTSN and their correspondence to the essential requirements.

Point	Basic parameter	Essential requirements				
		Safety	Reliability and availability	Health	Environment protection	Technical compatibility
4.2.2.1.1	End coupling	1.1.1, 1.1.3, 1.1.5, 2.4.1				
4.2.2.1.2	Inner coupling	1.1.1, 1.1.3, 2.4.1				
4.2.2.2	Strength of unit	1.1.1, 1.1.3, 2.4.1				
4.2.2.3	Integrity of the unit	1.1.1				
4.2.3.1	Gauging	1.1.1				2.4.3
4.2.3.2	Compatibility with load carrying capacity of lines	1.1.1				2.4.3
4.2.3.3	Compatibility with train detection systems	1.1.1				2.4.3
4.2.3.4	Axle bearing condition monitoring	1.1.1	1.2			2.4.3
4.2.3.5.1	Safety against derailment running on twisted track	1.1.1, 1.1.2, 2.4.1				2.4.3
4.2.3.5.2	Running dynamic behaviour	1.1.1, 1.1.2				2.4.3
4.2.3.5.3	Derailment detection and prevention function	1.1.1, 1.1.2				2.4.3
4.2.3.6.1	Structural design of bogie frame	1.1.1, 1.1.2, 1.1.3				
4.2.3.6.2	Characteristics of wheelsets	1.1.1, 1.1.2, 1.1.3				2.4.3

Point	Basic parameter	Essential requirements				
		Safety	Reliability and availability	Health	Environment protection	Technical compatibility
4.2.3.6.3	Characteristics of wheels	1.1.1, 1.1.2, 1.1.3				2.4.3
4.2.3.6.4	Characteristics of axles	1.1.1, 1.1.2, 1.1.3				
4.2.3.6.5	Axle box/bearings	1.1.1, 1.1.2, 1.1.3				
4.2.3.6.6	Automatic variable gauge systems	1.1.1, 1.1.2, 1.1.3	1.2			1.5
4.2.3.6.7	Running gear for manual change of wheelsets	1.1.1, 1.1.2, 1.1.3				
4.2.4.2	Brake — Safety requirements	1.1.1, 1.1.3	1.2 2.4.2			
4.2.4.3.1	Brake — General functional requirements	1.1.1, 2.4.1	2.4.2			
4.2.4.3.2.1	Brake performance — In-service brake	1.1.1, 1.1.2, 2.4.1	2.4.2			1.5
4.2.4.3.2.2	Brake performance — Parking brake	2.4.1				2.4.3
4.2.4.3.3	Brake — Thermal capacity	1.1.1, 1.1.3, 2.4.1				2.4.3
4.2.4.3.4	Brake — Wheel slide protection (WSP)	2.4.1	2.4.2			
4.2.4.3.5	Friction elements for wheel tread brakes	1.1.1, 1.1.2, 1.1.3, 2.4.1				2.4.3

Point	Basic parameter	Essential requirements				
		Safety	Reliability and availability	Health	Environment protection	Technical compatibility
4.2.5	Environmental conditions	1.1.1, 1.1.2				2.4.3
4.2.6.1	Fire safety	1.1.1, 1.1.4				
4.2.6.1.2.1	Fire safety Barriers	1.1.4		1.3.2	1.4.2	
4.2.6.1.2.2	Fire safety Materials	1.1.4		1.3.2	1.4.2	
4.2.6.1.2.3	Fire safety Cables	1.1.4, 1.1.5		1.3.2	1.4.2	
4.2.6.1.2.4	Fire safety — Flammable liquids	1.1.4		1.3.2	1.4.2	
4.2.6.2	Protection against electric hazard	1.1.5, 2.4.1				
4.2.6.3	Attachment device for rear-end signal	1.1.1				

The essential requirements 1.3.1, 1.4.1, 1.4.3, 1.4.4 and 1.4.5 of Schedule 2 to the Railways (Interoperability) Regulations 2011 fall under the scope of other legislation.

4. CHARACTERISATION OF THE SUBSYSTEM

4.1. INTRODUCTION

The GB rail system, to which the Railways (Interoperability) Regulations 2011 applies and of which freight wagons form a part, is an integrated system whose consistency shall be verified. This consistency shall be checked in particular with regard to the specifications of the rolling stock subsystem and the compatibility with the network (point 4.2), its interfaces in relation to the other subsystems of the GB rail system in which it is integrated (point 4.2 and 4.3), as well as the initial operating and maintenance rules (point 4.4 and 4.5).

The technical file, as set out in regulation 17(2) of and Schedule 4 to the RIR 2011 , shall contain in particular design related values concerning the compatibility with the network.

4.2. FUNCTIONAL AND TECHNICAL SPECIFICATIONS OF THE SUBSYSTEM

4.2.1. General

In light of the essential requirements in Chapter 3, the functional and technical specifications of the subsystem 'rolling stock — freight wagons' are grouped and sorted out in the following points of this Chapter:

— Structures and mechanical parts

— Gauging and vehicle track interaction

— Brake

— Environmental conditions

— System protection.

Except where this is strictly necessary for the interoperability of the GB rail system and to meet the relevant essential requirements, the functional and technical specifications of the freight wagon and its interfaces do not impose the use of any particular technical solutions.

When the functional and technical specifications that are necessary in order to achieve interoperability and to meet the essential requirements, have not been developed concerning a particular technical aspect, this aspect is identified as an open point in the relevant point. All open points are listed in Appendix A.

In Appendix C a set of conditions is specified. The conformity with this set of conditions is optional. If this option is selected, the conformity shall be assessed by an approved body within the UK verification procedure.

Provision may be made for UK specific cases for each NTSN. Such provisions are found in point 7.3 Chapter 7.

As far as possible the assessment procedure for the requirements in point 4.2 is defined in Chapter 6. In these cases the text of point 4.2 makes a reference to the corresponding points and sub points clauses of Chapter 6. If for a particular basic parameter the separation of requirements and assessment procedures is not feasible, no reference is given.

4.2.2. Structures and mechanical parts

4.2.2.1. Mechanical interface

4.2.2.1.1. End coupling

The end coupling is the mechanical interface between units forming a train.

The coupling system shall be designed in a way that no human presence between the units to be coupled/uncoupled shall be required whilst either one unit is moving.

End couplings shall be resilient and capable of withstanding the forces in accordance with the defined design operating state of the unit.

4.2.2.1.2. Inner coupling

The inner coupling is the mechanical interface between elements forming a unit.

The inner coupling shall be resilient and capable of withstanding the forces in accordance with the defined design operating state of the unit. The joint between two elements sharing the same running gear, is covered by point 4.2.2.2.

The longitudinal strength of the inner coupling(s) shall be equal to or higher than the one of the end coupling(s) of the unit.

4.2.2.2. Strength of unit

The structure of a unit body, any equipment attachments and lifting and jacking points shall be designed such that no cracks, no significant permanent deformation or ruptures occur under the load cases defined in the specification referenced in Appendix D Index 1.

In case of a rake of a rail compatible system composed of separate rail bogies connected to compatible road vehicles, the load cases may differ from those mentioned above, due to their bi- modal specification; in such a case, the load cases considered shall be described by the applicant based on a consistent set of specifications with consideration of the specific conditions of use related to train composition, shunting and operation.

The demonstration of conformity is described in point 6.2.2.1.

The lifting and jacking positions shall be marked on the unit. The marking shall comply with the specification referenced in Appendix D Index [2].

Note: Joining techniques are deemed to be covered as well by the demonstration of conformity in accordance to point 6.2.2.1.

4.2.2.3. Integrity of the unit

The unit shall be designed so that all movable parts intended to close an aperture (access doors, tarpaulin, lids, hatches, etc.) are prevented against an unintentional movement of these parts.

Units intended to be used for combined transport shall be equipped with devices for securing the Intermodal Loading Unit.

Locking devices shall indicate their status (open/closed) and shall be visible outside the unit.

4.2.3. Gauging and track interaction

4.2.3.1. Gauging

This point concerns the rules for calculation intended for sizing the rolling stock to run on one or several networks without interference risk.

The compliance of a unit with the intended reference profile including the reference profile for the lower part shall be established by one of the methods set out in the specification referenced in Appendix D index [4].

The kinematic method, as described in the specification referenced in Appendix D Index [4] shall be used to establish conformity, if any, between the reference profile established for the unit and the respective target reference profiles G1, GA, GB and GC including those used for the lower part GI1 and GI2.

Note: there is a UK specific case relevant to this point (see point 7.3.2.1a).

4.2.3.2. Compatibility with load carrying capacity of lines

The vertical loading characteristics of the unit shall be determined in order to check compatibility with the load carrying capacity of lines.

The permissible payload a unit may carry, for axle loads up to and including 25 t, shall be determined by application of the specification referenced in Appendix D Index [5].

4.2.3.3. Compatibility with train detection systems

If the unit is intended to be compatible with one or more of the following train detection systems, this compatibility shall be established in accordance with the provisions of the technical document referenced in Appendix D.2 Index [A]:

(a) train detection systems based on track circuits (the electrical resistance of the wheelset can be assessed at IC level or at vehicle level);

(b) train detection systems based on axle counters;

(c) train detection systems based on loop equipment.

The related specific cases are defined in point 7.7 of the CCS NTSN.

4.2.3.4. Axle bearing condition monitoring

It shall be possible to monitor the axle bearing condition either by:

— line side detection equipment, or

— on-board equipment.

If the unit is intended to be capable of being monitored by line side equipment on the 1 435 mm track gauge network the unit shall be compliant with the specification referenced in Appendix D Index [6] in order to ensure sufficient visibility.

Table 2

This table has been intentionally removed

If the unit is intended to be capable of being monitored by on-board equipment, the following requirements shall apply:

— This equipment shall be able to detect a deterioration of any of the axle box bearings of the unit.

— The bearing condition shall be evaluated either by monitoring its temperature, or its dynamic frequencies or some other suitable bearing condition characteristic.

— The detection system shall be located entirely on board the unit, and diagnosis messages shall be available on board the unit.

— The diagnosis messages delivered and how they are made available shall be described in the operating documentation set out in point 4.4 of this NTSN, and in the maintenance rules described in point 4.5 of this NTSN.

4.2.3.5. Running safety

The dynamic behaviour of a vehicle has a strong influence on safety against derailment, running safety and track loading.

4.2.3.5.1. Safety against derailment running on twisted track

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.

The demonstration of conformity is described in point 6.2.2.2.

Note: there is a UK specific case relevant to this point (see point 7.3.2.3).

4.2.3.5.2. Running dynamic behaviour

The unit shall be designed to provide safe movement up to the maximum design speed.

The running dynamic behaviour of a unit shall be proven either by:

— following the procedures set out in the specification referenced in Appendix D Index [7], or

— performing simulations using a validated model.

The demonstration of conformity is described in point 6.2.2.3.

Running dynamic behaviour is permitted to be assessed at interoperability constituent level in accordance with point 6.1.2.1. In this case a specific test or simulation at subsystem level is not required.

Note: there is a UK specific case relevant to this point (see point 7.3.2.4).

4.2.3.5.3. Derailment detection and prevention function

The derailment detection and prevention function is intended to prevent derailments or to mitigate the consequences of a derailment of the unit.

If a unit is fitted with the derailment detection and prevention function, the requirements below shall be met.

4.2.3.5.3.1. General requirements

The function shall be able to detect either a derailment or conditions which are a precursor to a derailment of the unit in accordance with one of the three sets of requirements set out in points 4.2.3.5.3.2, 4.2.3.5.3.3 and 4.2.3.5.3.4 below.

It is allowed to combine these functions as follows:

— 4.2.3.5.3.2 and 4.2.3.5.3.3

— 4.2.3.5.3.2 and 4.2.3.5.3.4

4.2.3.5.3.2. Derailment prevention function (DPF)

The DPF shall, if necessary, send a signal to the driver's cab of the locomotive hauling the train once a precursor to derailment is detected in the unit.

The signal enabling the DPF to be available at train level and its transmission between the unit, the locomotive and the other coupled unit(s) in a train shall be documented in the technical file.

4.2.3.5.3.3. Derailment detection function (DDF)

The DDF shall send a signal to the driver's cab of the locomotive hauling the train once the derailment is detected in the unit.

The signal enabling the DDF to be available at train level and its transmission between the unit, the locomotive and the other coupled unit(s) in a train shall be documented in the technical file.

4.2.3.5.3.4. Derailment detection and actuation function (DDAF)

The DDAF shall automatically activate a brake application when the derailment is detected without possibility of overriding by the driver.

The risk of false derailment detections shall be limited to an acceptable level.

Therefore, the DDAF shall be subject to a risk assessment in accordance with Implementing Regulation (EU) No 402/2013[1].

It shall be possible to deactivate the DDAF directly on the unit when the unit is stopped. That deactivation will release and isolate the DDAF from the brake system.

The DDAF shall indicate its status (activated/deactivated) and that status shall be visible from both sides of the unit. If this is not physically feasible, the DDAF shall indicate its status from at least one side and the other side of the wagon shall be marked in accordance with the specification referenced in Appendix D Index [2].

4.2.3.6. Running gear

The running gear guarantees to carry and guide the unit safely as well as to transmit braking forces where so required.

[1] Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment. This EU legislation is retained EU law under section 3 of the European Union (Withdrawal) Act 2018, and it has been amended under that Act by the Rail Safety (Amendment etc.) (EU Exit) Regulations 2019 as a result of the UK's exit from the EU.

4.2.3.6.1. Structural design of bogie frame

The integrity of the structure of a bogie frame, all attached equipment and body to bogie connection shall be demonstrated based on methods as set out in the specification referenced in Appendix D Index [9].

The integrity of the structure of a bogie frame is permitted to be assessed at interoperability constituent level in accordance with point 6.1.2.1. In this case a specific test or simulation at subsystem level is not required.

4.2.3.6.2. Characteristics of wheelsets

The wheelset assembly shall be able to transmit forces and torque between the fitted parts in accordance with the area of use.

The geometric dimensions of the wheelsets, as defined in Figure 1, shall be compliant with limit values specified in Table 3. These limit values shall be taken as design values and shall be stated as in-service limit values in the maintenance file described in point 4.5.

The demonstration of conformity is described in point 6.1.2.2.

Note: there is a UK specific case relevant to this point (see point 7.3.2.5).

Figure 1

Symbols for wheelsets used in Table 3

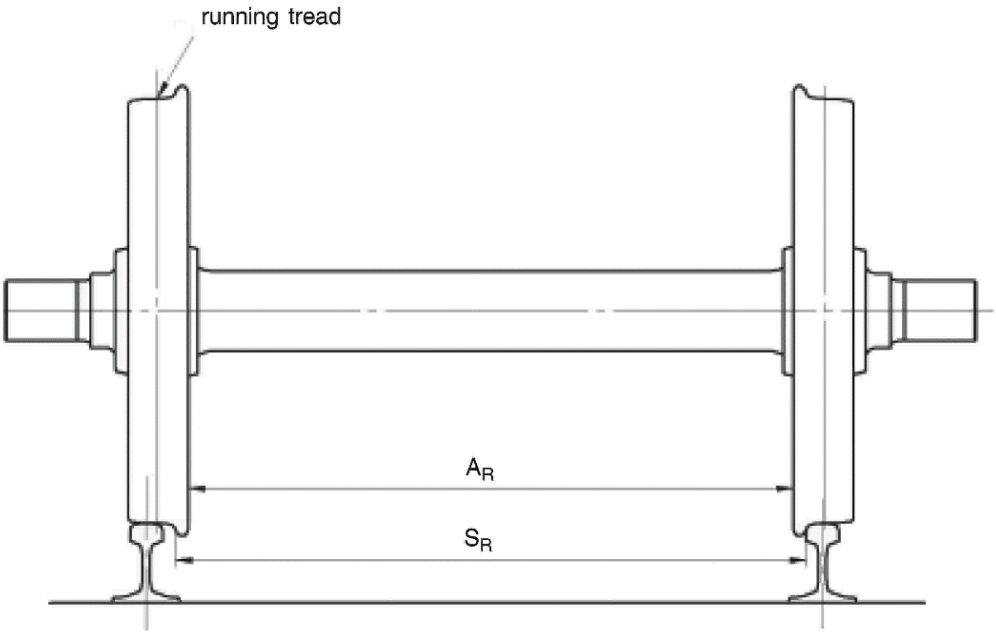


Table 3

Limits of use of the geometric dimensions of wheelsets

Designation		**Wheel diam. D [mm]**	**Minimum value [mm]**	**Maximum value [mm]**
1 435 mm	Front-to-front dimension (S_R) $S_R = A_R + S_{d,left} + S_{d,right}$	330 ≤ D ≤ 760	1 415	1 426
		760 < D ≤ 840	1 412	1 426
		D > 840	1 410	1 426
	Back-to-back distance (A_R)	330 ≤ D ≤ 760	1 359	1 363
		760 < D ≤ 840	1 358	1 363
		D > 840	1 357	1 363

4.2.3.6.3. Characteristics of wheels

The geometrical dimensions of the wheels as defined in Figure 2 shall be compliant with limit values specified in Table 4.

Table 4

Limits of use of the geometric dimensions of wheels

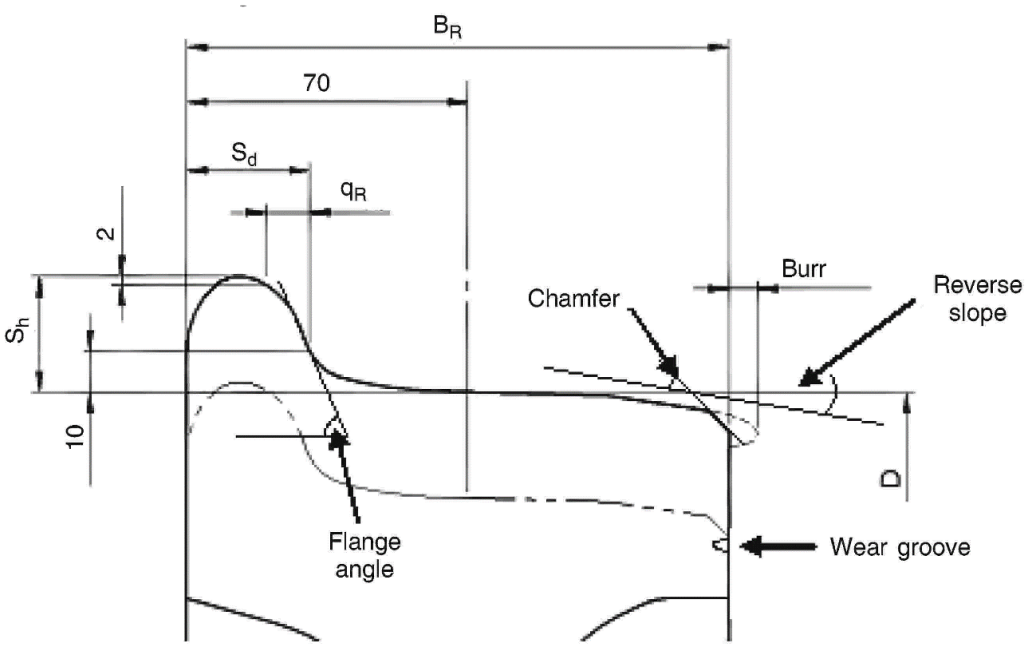
Designation		**Wheel diam. D [mm]**	**Minimum value [mm]**	**Maximum value [mm]**
1 435 mm	Width of the rim (B_R) (with maximum BURR of 5 mm)	D ≥ 330	133	140
	Thickness of the flange (S_d)	330 ≤ D ≤ 760	27,5	33
		760 < D ≤ 840	25	33
		D > 840	22	33
	Height of the flange (S_h)	330 ≤ D ≤ 630	31,5	36
		630 < D ≤ 760	29,5	36
		D > 760	27,5	36

	Face of the flange (q_R)	D ≥ 330	6,5	—

These limit values shall be taken as design values and shall be stated as in-service limit values in the maintenance file described in point 4.5.

Figure 2

Symbols for wheels used in Table 4



The mechanical characteristics of the wheels shall ensure the transmission of forces and torque as well as the resistance against thermal load where so required in accordance with the area of use.

The demonstration of conformity is described in point 6.1.2.3.

Note: there is a UK specific case relevant to this point (see point 7.3.2.5).

4.2.3.6.4. Characteristics of axles

The characteristics of the axle shall ensure the transmission of forces and torque in accordance with the area of use.

The demonstration of conformity is described in point 6.1.2.4.

The traceability of axles shall take into account the findings of the ERA Task force on Freight Maintenance (see '*Final report on the activities of the Task Force Freight Wagon Maintenance*' published on the ERA website http://www.era.europa.eu).

Note: there is a UK specific case relevant to this point (see point 7.3.2.5).

4.2.3.6.5. Axle boxes/bearings

The axle box and the rolling bearing shall be designed with consideration of mechanical resistance and fatigue characteristics. Temperature limits reached in service relevant for the hot box detection shall be defined.

The demonstration of conformity is described in point 6.2.2.4.

4.2.3.6.6. Automatic variable gauge systems

This requirement is applicable to units equipped with an automatic variable gauge system with changeover mechanism of the axial position of the wheels allowing the unit to be compatible with 1 435 mm track gauge and other track gauge(s) within the scope of this NTSN by means of passage through a track gauge changeover facility.

The changeover mechanism shall ensure the locking in the correct intended axial position of the wheel.

After passage through the track gauge changeover facility, the verification of the state of the locking system (locked or unlocked) and of the position of the wheels shall be performed by one or more of the following means: visual control, on-board control system or infrastructure/facility control system. In case of on-board control system, a continuous monitoring shall be possible.

If a running gear is equipped with brake equipment subject to a change in position during the gauge change operation, the automatic variable gauge system shall ensure the position and safe locking in the correct position of this equipment simultaneously to those of the wheels.

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

The automatic variable gauge system is defined as an interoperability constituent (point 5.3.4b) and is part of the interoperability constituent wheelset (point 5.3.2). The conformity assessment procedure is specified in point 6.1.2.6 (interoperability constituent level), point 6.1.2.2 (safety requirement) and in point 6.2.2.4a (subsystem level) of this NTSN.

The track gauges the unit is compatible with shall be recorded in the technical documentation.

A description of the changeover operation in normal mode, including the type(s) of track gauge changeover facility(ies) the unit is compatible with, shall be part of the technical documentation (see also point 4.4 of this NTSN).

The requirements and conformity assessments required in other sections of this NTSN apply independently for each wheel position corresponding to one track gauge and have to be documented accordingly.

4.2.3.6.7. Running gear for manual change of wheelsets

The requirement is applicable to units prepared to run on different track gauges, by means of a physical change of wheelset.

The unit shall be equipped with a locking mechanism in order to ensure the correct position of its brake equipment in the different configurations considering the dynamic effects in accordance with the design operating state of the unit.

The demonstration of conformity is described in point 6.2.2.5.

4.2.4. Brake

4.2.4.1. General

The purpose of the train brake system is to ensure that:

— the train's speed can be reduced,

— the train's speed can be maintained on a slope,

— the train can be stopped within the maximum allowable braking distance, and that

— the train can be immobilised.

Primary factors that influence the braking performance and the braking process are:

— the braking power,

— the train mass,

— the speed,

— the allowable braking distance,

— the available adhesion, and

— the track gradient.

The brake performance of a train is derived from the individual brake performance of each unit in the train.

4.2.4.2. Safety requirements

The braking system contributes to the safety level of the railway system. Therefore the design of the braking system of a unit has to undergo a risk assessment in accordance with Commission Implementing Regulation (EU) No 402/2013[2] considering the hazard of complete loss of the brake capability of the unit. The severity level shall be deemed as catastrophic when:

— it affects the unit alone (combination of failures), or

— it affects the brake capability of more than the unit (single fault).

The fulfilment of the conditions of C.9 and C.14 of Appendix C is presumed to be in conformity with this requirement.

4.2.4.3. Functional and technical requirements

4.2.4.3.1. General functional requirements

The brake equipment of the unit shall provide the functions of braking such as the application and the release of the brake, upon a transmitted signal. The brake shall be:

— continuous (the brake application or release signal is transmitted from a central command to the whole train by a control line),

— automatic (an inadvertent disruption of the control line shall lead to brake activation on all units of the train bringing each part to stand still),

— disengageable, which enables its release and isolation.

4.2.4.3.2. Brake performance

4.2.4.3.2.1. Service brake

The brake performance of a train or a unit is its ability to decelerate. It is the result of the braking power available to decelerate the train or unit within defined limits and all factors involved in the conversion and dissipation of energy including train resistance.

The brake performance of a unit shall be calculated in accordance with one of the specifications referenced in Appendix D, either Index [16], Index [37], Index [58] or Index [17].

[2] Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation was retained as assimilated UK law.

The calculation shall be validated by tests. Brake performance calculation in accordance with the specification referenced in Appendix D Index [17] shall be validated as set out in the same specification or in the specification referenced in Appendix D, Index [58].

4.2.4.3.2.2. Parking brake

A Parking Brake is a brake used to prevent parked rolling stock moving under the specified conditions taking into account the place, wind, gradient and rolling stock loading state, until intentionally released.

If the unit is equipped with a parking brake, the following requirements shall be met:

— the immobilisation shall remain until intentionally released,

— where it is not possible to identify the state of the parking brake directly, an indicator showing the state shall be provided on both sides on the outside of the vehicle,

— the minimum parking brake force considering no wind, shall be determined by calculations as defined in the specification referenced in Appendix D Index [16],

Where relevant the calculations shall determine:

— the minimum parking brake force for an unloaded wagon

— the maximum parking brake force for a fully loaded wagon

— the breakover loading mass, i.e. the minimum loading condition for the maximum parking brake force

— the parking brake of a unit shall be designed considering a wheel/rail (steel/steel) adhesion factor not higher than 0,12.

4.2.4.3.3. Thermal capacity

The brake equipment shall be able to withstand one emergency brake application without any loss of brake performance due to thermal or mechanical effects.

The thermal load that the unit is capable of withstanding without any adverse loss of brake performance due to thermal or mechanical effects, shall be defined and expressed in terms of speed, axle load, gradient and brake distance.

The demonstration of conformity is described in point 6.2.2.6.

A slope of 21 ‰ at 70 km/h during 40 km may be considered as the reference case for the thermal capacity which results in a braking power of 45 kW per wheel

during 34 minutes for a nominal wheel diameter of 920 mm and an axle load of 22,5 t. There may be other relevant reference cases available for use.

4.2.4.3.4. Wheel slide protection (WSP)

Wheel slide protection (WSP) is a system designed to use the maximum available adhesion by decreasing, holding or increasing the brake force to prevent wheel sets from locking and uncontrolled sliding. Thereby the stopping distance shall be optimised.

If an electronic WSP-control is used negative effects caused by malfunctions of WSP shall be reduced by suitable system design processes and technical configuration.

The WSP shall not alter the functional characteristics of the brakes. The vehicle's air equipment shall be dimensioned such that the air consumption of the WSP does not impair the performance of the pneumatic brake. The design process of the WSP shall take into account that the WSP has no detrimental effect on the constituent parts of the vehicle (brake gear, wheel tread, axle boxes, etc.).

The following types of units shall be fitted with WSP:

— types of units equipped with all types of brake blocks except composite brake blocks, for which the maximum mean utilisation of adhesion is greater than 0,12,

— types of units equipped with disc brakes only and/or with composite brake blocks, for which the maximum mean utilisation of adhesion is greater than 0,11.

4.2.4.3.5. Friction elements for wheel tread brakes

The friction element for wheel tread brakes (i.e. brake block) generates brake forces by friction when engaged with the wheel tread.

If wheel tread brakes are used the characteristics of the friction element shall contribute reliably to achieving the intended brake performance.

The demonstration of conformity is described in point 6.1.2.5 of this NTSN.

4.2.5. Environmental conditions

The design of the unit, as well as its constituents shall take into account the environmental conditions to which this rolling stock will be subjected to.

The environmental parameters are described in the clauses below. For each environmental parameter, a nominal range is defined, which is the most commonly encountered in Europe, and is the basis for the interoperable unit.

For certain environmental parameters ranges other than the nominal one are defined. In that case, a range shall be selected for the design of the unit.

For the functions identified in the clauses below, design and/or testing provisions taken to ensure that the rolling stock is meeting the NTSN requirements in this range shall be described in the technical file.

Depending on the ranges selected and on provisions taken (described in the technical file), appropriate operating rules could be necessary when the unit designed for the nominal range is operated on a particular line where the nominal range is exceeded at certain periods of the year.

The unit and its constituents shall be designed under consideration of one or several of the following external air temperature ranges:

— T1: – 25 °C to + 40 °C (nominal),

— T2: – 40 °C to + 35 °C, and

— T3: – 25 °C to + 45 °C.

The unit shall meet the requirements of this NTSN without degradation for snow, ice and hail conditions as defined in the specification referenced in Appendix D Index [18], which correspond to the nominal range.

Where more severe ‘snow, ice and hail’ conditions than considered in the standard are selected, the unit and its constituents shall then be designed to meet NTSN requirements considering the combined effect with low temperature according to the temperature range chosen.

In relation with the temperature range T2 and with the severe conditions for snow, ice and hail, the provisions taken to meet NTSN requirements in these severe conditions shall be identified and verified, in particular design and/or testing provisions considering the following functions:

— Coupling function restricted to the resiliency of couplings.

— Brake function, including brake equipment.

The demonstration of conformity is described in point 6.2.2.7.

4.2.6. System protection

4.2.6.1. Fire safety

4.2.6.1.1. General

All significant potential fire sources (high risk components) on the unit shall be identified. The fire safety aspects of the unit design shall be aimed at:

— preventing a fire from occurring,

— limiting the effects if a fire occurs.

The goods carried on the unit are not part of the unit and do not have to be taken into account in the conformity assessment.

4.2.6.1.2. Functional and technical specification

4.2.6.1.2.1. Barriers

In order to limit the effects of fire, fire barriers with integrity of at least 15 minutes shall be installed between the identified potential fire sources (high risk components) and the carried load.

The demonstration of conformity is described in point 6.2.2.8.1.

4.2.6.1.2.2. Materials

All permanent materials used on the unit shall have limited ignitability and flame spread properties, unless:

— the material is separated from all potential fire risks on the unit by a fire barrier and the safe application is supported by a risk assessment, or

— the component has a mass < 400 g, and is located within a horizontal distance of ≥ 40 mm and a vertical distance of ≥ 400 mm to other non-tested components.

The demonstration of conformity is described in point 6.2.2.8.2.

4.2.6.1.2.3. Cables

The selection and installation of electrical cables shall take into account their fire behaviour properties.

The demonstration of conformity is described in point 6.2.2.8.3.

4.2.6.1.2.4. Flammable liquids

The unit shall be provided with measures preventing a fire from occurring and spreading due to leakage of flammable liquids or gases.

The demonstration of conformity is described in point 6.2.2.8.4.

4.2.6.2. Protection against electrical hazards

4.2.6.2.1. Protective measures against indirect contact (protective bonding)

The impedance between vehicle body and the running rail shall be low enough to prevent hazardous voltages between them.

Units shall be bonded in accordance with the provisions as described in the specification referenced in Appendix D index [27].

4.2.6.2.2. Protective measures against direct contact

The electrical installations and equipment of a unit shall be designed so as to protect persons from electric shock.

The unit shall be designed so that direct contact is prevented following the provisions set out in the specification referenced in Appendix D index [27].

4.2.6.3. Attachment devices for rear-end signal

On all units designed to receive a rear-end signal, two devices at the end of the unit shall provide for the installation of two lamps or two reflective plates as set out in Appendix E at the same height above rail and not higher than 2 000 mm. The dimensions and clearance of these attachment devices shall be as described in the specification referenced in Appendix D Index [28].

Note: there is a UK specific case relevant to this point (see point 7.3.2.6).

4.3. FUNCTIONAL AND TECHNICAL SPECIFICATION OF THE INTERFACES

4.3.1. Interface with the subsystem 'infrastructure'

Table 5

Interface with infrastructure subsystem

Reference in WAG NTSN	**Reference in INF NTSN**
4.2.3.1. Gauging	Structure gauge Distance between track centres Minimum radius of vertical curve
4.2.3.2. Compatibility with load carrying capacity of lines	Track resistance to vertical loads Lateral track resistance Resistance of bridges to traffic loads Equivalent vertical loading for earthworks and earth pressure effects Resistance of existing bridges and earthworks to traffic loads
4.2.3.5.2. Running dynamic behaviour	Track geometrical quality
4.2.3.6.2. Characteristics of wheelsets 4.2.3.6.3. Characteristics of wheels	Nominal track gauge Rail head profile for plain line Design geometry of switches and crossings

4.3.2. Interface with the subsystem ‘operation and traffic management’

Table 6

Interface with operation and traffic management subsystem

Reference in WAG NTSN	**Reference in OPE NTSN**
4.2.2.2 Strength of unit — Lifting and jacking	4.2.3.6.3 Contingency arrangements
4.2.3.1 Gauging	4.2.2.5 Train composition
4.2.3.2 Compatibility with load carrying capacity of lines	4.2.2.5 Train composition
4.2.4 Brake	4.2.2.6 Train braking
4.2.6.3 Attachment devices for rear-end signal. Appendix E Rear-end signal	4.2.2.1.3.2 Rear-end

4.3.3. Interface with the subsystem 'control, command and signalling'

Table 7

Interface with control, command and signalling subsystem

Reference in WAG NTSN	Reference in CCS NTSN
4.2.3.3 a) Rolling stock characteristics compatible with train detection system based on track circuits	4.2.10: Compatibility with trackside train detection systems: vehicle design : 4.2.11: Electromagnetic compatibility between rolling stock and Control-Command and Signalling trackside equipment
4.2.3.3 b) Rolling stock characteristics compatible with train detection system based on axle counters	4.2.10: Compatibility with trackside train detection systems: vehicle design 4.2.11: Electromagnetic compatibility between rolling stock and Control-Command and Signalling trackside equipment
4.2.3.3 c) Rolling stock characteristics compatible with train detection system based on loop equipment	4.2.10: Compatibility with trackside train detection systems: vehicle design

4.4. OPERATING RULES

Operating rules are developed within the procedures described in the railway undertaking safety management system. These rules take into account the documentation related to operation which forms a part of the technical file as required in regulation 17(2) of and Schedule 4 to the RIR 2011

For the safety critical components (Channel Tunnel only) (see also point 4.5), the specific operational and operational traceability requirements are developed by the designers/manufacturers at design phase and through a collaboration between designers/manufacturers and the concerned railway undertakings or the concerned wagon keeper after vehicles have entered into operation.

The documentation related to operation describes the characteristics of the unit in relation to the design operating state to be considered in order to define the operating rules in normal and in various reasonably foreseeable degraded modes.

The documentation related to operation is composed of:

— a description of operation in normal mode, including the operational characteristics and limitations of the unit (e.g. vehicle gauge, maximum design speed, axle loads, brake performance, compatibility with train detection systems, permitted environmental conditions, type(s) and operation of track gauge changeover facility(ies) the unit is compatible with),

— a description of operation in degraded mode (when equipment or functions described in this NTSN suffer safety failures) as far as can reasonably predicted, together with the related acceptable limits and operating conditions of the unit that could be experienced,

— a safety critical components list (Channel Tunnel only): The safety critical components list shall contain the specific operational and operational traceability requirements.

The applicant shall provide the initial version of the documentation related to operating rules. This documentation might be modified later in accordance with the corresponding legislation, taking into account the existing operating and maintenance conditions of the unit. The approved body shall verify only that the documentation on operation is provided.

4.5. MAINTENANCE RULES

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.

The following documents being part of the technical file as required in regulation 17(2) of and Schedule 4 to the RIR 2011 are necessary to undertake maintenance activities on the units:

— general documentation (point 4.5.1),

— the maintenance design justification file (point 4.5.2), and

— the maintenance description file (point 4.5.3).

The applicant shall provide the three documents described in 4.5.1, 4.5.2. and 4.5.3. This documentation might be modified later in accordance with the corresponding legislation, taking into account the existing operating and maintenance conditions of the unit. The approved body shall verify only that the documentation on maintenance is provided.

The applicant or any entity authorised by the applicant (e.g. a keeper) shall provide this documentation to the entity in charge of maintenance as soon as it is assigned for the maintenance of the unit.

On the basis of these three documents, the entity in charge of maintenance shall define a maintenance plan and appropriate maintenance requirements at maintenance operational level under its sole responsibility (not in the scope of the assessment against this NTSN).

The following only applies to wagons that access the Channel Tunnel:

— The documentation includes a list of safety critical components. Safety critical components are components for which a single failure has a credible potential to lead directly to a serious accident, which is defined as any train collision or derailment of trains resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other accident with the same consequences which has an obvious impact on railway safety regulation or the management of safety; 'extensive damage' means damage that can be immediately assessed by the investigating body to cost at least EUR 2 million in total.

— The safety critical components and their specific servicing, maintenance and maintenance traceability requirements are identified by the designers/manufacturers at design phase and through a collaboration between designers/manufacturers and the concerned entities in charge of maintenance after vehicles have entered into operation.

4.5.1. General documentation

The general documentation comprises:

— Drawings and description of the unit and its components.

— Any legal requirement concerning the maintenance of the unit.

— Drawing of systems (electrical, pneumatic, hydraulic and control-circuit diagrams).

— Additional on-board systems (description of the systems including description of functionality, specification of interfaces and data processing and protocols).

— Configuration files for each vehicle (parts list and bill of material) to enable (in particular but not only) traceability during maintenance activities.

4.5.2. Maintenance design justification file

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 permissible 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. The maintenance design justification file comprises:

— Precedents, principles and methods used to design the maintenance of the unit.

— For Channel Tunnel, precedents, principles and methods used to identify the safety critical components and their specific operational, servicing, maintenance and traceability requirements.

— Limits of the normal use of the unit (e.g. km/month, climatic limits, foreseen types of loads, etc.).

— Relevant data used to design the maintenance and origin of these data (return of experience).

— Tests, investigations and calculations carried out to design the maintenance.

4.5.3. Maintenance description file

The maintenance description file describes how maintenance activities can be conducted. Maintenance activities include, among others, inspections, monitoring, tests, measurements, replacements, adjustments and repairs.

Maintenance activities are split into:

— preventive maintenance (scheduled and controlled), and

— corrective maintenance.

The maintenance description file includes the following:

— Component hierarchy and functional description which sets up the boundaries of the rolling stock by listing all the items belonging to the product structure of that rolling stock and using an appropriate number of discrete levels. The lowest item of the hierarchy shall be a replaceable component.

— Parts list which shall contain the technical and functional descriptions of the spare parts (replaceable units). The list shall include all parts specified for changing based on condition, which may require a replacement following electrical or mechanical malfunction or which will foreseeable require a replacement after an accidental damage. Interoperability constituents shall be indicated and referenced to their corresponding declaration of conformity.

— Safety critical components list (Channel Tunnel only): The safety critical components list shall contain the specific servicing, maintenance and servicing/maintenance traceability requirements.

— Limit values for components which are not to be exceeded in service. It is permitted to specify operational restrictions in degraded mode (limit value reached).

— List of reference to the legal obligations to which components or subsystems are subject.

— Maintenance plan[3] i.e. the structured set of tasks to perform the maintenance including the activities, procedures and means. The description of this set of tasks includes:

  (a) Disassembly/assembly instructions drawings necessary for correct assembly/disassembly of replaceable parts.

  (b) Maintenance criteria.

  (c) Checks and tests in particular of safety relevant parts; these include visual inspection and non-destructive tests (where appropriate e.g. to detect deficiencies that may impair safety).

  (d) Tools and materials required to undertake the task.

  (e) Consumables required to undertake the task.

  (f) Personal protective safety provision and equipment.

— Necessary tests and procedures to be undertaken after each maintenance operation before re-entry into service of rolling stock.

4.6. PROFESSIONAL COMPETENCIES

The professional competencies of staff required for the operation and maintenance of units are not covered by this NTSN.

4.7. HEALTH AND SAFETY CONDITIONS

The provisions for health and safety of staff required for the operation and maintenance of units are covered by 'Essential Requirements' 1.1.5, 1.3.1, 1.3.2, 2.5.1 and 2.6.1 set out in Schedule 2 of the RIR 2011.

In particular, the following parts of point 4.2 specify provisions for health and safety of staff:

3 The maintenance plan shall take into account the findings of the ERA Task force on Freight Maintenance (see "Final report on the activities of the Task Force Freight Wagon Maintenance" published on the ERA website http://www.era.europa.eu).

— point 4.2.2.1.1: End coupling,

— point 4.2.6.1: Fire safety,

— point 4.2.6.2: Protection against electrical hazards.

If the unit is fitted with a manual coupling system, a free space for shunters during coupling and uncoupling shall be provided.

All protruding parts deemed a hazard to operational staff shall be clearly indicated and/or fitted with protective devices.

The unit shall be equipped with footsteps and handrails except in those cases it is not intended to be operated with staff on-board, e.g. for shunting.

4.8. PARAMETERS TO BE RECORDED IN THE TECHNICAL FILE AND LIST OF DETERMINATIONS OF TYPE FOR AUTHORISED TYPES OF VEHICLES

The technical file shall contain at least the following parameters:

— Type, position and resiliency of the end coupling

— Load due to dynamic traction forces and compressive forces

— Gauge reference profiles to which the unit complies

— Conformity, if any, to target gauge reference profile(s) G1, GA, GB and GC

— Compliance, if any, to gauge lower reference profile(s) GI1 and GI2

— Mass per axle (tare and fully laden)

— Position of the axles along the unit and number of axles

— Length of the unit

— Maximum design speed

— Track gauges(s) the unit can be operated on

— Compatibility with train detection systems (track circuits/axle counters/loop equipment)

— Compatibility with hot axle box detection systems

— In-service temperature range of the axle bearings

— Nature of the signal which controls the brake (example: pneumatic main brake pipe, electric brake type XXX, etc.)

— Characteristics of the control line and of its coupling with other units (main brake pipe diameter, section of the electric cable etc.)

— Individual nominal performance of the brake unit, depending on the brake mode, if any (response time, brake force, level of adhesion required, etc.)

— Braking distance or brake weight depending on the brake mode, if any.

— Thermal load of the brake components expressed in terms of speed, axle load, gradient and brake distance

— Temperature range and severity level of snow/ice/hail conditions

— Minimum brake force and, where relevant, maximum brake force and breakover loading mass for the parking brake (if applicable)

— Number of axles where the parking brake is applied

— Ability/inability to be hump shunted

— Presence of footsteps and/or handrails

— Presence of one or more of the following functions: DDF, DPF, DDAF.

— Description of the signal informing of a derailment or a precursor to a derailment and its transmission for units fitted with DDF or DPF.

The rolling stock data must be recorded in the list of determinations of types for vehicles authorised by the Safety Authority issued in accordance with regulation 8 of the RIR 2011.

5. INTEROPERABILITY CONSTITUENTS

5.1. GENERAL

Interoperability constituents (ICs), as defined in regulation 2 of the RIR 2011, are listed in point 5.3 together with:

— their area of use covering parameters of the subsystem, and

— the reference to corresponding requirements defined in point 4.2.

When a requirement is identified in point 5.3 as being assessed at IC level, an assessment for the same requirement at subsystem level is not required.

5.2. INNOVATIVE SOLUTIONS

As stated in Summary subsection 7 ‘Exemptions from this NTSN’, innovative solutions may require new specifications and/or new assessment methods. Such specifications and assessment methods shall be developed using the process described in point 6.1.3 whenever an innovative solution is envisaged for an interoperability constituent.

5.3. INTEROPERABILITY CONSTITUENT SPECIFICATIONS

5.3.1. Running gear

The running gear shall be designed for all application ranges, the areas of use, as defined by the following parameters:

— Track gauge

— Maximum speed

— Maximum cant deficiency

— Minimum tare of the unit

— Maximum axle load

— Range of distances between bogie pivots or range of wheelbase of 'two-axle units'

— Maximum height of centre of gravity of empty unit

— Coefficient of height of centre of gravity of loaded unit

— Minimum torsional stiffness coefficient of car body

— Maximum mass distribution coefficient for empty units with:

$$\frac{1}{2a^*} \cdot \sqrt{\frac{I_{zz}}{m}}$$

— Where:

I_{zz} = moment of inertia of the car body relative to the vertical axis through the centre of gravity of the car body

m = mass of the car body

2a* = wheelbase

— Minimum nominal wheel diameter

— Rail inclination.

The parameters speed and axle load may be considered in combination in order to define the appropriate area of use (e.g. maximum speed and tare weight).

The running gear shall comply with the requirements expressed in points 4.2.3.5.2 and 4.2.3.6.1. These requirements shall be assessed at IC level.

5.3.2. Wheelset

For the purpose of this NTSN, wheelsets include the main parts ensuring the mechanical interface with the track (wheels and connecting elements: e.g. transverse axle, independent wheel axle). Accessories parts (axle bearings, axle boxes and brake discs) are assessed at subsystem level.

The wheelset shall be assessed and designed for the area of use as defined by:

— track gauge,

— nominal wheel tread diameter, and

— maximum vertical static force.

A wheelset shall comply with the requirements on geometrical and mechanical parameters defined in point 4.2.3.6.2. These requirements shall be assessed at IC level.

Note: there is a UK specific case relevant to this IC (see point 7.3.2.5).

5.3.3. Wheel

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

— nominal tread diameter,

— maximum vertical static force,

— maximum speed,

— in-service limits, and

— maximum braking energy.

A wheel shall comply with the requirements on geometrical, mechanical and thermo mechanical parameters defined in point 4.2.3.6.3. These requirements shall be assessed at IC level.

5.3.4. Axle

An axle shall be designed and assessed for an area of use defined by:

— maximum vertical static force.

An axle shall comply with the requirements on mechanical parameters defined in point 4.2.3.6.4. These requirements shall be assessed at IC level.

5.3.4a. Friction element for wheel tread brakes

The friction element for wheel tread brakes shall be designed and assessed for an area of use defined by:

— dynamic friction coefficients and their tolerance bands,

— minimum static friction coefficient,

— maximum permitted brake forces applied on the element,

— suitability for train detection by systems based on track circuits,

— suitability for severe environmental conditions.

A friction element for wheel tread brakes shall comply with the requirements defined in point 4.2.4.3.5. These requirements shall be assessed at IC level.

5.3.4b. Automatic variable gauge system

An IC “automatic variable gauge system” shall be designed and assessed for an area of use defined by:

— the track gauges the system is designed for,

— the range of maximum static axle loads,

— the range of nominal wheel tread diameters,

— the maximum design speed of the unit, and

— the types of track gauge changeover facility(ies) the system is designed for, including the nominal speed through the track changeover facility(ies) and the maximum axial forces during the automatic gauge changeover process.

An automatic variable gauge system shall comply with the requirements set out in point 4.2.3.6.6; these requirements shall be assessed at IC level as set out in point 6.1.2.6.

5.3.5. Rear-end signal

The rear-end signal, as described in Appendix E, is an independent IC. There are no requirements in point 4.2 dealing with the rear-end signal. Its assessment by the approved body is not part of the UK verification of the subsystem.

6. CONFORMITY ASSESSMENT AND UK VERIFICATION

6.1. INTEROPERABILITY CONSTITUENT

6.1.1. Modules

The conformity assessment of an interoperability constituent shall be performed in accordance with the module(s) described in Table 8.

Table 8

Modules for conformity assessment of interoperability constituents

Module CA1	Internal production control plus product verification by individual examination
Module CA2	Internal production control plus product verification at random intervals
Module CB	UK-Type examination
Module CD	Conformity to type based on quality management system of the production process
Module CF	Conformity to type based on product verification
Module CH	Conformity based on full quality management system
Module CH1	Conformity based on full quality management system plus design examination
Module CV	Type validation by in-service experience (suitability for use)

These modules are specified in detail in the NTSN concerning the modules for the procedures for assessment of conformity or suitability for use and UK verification ("Modules NTSN").

6.1.2. Conformity assessment procedures

The manufacturer or its authorised representative shall choose one of the modules or module combinations indicated in Table 9 in accordance with the required constituent.

Table 9

Modules to be applied for interoperability constituents

Point	Constituent	Modules					
		CA1 or CA2	**CB + CD**	**CB + CF**	**CH**	**CH1**	**CV**
4.2.3.6.1	Running gear		X	X		X	
	Running gear — established	X			X		
4.2.3.6.2	Wheelset	X ([1])	X	X	X ([1])	X	
4.2.3.6.3	Wheel	X ([1])	X	X	X ([1])	X	
4.2.3.6.4	Axle	X ([1])	X	X	X ([1])	X	
4.2.3.6.6	Automatic variable gauge system	X ([1])	X	X	X ([1])	X	X ([2])
4.2.4.3.5	Friction element for wheel tread brakes	X ([1])	X	X	X ([1])	X	X ([2])
5.3.5	Rear-end signal	X			X		

([1]) Modules CA1, CA2 or CH may be used only in the case of products placed on the market, and therefore developed, before the 1 January 2014, provided that the manufacturer demonstrated to the notified body. that design review and type examination were performed for previous applications under comparable conditions, and were in conformity with the requirements of the TSI for Commission Regulation EU 321/2013 (Wagon TSI); this demonstration shall be documented, and is considered as providing the same level of proof as module CB or design examination according to module CH1.

([2]) Module CV shall be used in case the manufacturer of friction element for wheel tread brakes has no sufficient return of experience (according to its own judgment) for the proposed design.

Within the application of the chosen module or module combination the interoperability constituent shall be assessed against the requirements mentioned in Section 4.2. If necessary, additional requirements concerning the assessment of particular interoperability constituents are given in the following clauses.

6.1.2.1. Running gear

The demonstration of conformity for running dynamic behaviour is set out in the specification referenced in Appendix D Index [8].

Units equipped with an established running gear as described in that specification are presumed to be in conformity with the relevant requirement provided that the running gears are operated within their established area of use.

The minimum axle load and maximum axle load during operation of a wagon equipped with an established running gear shall be compliant with the loading

conditions between tare and loaded specified for the established running gear, as in the specification referenced in Appendix D Index [8].

In case the minimum axle load is not achieved by the mass of the vehicle in tare condition, conditions for use can be applied to the wagon requiring to operate it always with a minimum payload or a ballast (for example with an empty loading device), to be compliant with the parameters of the specification referenced in Appendix D Index [8].

In such case, the parameter 'Mass of wagon in tare conditions' used for dispensation of on track tests can be substituted by 'Minimum axle load'. This shall be reported in the Technical File as a condition for use.

The assessment of the bogie frame strength shall be based on the specification referenced in Appendix D Index [9].

6.1.2.2. Wheelset

The demonstration of conformity for the mechanical behaviour of the wheelset assembly shall be carried out in accordance with the specification referenced in Appendix D Index [10], which defines limit values for the axial assembly force and the associated verification test.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

A verification procedure shall exist to ensure at the assembly phase that no defects may detrimentally affect safety due to any change in the mechanical characteristics of the fitted parts of the axle. This procedure shall contain the determination of the interference values and, in case of press-fitted wheelsets, the corresponding press-fitting diagram.

6.1.2.3. Wheel

(a) Forged and rolled wheels: The mechanical characteristics shall be proven following the procedure described in the specification referenced in Appendix D Index [11].

If the wheel is intended to be used with brake blocks acting on the wheel running surface, the wheel shall be thermo mechanically proven by taking into account the maximum braking energy foreseen. A type test, as described in the specification referenced in Appendix D Index [11], shall be performed in order to check that the lateral displacement of the rim during braking and the residual stress are within the specified tolerance limits.

The decision criteria of residual stresses for forged and rolled wheels are set out in the same specification.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

(b) Other types of wheels: Other types of wheels are permitted for units in national use. In that case the decision criteria and the fatigue stress criteria shall be specified in national technical rules.

A verification procedure shall exist to ensure at the production phase that no defects may adversely affect safety due to any change in the mechanical characteristics of the wheels. The tensile strength of the material in the wheel, the hardness of the rim, the fracture toughness (only for tread-braked wheels), the resistance to impact, the material characteristics and the material cleanliness shall be verified. The verification procedure shall specify the batch sampling used for each characteristic to be verified.

6.1.2.4. Axle

In addition to the requirement for the assembly above, the demonstration of conformity of the mechanical resistance and fatigue characteristics of the axle shall be based on the specification referenced in Appendix D, index [12].

That specification includes the decision criteria for the permissible stress. A verification procedure shall exist to ensure at the production phase that no defects may adversely affect safety due to any change in the mechanical characteristics of the axles. The tensile strength of the material in the axle, the resistance to impact, the surface integrity, the material characteristics and the material cleanliness shall be verified. The verification procedure shall specify the batch sampling used for each characteristic to be verified.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

6.1.2.4a

Where the EN standards referred to in points 6.1.2.2, 6.1.2.3 and 6.1.2.4 do not cover the proposed technical solution, it is permitted to use other standards to demonstrate conformity of the mechanical behaviour of the wheelset assembly, the mechanical characteristics of the wheels and the mechanical resistance and fatigue characteristics of the axle respectively; in that case the approved body shall verify that the alternative standards form part of a technically consistent set of standards applicable to the design, construction and testing of the wheelsets, containing specific requirements for wheelset, wheels and axles covering:

— wheelset assembly,

— mechanical resistance,

— fatigue characteristics,

— permissible stress limits,

— thermomechanical characteristics.

Only standards that are publicly available can be referred to in the demonstration required above. The verification carried out by the approved body shall ensure the consistency between the methodology of the alternative standards, the assumptions taken by the applicant, the intended technical solution and the intended area of use.

6.1.2.5. Friction elements for wheel tread brakes

The demonstration of conformity of friction elements for wheel tread brakes shall be carried out by determining the following friction element properties in accordance with the European Railway Agency (ERA) technical document ERA/TD/2013-02/INT version 3.0 of 27.11.2015 published on the ERA website (http://www.era.europa.eu):

— dynamic friction performance (chapter 4);

— static friction coefficient (chapter 5);

— mechanical characteristics including properties in respect to shear strength test and flexural strength test (chapter 6).

Demonstration of the following suitabilities shall be carried out in accordance with chapters 7 and/or 8 of the ERA technical document ERA/TD/2013-02/INT version 3.0 of 27.11.2015 published on the ERA website (http://www.era.europa.eu), if the friction element is intended to be suitable for:

— train detection by systems based on track circuits; and/or

— severe environmental conditions.

If a manufacturer does not have sufficient return of experience (according with its own judgement) for the proposed design, the type validation by in-service experience procedure (module CV) shall be part of the assessment procedure for suitability for use. Before commencing in-service tests, a suitable module (CB or CH1) shall be used to certify the design of the interoperability constituent.

The in-service tests shall be organised on request from the manufacturer, who must obtain agreement from a railway undertaking that will contribute to such an assessment.

The suitability for train detection by systems based on track circuits for friction elements intended to be used in subsystems beyond the scope set out in chapter 7 of the ERA technical document ERA/TD/2013-02/INT version 3.0 of 27.11.2015 published on the ERA website (http://www.era.europa.eu) may be demonstrated using the procedure for innovative solutions described in point 6.1.3.

The suitability for severe environmental conditions by a dynamometer test for friction elements intended to be used in subsystems beyond the scope set out in clause 8.2.1 of the ERA technical document ERA/TD/2013-02/INT version 3.0 of 27.11.2015 published on the ERA website (http://www.era.europa.eu) may be demonstrated using the procedure for innovative solutions described in point 6.1.3.

6.1.2.6. Automatic variable gauge system

The assessment procedure shall be based on a validation plan covering all aspects mentioned in points 4.2.3.6.6 and 5.3.4b.

The validation plan shall be consistent with the safety analysis required in clause 4.2.3.6.6 and shall define the assessment needed in all the following different phases:

— Design review

— Static tests (bench tests and integration-in-the-wheelset/unit tests)

— Test on track gauge changeover facility(ies), representative of in-service conditions

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

Regarding the demonstration of compliance to the safety level required in point 4.2.3.6.6, the assumptions considered for the safety analysis related to the unit the system is intended to be integrated in, and related to the mission profile of that unit, shall be clearly documented.

The automatic variable gauge system may be subject to an assessment of suitability for use (module CV). Before commencing in-service tests, a suitable module (CB or CH1) shall be used to certify the design of the interoperability constituent. The in-service tests shall be organised on request from the manufacturer, who must obtain an agreement from a railway undertaking for its contribution to such assessment.

The certificate delivered by the approved body in charge of the conformity assessment shall include both the conditions for use as per clause 5.3.4b and the type(s) and operating conditions of the track gauge changeover facility(ies) the automatic variable gauge system has been assessed for.

6.1.3. Innovative solutions

If an innovative solution referred to in Summary subsection 7 ‘Exemptions from this NTSN’ is proposed for an interoperability constituent, the manufacturer or its authorised representative shall apply the procedure set out in Summary subsection 7.

6.2. SUBSYSTEM

6.2.1. Modules

The UK verification of the subsystem ‘Rolling stock — freight wagons’ shall be performed in accordance with the module(s) described in Table 10.

Table 10

Modules for UK verification of subsystems

SB	UK-Type Examination
SD	UK verification based on quality management system of the production process
SF	UK verification based on product verification
SH1	UK verification based on full quality management system plus design examination

These modules are specified in detail in the Modules NTSN.

6.2.2. UK verification procedures

The applicant shall choose one of the following combinations of modules or module for the UK verification of the subsystem:

— (SB+SD), or

— (SB+SF), or

— (SH1).

Within the application of the chosen module or module combination the subsystem shall be assessed against the requirements mentioned in Section 4.2. If necessary, additional requirements concerning the assessment of particular constituents are given in the following clauses.

6.2.2.1. Strength of unit

The demonstration of conformity shall be in accordance with one of the specifications referenced in Appendix D, either Index [3] or Index [1].

Regarding joints, a recognised verification procedure shall exist to ensure at the production phase that no defect may decrease the intended mechanical characteristics of the structure.

6.2.2.2. Safety against derailment running on twisted track

The demonstration of conformity shall be carried out in accordance with the specification referenced in Appendix D Index [7].

6.2.2.3. Running dynamic behaviour

On-track tests

The demonstration of conformity shall be carried out in accordance with the specification referenced in Appendix D Index [7].

The combination of the highest equivalent conicity and speed for which the unit meets the stability criterion in the specification referenced in Appendix D Index [7] shall be recorded in the report.

6.2.2.4. Axle box/bearings

The demonstration of conformity for mechanical resistance and fatigue characteristics of the rolling bearing shall be in accordance with the specification referenced in Appendix D, index [13].

It is permitted to use other standards for the above demonstration of conformity where the EN standards do not cover the proposed technical solution; in that case the approved body shall verify that the alternative standards form part of a technically consistent set of standards applicable to the design, construction and testing of the bearings.

Only standards that are publicly available can be referred to in the demonstration required above.

In the case of bearings manufactured according to a design developed and already used to place products on the market before the entry into force of relevant NTSNs applicable to those products, the applicant is allowed to deviate from the demonstration of conformity above and refer to design review and type examination performed for previous applications under comparable conditions instead; this demonstration shall be documented and is considered as providing the

same level of proof as type examination according to module SB or design examination according to module SH1.

6.2.2.4a. Automatic variable gauge systems

The safety analysis required in point 4.2.3.6.6, and performed at IC level, shall be consolidated at the level of the unit; in particular, the assumptions made in accordance with point 6.1.2.6 may need to be reviewed to take into account the unit and its mission profile.

6.2.2.5. This provision has been left intentionally blank

6.2.2.6. Thermal capacity

Calculations, simulations or tests shall demonstrate that the temperature of the brake block, brake pad or brake disc does not exceed their thermal capacity. The following shall be taken into account:

(a) concerning the emergency brake application: the critical combination of speed and payload considering straight and level track, minimum wind and dry rails;

(b) concerning the continuous brake application:

— the range up to the maximum braking power,

— the range up to the maximum speed, and

— the corresponding brake application time.

6.2.2.7. Environmental conditions

Steel materials are deemed to comply with all the ranges indicated in point 4.2.5 if the material properties are determined down to – 20 °C.

6.2.2.8. Fire safety

6.2.2.8.1. Barriers

Barriers shall be tested in accordance with the specification referenced in Appendix D Index [19]. Steel sheets of at least 2 mm thickness and aluminium sheets of at least 5 mm thickness are deemed to comply with the integrity requirements without testing.

6.2.2.8.2. Materials

Testing of the materials ignitability and flame spread properties shall be performed in accordance with the specification referenced in Appendix D index [20], for which the limit value shall be CFE ≥ 18 kW/m^2.

For rubber parts of bogies, the testing shall be performed in accordance with the specification referenced in Appendix D index [23], for which the limit value shall be MARHE ≤ 90 kW/m^2 under the test conditions set out in the specification referenced in Appendix D index [22].

For the following materials and components the fire safety requirements are deemed to comply with the required ignitability and flame spread properties:

— Wheelsets, coated or uncoated,

— metals and alloys with inorganic coatings (such as, but not limited to: galvanised coating, anodic coating, chromate film, phosphate conversion coating),

— metals and alloys with an organic coating with a nominal thickness less than 0,3 mm (such as, but not limited to paints, plastic coating, asphaltic coating),

— metals and alloys with a combined inorganic and organic coating of which the nominal thickness of the organic layer is less than 0,3 mm,

— glass, stoneware, ceramic and natural stone products,

— materials that meet the requirements of category C-s3, d2 or higher in accordance with the specification referenced in Appendix D index [21] .

6.2.2.8.3. Cables

The electrical cables shall be selected and installed in accordance with the specifications referenced in Appendix D indexes [24] and [25] .

6.2.2.8.4. Flammable liquids

The measures taken shall be in accordance with the specifications referenced in Appendix D index [26].

6.2.3. Innovative solutions

If an innovative solution referred to in Summary subsection 7 ‘Exemptions from this NTSN’s proposed for the ‘rolling stock — freight wagons’ subsystem, the applicant shall apply the procedure set out in Summary subsection 7.

6.3. SUBSYSTEM CONTAINING COMPONENTS CORRESPONDING TO INTEROPERABILITY CONSTITUENTS NOT HOLDING AN EC OR UK DECLARATION

An approved body or designated body is permitted to issue a UK certificate of verification of a subsystem, even if one or more of the components corresponding to interoperability constituents incorporated within the subsystem are not covered by a relevant EC or UK declaration of conformity in accordance with this NTSN (non-certified ICs), if the constituent was manufactured before the 1 January 2014 and the type of constituent has been:

— used in a subsystem already approved, and

— placed in service in at least one EU Member State or the UK before the 1 January 2014.

The UK verification of the subsystem shall be carried out by the approved body or designated body against the requirements of Chapter 4 by using the corresponding requirements concerning assessment in Chapter 6 together with Chapter 7 except for specific cases. For this UK verification the modules of the subsystem, set out in point 6.2.2, apply.

UK declarations of conformity or suitability for use shall not be drawn up for the components assessed in this manner.

6.4. PROJECT PHASES WHERE ASSESSMENT IS REQUIRED

The assessment shall cover the following two phases as identified by 'X' in the Table F.1 of Appendix F in this NTSN. In particular, where a type test is identified the conditions and requirements of point 4.2 shall be considered.

(a) Design and development phase:

— Design review and/or design examination

— Type test: test to verify the design, if and as defined in the point 4.2.

(b) Production phase:

— Routine test to verify the conformity of production. The entity in charge of the assessment of the routine tests is determined according to the assessment module chosen.

Appendix F is structured according to point 4.2. Where relevant, a reference 6.1 and 6.2 is given.

6.5. CONSTITUENTS HOLDING AN EC DECLARATION OF CONFORMITY PRE-DATING 1 JANUARY 2014

Where a constituent has been identified as an IC and held an EC declaration of conformity before 1 January 2014, its treatment under this NTSN is set out as follows:

(a) In the case this constituent is not recognised as an IC in this NTSN, neither the certificate nor the declaration are valid for the UK verification procedure related to this NTSN.

(b) The EC certificates of conformity, EC-type examination certificates and EC-design examination certificates of the following ICs shall remain valid under this NTSN until their expiry:

— Wheelset;

— Wheel;

— Axle.

7. IMPLEMENTATION

7.1. AUTHORISATION FOR PLACING IN SERVICE

(1) This NTSN is applicable to the 'rolling stock — freight wagons' subsystems on the GB rail system as set out within article 1 'Scope' which are placed into service after the date of publication of this NTSN, except where point 7.1.1 'Application to ongoing projects' applies.

(2) This NTSN is also applicable on a voluntary basis to:

— units referred to in point 2.1 (a) in running mode, in case they correspond to a "unit" as defined in this NTSN, and

— units as defined in point 2.1(c), in case they are in empty configuration.

In case the applicant chooses to apply this NTSN, the corresponding UK declaration of verification shall be valid.

(3) Compliance with the previous NTSN is deemed equivalent to compliance with this NTSN, except for the NTSN changes listed in Appendix A.

7.1.1. Application to ongoing projects

(1) The application of this NTSN applicable from 2nd May 2025 is not mandatory for projects that, on that date, are in phase A or phase B as defined in Article 2.

(2) Without prejudice to Appendix A, Table A.2, the application of the requirements of Chapters 4, 5, 6 to projects referred in point (1) is possible on a voluntary basis.

(3) If the applicant chooses not to apply this NTSN version to an ongoing project, the version of this NTSN applicable at the beginning of phase A as referred to in point (1) remains applicable.

7.1.2. GB recognition of wagons previously authorised outside of GB

Applicants shall comply with the requirements of regulation 6 of the RIR 2011 or in cases where wagons are intended to transit the Channel Tunnel, with the separate requirements in place for the Channel Tunnel in the Channel (Tunnel) Safety Order 2007[4].

For wagons in international service, the Convention concerning International Carriage by Rail ("COTIF") requirements shall apply.

7.2. GENERAL RULES FOR IMPLEMENTATION

7.2.1. Substitution of constituents

This section deals with substitutions of constituents meaning any replacement of components by parts of identical function and performance in the framework of preventive or corrective maintenance.

The following categories have to be considered:

— Certified ICs: Components which RIR 2011 correspond to an IC in Chapter 5 and which are holding a certificate of conformity.

— Other components: Any component, which is not corresponding to an IC in Chapter 5.

— Non-certified ICs: Components which correspond to an IC in Chapter 5 but are not holding a certificate of conformity and which are produced before the expiry of the transitional period referred to in Article 3.

4 The Channel Tunnel requirements of the binational safety regulation as given effect in the UK by SI 2007/3531 (the Channel (Tunnel) Safety Order 2007.

Table 11 shows the possible permutations.

Table 11

Substitution permutation table

	... substituted by ...		
	... certified ICs	... other components	... non-certified ICs
Certified ICs …	Check	not possible	check
Other components …	not possible	check	not possible
Non-certified ICs …	Check	not possible	check

The word “check” in Table 11 means that the entity in charge of maintenance (ECM) may under its responsibility substitute a component by another one utilising the same function and at least the same performance in accordance with the relevant NTSN requirements considering that these components are:

— suitable, i.e. conform to the relevant NTSN(s),

— used within its area of use,

— enabling interoperability,

— meeting the essential requirements, and

— in line with restrictions stated in the technical file.

7.2.2. Changes to a unit in operation or to an existing unit type

In accordance with regulation 13 of the Railways (Interoperability) Regulations 2011, a project entity may apply in writing to the Competent Authority for a decision as to whether an authorisation is required for the renewal or upgrading of a structural subsystem.

7.2.3. Rules related to the UK type or design examination certificates

7.2.3.1. Rolling stock subsystem

This point concerns a rolling stock type (in the context of this NTSN), which is subject to a UK type or design verification procedure in accordance with section 6.2 of this NTSN. It also applies to the UK type or design verification procedure in accordance with the NTSN Noise, which refers to this NTSN for its scope of application to freight units.

The NTSN assessment basis for a UK type or design examination is defined in columns “Design review” and “Type test” of Appendix F of this NTSN and of Appendix C of the Noise NTSN.

7.2.3.1.1. Definitions

(1) Initial assessment framework

The initial assessment framework is the set of NTSNs (this NTSN, the NOI NTSN) applicable at the beginning of the design phase when the notified body is contracted by the applicant.

(2) Certification framework

The certification framework is the set of NTSNs (this NTSN, the NOI NTSN) applicable at the time of issuing the UK type or design examination certificate. It is the initial assessment framework amended with the revisions of NTSNs that came into force during the design phase.

(3) Design phase

The design phase is the period starting once a notified body, which is responsible for UK verification, is contracted by the applicant and ending when the UK type or design examination certificate is issued.

A design phase can cover a type and one or several type variant(s) and type version(s). For all type variant(s) and type version(s), the design phase is considered as starting at the same time as for the main type.

(4) Production phase

The production phase is the period during which units may be placed on the market on the basis of an UK declaration of verification referring to a valid UK type or design examination certificate.

(5) Unit in operation

A unit is in operation when it is registered with ‘Valid’ registration code ‘00’, in the National Vehicle Register in accordance with Commission Decision 2007/756/EC or in the European Vehicle Register in accordance with Commission Implementing Decision (EU) 2018/1614 and maintained in a safe state of running in accordance with Commission Implementing Regulation (EU) 2019/779.

7.2.3.1.2. Rules related to the UK type or design examination certificate

(1) The approved body shall issue the UK type or design examination certificate referring to the certification framework.

(2) When a revision of this NTSN or of the NTSN Noise comes into force during the design phase, the notified body shall issue the UK type or design examination certificate in accordance with the following rules:

— For changes in the NTSNs that are not referenced in appendix A, conformity with the initial assessment framework leads to conformity to the certification framework. The Approved Body shall issue the UK type or design examination certificate referring to the certification framework without additional assessment.

— For changes in the NTSNs that are referenced in appendix A, their application is mandatory in accordance with the transition regime defined in the appendix. During the defined transition period, the Approved Body may issue the UK type or design examination certificate referring to the certification framework without additional assessment. The Approved Body shall list in the UK type or design examination certificate all the points assessed in accordance with the initial assessment framework.

(3) When several revisions of this NTSN or of the NTSN Noise come into force during the design phase, point (2) shall apply to all revisions successively

(4) It is always permissible (but not mandatory) to use a most recent version of any NTSN, either totally or for particular sections, unless explicitly otherwise specified in the revision of those NTSNs; in case of application limited to particular sections, the applicant has to justify and document that applicable requirements remain consistent, and this has to be approved by the approved body.

7.2.3.1.3. Validity of the UK type or design examination certificate

(1) When a revision of this NTSN or of the NTSN Noise comes into force the UK type or design examination certificate for the subsystem remains valid unless it is required to be revised in accordance with the specific transition regime of an NTSN change.

(2) Only the changes to the NTSNs with a specific transition regime can apply to units in production phase or to units in operation

7.2.3.2. Interoperability constituents

(1) This point concerns interoperability constituents which are subject to UK type examination (module CB), design examination (module CH1) or to suitability for use (module CV) in accordance with point 6.1 of this NTSN.

(2) The type or design examination or suitability for use remains valid even if a revision of this NTSN or of the NTSN Noise comes into force, unless explicitly otherwise specified in the revision of these NTSNs.

During this time, new constituents of the same type are permitted to be placed on the market without a new type assessment.

7.3. UK SPECIFIC CASES

7.3.1. Introduction

The UK specific cases, as listed in point 7.3.2, are classified as:

— ‘P’ cases: “permanent” cases.

— ‘T’ cases: “temporary” cases (note that there are no T cases).

In case of a UK specific case applicable to a component defined as interoperability constituent in section 5.3 of this NTSN, the conformity assessment has to be performed according to point 6.1.2.

7.3.2. List of UK specific cases

7.3.2.1. This provision has been left intentionally blank

7.3.2.1a. Gauging (point 4.2.3.1)

(‘P’) For technical compatibility with the existing network, the calculation intended for sizing the rolling stock to run on the railway network of Great Britain without interference risk may be in accordance with national technical rules.

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

7.3.2.2. This provision has been left intentionally blank

7.3.2.3. Safety against derailment running on twisted track (point 4.2.3.5.1)

('P') The limitations to the use of Method 3 set out in EN 14363:2016 clause 6.1.5.3.1 are not applicable for units that are intended for national use on the UK mainline network only.

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

7.3.2.4. Running dynamic behaviour (point 4.2.3.5.2)

('P') Base condition for use of simplified measuring method specified in EN 14363:2016 clause 7.2.2 should be extended to nominal static vertical wheelset forces (PF0) up to 250 kN. For technical compatibility with the existing network it is permissible to use national technical rules amending EN 14363:2016 and notified for the purpose of running dynamic behaviour.

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

7.3.2.5. Characteristics of wheelsets, wheels and axles (points 4.2.3.6.2, 4.2.3.6.3 and 4.2.3.6.4 and 4.3.2.6.3)

('P') For units intended to operate solely on the railway network of Great Britain the characteristics of the wheelsets, wheels and axles may be in accordance with the national technical rules.

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

7.3.2.6. Attachment devices for rear end signals (point 4.2.6.3)

('P') The attachment devices for rear-end signals on units intended to operate solely on the railway network of Great Britain shall be compatible with the rear-end signals that conform with the national technical rules.

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

7.3.2.7. This provision has been left intentionally blank

Appendix A Changes of requirements and transition regimes

For other NTSN points than these listed in Table A.1 and Table A.2, compliance with the 'previous NTSN' imply compliance with this NTSN applicable from 2nd May 2025.

Changes with a generic transition regime of 7 years:

For NTSN points listed in Table A.1, compliance with the previous NTSN does not imply compliance with this NTSN applicable from 2nd May 2025.

Projects already in design phase when this NTSN enters into force, the requirement of the previous NTSN can still apply for a duration of 7 years from the entry in to force of this NTSN.

Projects in production phase and units in operation are not affected by the NTSN requirements listed in table A.1

Table A.1

Transition regime of 7 years

NTSN clause(s)	NTSN clause(s) in previous NTSN	Explanation of the NTSN change
4.2.2.3 Second paragraph	New requirement	Inclusion of a requirement on the securing devices
4.2.3.5.3 Derailment detection and prevention function	No clause	Inclusion of requirements for the derailment detection and prevention function
4.2.4.3.2.1 Service brake	4.2.4.3.2.1 Service brake	Evolution of the specification referenced in Appendix D.1, indexes [16] and [17]
4.2.4.3.2.2 Parking brake	4.2.4.3.2.2 Parking brake	Evolution of the specification referenced in Appendix D.1 index [17]
4.2.4.3.2.2 Parking brake	4.2.4.3.2.2 Parking brake	Change in the calculation of the parking brake parameters
6.2.2.8.1 Testing of barriers	6.2.2.8.1 Testing of barriers	Evolution of the specification referenced in Appendix D.1 index [19]

Point 9 of Appendix C	Point 9 of Appendix C	Evolution of the specification referenced in Appendix D.1, indexes [38], [39], [42], [46], [48], [49], [58]
Points referring to Appendix H and Appendix D.2 index [B]	New requirement	Inclusion of requirements on the codification of units intended to be used in combined transport
Clauses referring to Appendix A, Index 77 of CCS NTSN except to clause 3.2.2	Clauses referring to Appendix J-2 index 1 except to clause 3.2.2	ERA/ERTMS/033281 V5 replaces ERA/ERTMS/033281 V4, main changes concern frequency management for interference current limits and closure of open points

Changes with a specific transition regime:

For NTSN points listed in Table A.2, compliance with the previous NTSN does not imply compliance with this NTSN applicable from 2nd May 2025.

Projects already in design phase on 2nd May 2025, projects in production phase, and units in operation shall comply with the requirement of this NTSN in accordance with the respective transition regime set out in Table A.2 starting from 2nd May 2025.

Table A.2

Specific transition regime

NTSN point(s)	NTSN point(s) in previous version	Explanation on NTSN change	Transition regime			
			Design phase not started	Design phase started	Production phase	units in operation
Points referring to point 3.2.2 of Append	Points referring to point 3.2.2 of ERA/ERTMS/033281 V4	ERA/ ERTMS/033281 V5 replaces ERA/	Transition regime is defined in Table B1 in Appendix B to the CCS NTSN			

ix D.2, Index [A]		ERTMS/033281 V4	

Appendix B *Not used*

Appendix C Additional optional conditions

The compliance with the following set of conditions C.1 to C.20 is optional. If the applicant selects this option, an approved body has to assess the compliance within the UK verification procedure.

1. Manual coupling system

The manual coupling system shall comply with the following requirements:

— The screw coupling system excluding the draw hook, and the draw hook itself, shall respectively comply with the requirements related to freight wagons defined in Appendix D Index [31],

— The wagon shall comply with the requirements related to freight wagons defined in Appendix D Index [59]

— The buffer shall comply with the requirements related to freight wagons of the specification referenced in Appendix D Index [32].

Where a combined automatic and screw coupler is fitted, it is permissible for the auto coupler head to infringe the space for shunting staff on the left-hand side when it is stowed and the screw coupler is in use. In this case the marking defined in the specification referenced in Appendix D Index [2] is mandatory.

In order to provide this full compatibility, it is permitted to have a different value of the distance between buffer centrelines taking into account the specification referenced in Appendix D Index [32].

2. UIC footsteps and handrails

The unit shall be equipped with footsteps and handrails in accordance with the specification referenced in Appendix D Index [28] and with clearances in accordance with the same specification.

3. Ability to be hump shunted

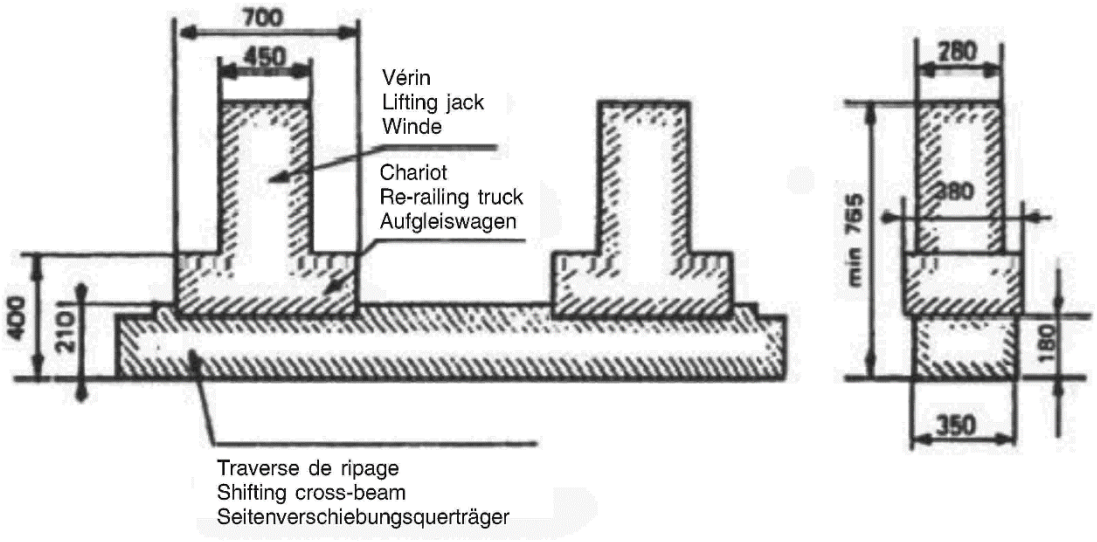
In addition to the requirements of point 4.2.2.2 the unit shall be assessed in accordance with the specification referenced in Appendix D Index [1] and classified in Category F I in accordance with the same specification with the following exception: for units designed to carry motor vehicles or combined transport units without long stroke shock absorbers the Category F-II may be used. The requirements concerning the buffing tests in the same specification apply.

4. Free space under lifting points

The unit shall comply with Figure C.2 on the free space under the re-railing places for rerailing:

Figure C.2

Free spaces under rerailing places



5. Marking of units

Units compliant with all requirements set out in point 4.2, fulfilling all conditions set out in point 7.1.2 and all conditions set out in Appendix C may receive the marking ‘GE’.

Units compliant with all requirements set out in point 4.2, fulfilling all conditions in point 7.1.2 and the conditions set out in Appendix C but not those set out in Appendix C, Sections 3 and/or 6 and/or 7.b, may receive the marking ‘CW’.

If the additional marking is used, it shall be inscribed on the unit as outlined in Figure C.3.

Figure C.3

The additional markings 'GE' and 'CW'

The letters shall be of the same font type as the TEN marking. The size of the letters shall be at least 100 mm high. The outer measures of the frame shall be at least 275 mm wide and 140 mm high, the frame shall be 7 mm thick.

The marking shall be located on the right-hand side of the area containing the European Vehicle Number and the TEN marking.

6. G1 gauge

The reference contour with which the unit complies with shall be G1 and GI1 determined as defined in point 4.2.3.1.

7. Compatibility with train detection systems

(a) The unit shall be compatible with the train detection systems based on track circuits, on axle counters and on loop equipment as specified in clauses 4.2.3.3(a), 4.2.3.3(b) and 4.2.3.3(c).

(b) The distance between two adjacent axles of the unit shall not exceed 17 500 mm.

(c) If the unit has electronic equipment on board emitting interference current via the rail, the 'influencing unit' (as defined in the technical document referenced in Appendix D.2 Index [A]) of which the unit is planned to be part shall be compliant with specific cases for track circuits notified by applying the harmonised vehicle test methods and vehicle impedance referred in the technical document referenced in Appendix D.2 Index [A]. Compliance of the unit is checked by the approved body as part of UK verification.

(d) If the unit has electrical or electronic equipment on board emitting interference electromagnetic fields:

— close to the wheel sensor of an axle counter, or

— induced by the return current via the rail if applicable,

the ‘influencing unit’ (as defined in the technical document referenced in Appendix D.2 Index [A]) of which the unit is planned to be part shall be compliant with specific cases for axle counters by applying the harmonised vehicle test methods referred in the technical document referenced in Appendix D.2 Index [A]. Compliance of the unit is checked by the approved body as part of UK verification.

8. Tests concerning longitudinal compressive forces

The verification of safe running under longitudinal compressive forces shall be in accordance with the specification referenced in Appendix D Index [33].

9. UIC brake

The brake system shall be compatible with vehicles equipped with UIC approved brake systems. The brake system of a unit is compatible with the UIC brake system if it fulfils the following requirements:

(a) The unit shall be equipped with a pneumatic brake pipe with an inner diameter of 32 mm.

(b) Brake modes have different brake application and release times and specific brake weight percentage.

(c) Every unit shall be fitted with a brake system having at least brake modes G and P. The brake modes G and P shall be assessed in accordance with the specification referenced in Appendix D Index [36].

(d) The minimum braking performance for brake-modes G and P shall be in accordance with Table C.3.

(e) If a unit is equipped with a brake system having in addition further brake modes the assessment procedure as described in point 4.2.4.3.2.1 shall be carried out for these additional brake modes. The brake application time of the P brake mode in accordance with the specification referenced in Appendix D Index [36] are also valid for further brake modes.

(f) The energy storage has to be designed in such way that after a brake application with the maximum brake cylinder pressure and the maximum unit specific brake cylinder stroke at any load state the pressure in the auxiliary reservoir must be at least 0,3 bar more than the brake cylinder pressure without the addition of any further energy. Details for standardised air reservoirs are set out in the specifications referenced in Appendix D Index[40] and Index [41].

(g) The pneumatic energy of the brake system shall not be used for other applications different than those related to braking purposes.

(h) The distributor and distributor isolating device shall be in accordance with the specification referenced in Appendix D Index [34]. At least one distributor shall be installed per 31 m unit length.

(i) The pneumatic half coupling and its hose:

(i) The interface of the brake pipe shall be in accordance with the specification referenced in Appendix D Index [42] .

(ii) The opening of the automatic air brake coupling head shall face the left when looking at the end of the vehicle.

(iii) The opening of the main reservoir coupling head shall face the right when looking at the end of the unit.

(iv) The end cocks shall be in accordance with the specification referenced in Appendix D Index [43].

(j) The brake mode switching device shall be in accordance with the specification referenced in Appendix D Index [44].

(k) Brake block holders shall be in accordance with the specification referenced in Appendix D Index [45].

(l) If the brake system requires a 'friction element for wheel tread brakes' interoperability constituent, the interoperability constituent shall, in addition to the requirements of point 6.1.2.5, comply with the specification referenced in Appendix D Index [46] or Index [47] .

(m) Slack adjusters shall be in accordance with the specification referenced in Appendix D index [48] . The assessment of conformity shall be carried out in accordance with the same specification. Additionally, a life test shall be performed to demonstrate the suitability of the slack adjuster for service on the unit and to verify the maintenance requirements for the operational design life. This shall be carried out at the maximum rated load cycling through the full range of adjustment.

(n) If the unit is equipped with a wheel slide protection system (WSP) it shall be in accordance with the specification referenced in Appendix D Index [49].

(o) For wagons with composite brake blocks and a nominal wheel diameter of max 1000 mm, minimal worn 840 mm and a braked weight per wheelset of more than 15,25 t (14,5 t plus 5%), a relay valve type E in accordance with the specification referenced in Appendix D Index [35] shall be used. For wagons with a nominal wheel diameter smaller than 920 mm, this brake weight limit value shall be adapted in line with the energy input into the wheel rim.

Table C.3

Minimum braking performance for brake modes G and P

Braking mode	Command Equipment	unit type	Load status	Requirement for running speed at 100 km/h		Requirement for running speed at 120 km/h	
				Maximum braking distance	**Minimum braking distance**	**Maximum braking distance**	**Minimum braking distance**
Braking mode ' P'	Changeover (1)	' S1' (2)	Empty	S_{max} = 700 m λ_{min} = 65 % a_{min} = 0,60 m/s^2	S_{min} = 390 m λ_{max} = 125 %, (130 %) (3) a_{max} = 1,15 m/s^2	S_{max} = 700 m λ_{min} = 100 % a_{min} = 0,88 m/s^2	S_{min} = 580 m λ_{max} = 125 %, (130 %) (3) a_{max} = 1,08 m/s^2
			Inter-mediate	S_{max} = 810 m λ_{min} = 55 % a_{min} = 0,51 m/s^2	S_{min} = 390 m λ_{max} = 125 % a_{max} = 1,15 m/s^2		
			Loaded	S_{max} = 700 m λ_{min} = 65 % a_{min} = 0,60 m/s^2	S_{min} = Max [(S = 480 m, λ_{max} = 100 %, a_{max} = 0,91 m/s^2) (S obtained with a mean retardation force of 16,5 kN per axle)] (4)		
	Variable load Relay (5)	' SS', ' S2'	Empty	S_{max} = 480 m λ_{min} = 100 % (6) a_{min} = 0,91 m/s^2 (6)	S_{min} = 390 m λ_{max} = 125 %, (130 %) (1) a_{max} = 1,15 m/s^2	S_{max} = 700 m λ_{min} = 100 % a_{min} = 0,88 m/s^2	S_{min} = 580 m λ_{max} = 125 %, (130 %) (1) a_{max} = 1,08 m/s^2

Braking mode	Command Equipment	unit type	Load status	Requirement for running speed at 100 km/h		Requirement for running speed at 120 km/h	
				Maximum braking distance	Minimum braking distance	Maximum braking distance	Minimum braking distance
		‘ S2’ (7)	Loaded	S_{max} = 700 m λ_{min} = 65 % a_{min} = 0,60 m/s^2	S_{min} = Max [(S = 480 m, λ_{max} = 100 %, a_{max} = 0,91 m/s^2) (S obtained with a mean retardation force of 16,5 kN per axle)] (8)		
		‘ SS’ (9)	Loaded (18 t per axle for brake blocks)			S_{max} (10) = Max [S = 700 m, λ_{max} = 100 %, a_{max} = 0,88 m/s^2) (S obtained with a mean retardation force of 16 kN per axle)] (11)	

Braking mode	Command Equipment	unit type	Load status	Requirement for running speed at 100 km/h		Requirement for running speed at 120 km/h	
				Maximum braking distance	Minimum braking distance	Maximum braking distance	Minimum braking distance
Braking mode ' G'					There shall be no separate assessment of the braking performance of units in position G. A unit's braked weight in position G is the result of the braked weight in position P (see the specifications referenced in Appendix D, either Index [17] or Index [58]		

([1]) Changeover in accordance with the specification referenced in Appendix D Index [38]

([2]) An 'S1' unit is a unit with empty/load device. The maximum load per axle is 22,5 t.

([3]) Only for two stage load brake (changeover command) and P10 (cast iron blocks with 10 ‰ phosphor)- or LL-brake blocks

([4]) The maximum mean retardation force allowed (for running speed at 100 km/h) is 18 x 0,91 = 16,5 kN / axle. This value comes from the maximum braking energy input permitted on a clasp braked wheel with a nominal new diameter in the range of [920 mm; 1 000 mm] during braking (the brake weight shall be limited to 18 tonnes/axle).

([5]) Variable load relay in accordance with the specification referenced in Appendix D Index [35] in combination with a variable load sensing device in accordance with the specification referenced in Appendix D Index [39]

([6]) 'a' = (((Speed (km/h)) / 3,6) ^{2}) / (2 x (S – ((Te) x (Speed (km/h) / 3,6)))), with Te = 2 sec. Distance calculation in accordance with the specification referenced in Appendix D Index [16]

([7]) An 'S2' unit is a unit with a variable load relay. The maximum load per axle is 22,5 t.

([8]) The automatic-load controlled equipment of wagons worked under s conditions can provide a maximum braked weight of λ = 100%, up to load limit equal to 67 % of the maximum permissible wagon weight.

For standard wheelset with using the max axle load

Max 1000 mm; minimal worn 840 mm, max axle load 22,5t,

Max axle load for λ=100: 15 t

Max 840 mm; minimal worn 760 mm,

max axle load 20 t, Max axle load for λ=100: 13 t

Max 760 mm; minimal worn 680 mm,

max axle load 18 t, Max axle load for λ=100: 12 t

Max 680 mm; minimal worn 620

Max axle load 16 t, Max axle load for λ=100: 10,5 t

([9]) An 'SS' unit shall be equipped with a variable load relay. The maximum load per axle is 22,5 t.

([10]) λ must not exceed 125 %, considering for braking only on wheels (brake blocks), the maximum mean retardation force allowed of 16 kN/axle (for running speed at 120 km/h).

([11]) The requirement by a running speed of 120 km/h is to fulfill λ = 100 % up to the SS load limit, with following derogation: the mean retardation force for tread brake with wheel diameter [new max 1.000mm, worn min. 840 mm] shall be limited to 16 kN/wheelset. This limit is caused by the maximum admissible braking energy corresponding to 20 t axle load with λ = 90 % and 18 t braked weight per wheelset.

If a braked weight percentage of more than 100 % is required with an axle load of more than 18 t, it is necessary to realize another type of brake system (for example disc brakes) to limit the thermal load on the wheel.

10. Location of parking brake handles

If a unit is equipped with a parking brake the location of its operating handle or operating wheel shall be:

— on both sides of the unit if it is operated from the ground, or

— on a platform, that can be accessed from both sides of the unit.

The operation from the ground shall be done by wheel.

11. Temperature ranges for air reservoirs, hoses and grease

The following requirements are deemed to comply with any temperature range indicated in point 4.2.5:

— Air reservoirs shall be designed for the temperature range of – 40 °C to + 70 °C.

— Brake cylinders and brake couplings shall be designed for the temperature range of – 40 °C to + 70 °C.

— Hoses for air brakes and air supply shall be specified for the temperature range of – 40 °C to + 70 °C.

The following requirement is deemed to comply with the range T1 indicated in point 4.2.5:

— The grease for the lubrication of roller bearing shall be specified for ambient temperatures down to – 20 °C.

12. Welding

Welding shall be carried out in accordance with the specifications referenced in Appendix D Indexes [50] to [54] .

13. Track gauge

The unit shall be compatible with the 1 435 mm track gauge.

14. Specific brake thermal capacity

The brake system shall resist a thermal load equivalent to the suggested reference case in point 4.2.4.3.3.

With regard to the use of wheel tread brake systems, this condition is deemed to be met if the 'friction element for wheel tread brakes' interoperability constituent is, in addition to the requirements of point 6.1.2.5, compliant with the specification referenced in Appendix D, either Index [46] or Index [47], and if the wheel:

— is assessed in accordance with point 6.1.2.3; and

— fulfils the conditions of Section 15 of Appendix C.

15. Specific product properties concerning the wheel

The wheels shall be in accordance with the specification referenced in Appendix D Index [55]. The thermal mechanical type test required in point 6.1.2.3 shall be carried out in accordance with the specifications referenced in Appendix D Index [11] when the complete brake system is acting directly on the wheel tread.

16. Tow hooks

Units shall be provided with tow hooks, each one being fixed to the side of the unit underframe in accordance with the specification referenced in Appendix D Index [56].

Alternative technical solutions are allowed as far as conditions listed in the same specification are respected. If the alternative solution is a cable eye bracket, it shall in addition have a minimum diameter of 85 mm.

17. Protective devices on protruding parts

To ensure the safety of staff, protruding (e.g. angular or pointed) parts of the unit located up to 2 m above rail level or above passageways, working surfaces or tow hooks which are liable to cause accidents, shall be fitted with protective devices as described in the specification referenced in Appendix D Index [56].

18. Label holders and attachment devices for rear-end signal

All units shall be equipped with a label holder in accordance with the specification referenced in Appendix D Index [57] and at both ends with attachment devices as set out in point 4.2.6.3.

19. Axle bearing condition monitoring

It shall be possible to monitor the axle bearing condition of the unit by means of line side detection equipment.

20. Running dynamic behaviour

The combination of maximum operating speed and maximum admissible cant deficiency shall be in accordance with the specification referenced in Appendix D Index [7].

Units equipped with established running gear as specified in clause 6.1.2.1 are presumed to be in conformity with this requirement.

Appendix D

D.1 Standards or normative documents

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[1]	**Railway applications - Structural requirements of railway vehicle bodies - Part 2: Freight wagons**	**EN 12663-2**	**2010**
[1.1]	Strength of unit	4.2.2.2	5
[1.2]	Strength of unit – demonstration of conformity	6.2.2.1	6, 7
[1.3]	Ability to be hump shunted	C.3	8
[1.4]	Classification	C.3	5.1

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[1.5]	Requirements concerning the buffing tests	C.3	8.2.5.1
[2]	**Railway applications - Marking on railway vehicles - Part 1: Freight wagons**	**EN 15877-1**	**2012+A1:2018**
[2.1]	Lifting and jacking position marking	4.2.2.2	4.5.14
[2.2]	Marking of DDAF	4.2.3.5.3.4	4.5.59
[2.4]	Marking for combined automatic and screw coupler	C.1	Figure 75
[3]	**Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)**	**EN 12663-1**	**2010+A1:2014**
[3.1]	Strength of unit – demonstration of conformity	6.2.2.1	9.2, 9.3
[4]	**Railway applications - Gauges - Part 2: Rolling stock gauge**	**EN 15273-2**	**2013+A1 :2016**
[4.1]	Gauging	4.2.3.1	5, annexes A to J, L, M, P
[5]	**Railway applications - Line categories for managing the interface between load limits of vehicles and infrastructure**	**EN 15528**	**2015**
[5.1]	Compatibility with load carrying capacity of lines	4.2.3.2	6.1, 6.2
[6]	**Railway applications – Axle box condition monitoring – Interface and design requirements - Part 1: Track side equipment and rolling stock axle box**	**EN 15437-1**	**2009**
[6.1]	Axle bearing condition monitoring	4.2.3.4	5.1, 5.2
[7]	**Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests**	**EN 14363**	**2016**
[7.1]	Safety against derailment running on twisted track	6.2.2.2	4, 5, 6.1

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[7.2]	Running dynamic behaviour	4.2.3.5.2	4, 5, 7
[7.3]	Running dynamic behaviour - On-track tests	6.2.2.3	4, 5, 7
[7.4]	Application to units operated on the 1668mm track gauge network	6.2.2.3	7.6.3.2.6 (2)
[7.5]	Running dynamic behaviour	C.20	Table H.1
[8]	**Railway application - Testing for the acceptance of running characteristics of railway vehicles - Freight wagons - Conditions for dispensation of freight wagons with defined characteristics from on-track tests according to EN 14363**	**EN 16235**	**2013**
[8.1]	Running dynamic behaviour	6.1.2.1	5
[8.2]	Established running gear	6.1.2.1	6
[8.3]	Minimum axle load for established running gears	6.1.2.1	Table 7, 8, 10, 13, 16 and 19, in chapter 6
[9]	**Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames**	**EN 13749**	**2021**
[9.1]	Structural design of bogie frame	4.2.3.6.1	6.2
[9.2]	Assessment of the bogie frame strength	6.1.2.1	6.2
[10]	**Railway applications - Wheelsets and bogies - Wheelsets - Product requirements**	**EN 13260**	**2020**
[10.1]	Characteristics of wheelsets	6.1.2.2	4.2.1
[11]	**Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Part 1: Forged and rolled wheels**	**EN 13979-1**	**2020**
[11.1]	Mechanical characteristics of wheels	6.1.2.3	8
[11.2]	Thermomechanical behaviour and criteria for residual stress	6.1.2.3	7

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[11.3]	Specific product properties concerning the wheel	C.15	7
[11.4]	Specific product properties concerning the wheel - Thermomechanical type test	C.15	Table A.1
[12]	**Railway applications - Wheelsets and bogies - Part 1: Design method for axles with external journals**	**EN 13103-1**	**2017**
[12.1]	Method of verification	6.1.2.4	5, 6, 7
[12.2]	Decision criteria for permissible stress	6.1.2.4	8
[13]	**Railway applications – Axle boxes - Performance testing**	**EN 12082**	**2017+A1:2021**
[13.1]	Mechanical resistance and fatigue characteristics of the rolling bearing	6.2.2.4	7
[14]	**Conditions with which wagons must comply in order to be accepted for transit between standard gauge railways and the Spanish and Portuguese broad gauge railways**	**UIC 430-1**	**2012**
[14.1]	Changeover between 1435 mm and 1668 mm track gauges, for axle units	6.2.2.5	Figures 9 and 10 of Annex B.4, and Figure 18 of Annex H
[14.2]	Changeover between 1435 mm and 1668 mm track gauges, for bogie units	6.2.2.5	Figure 18 of Annex H and Figures 19 and 20 of Annex I
[15]	**Goods wagons - Conditions to be satisfied by goods wagons to make them acceptable for running on both standard-gauge networks and the network of the finnish state railways**	**UIC 430-3**	**1995**
[15.1]	Changeover between 1435 mm and 1524 mm track gauges	6.2.2.5	Annex 7

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[16]	**Railway applications - Methods for calculation of stopping distances, slowing distances and immobilization braking - Part 1: General algorithms utilizing mean value calculation for train sets or single vehicles**	**EN 14531-1**	**2015+A1 :2018**
[16.1]	Service brake	4.2.4.3.2.1	4
[16.2]	Parking brake	4.2.4.3.2.2	5
[16.3]	Distance calculation	C.9 - Table C.3	4
[17]	**Brakes - Braking performance**	**UIC 544-1**	**2014**
[17.1]	Service brake - calculation	4.2.4.3.2.1	1 to 3 and 5 to 8
[17.2]	Service brake - validation	4.2.4.3.2.1	Appendix B
[17.3]	Assessment of braking mode G	C.9 - Table C.3	1 to 3 and 5 to 8
[18]	**Railway applications - Environmental conditions for equipment -Part 1: Rolling stock and on-board equipment**	**EN 50125-1**	**2014**
[18.1]	Environmental conditions	4.2.5	4.7
[19]	**Fire resistance tests - Part 1: General Requirements**	**EN 1363-1**	**2020**
[19.1]	Barriers	6.2.2.8.1	4 to 12
[20]	**Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration**	**ISO 5658- 2**	**2006/Am1:2011**
[20.1]	Testing of the materials ignitability and flame spread properties	6.2.2.8.2	5 to 13
[21]	**Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests**	**EN 13501-1**	**2018**
[21.1]	Material properties	6.2.2.8.2	8

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[22]	**Railway applications - Fire protection on railway vehicles -Part 2: Requirements for fire behaviour of materials and components**	**EN 45545-2**	**2020**
[22.1]	Test conditions	6.2.2.8.2	Ref T03.02 of Table 6
[23]	**Reaction-to-fire tests — Heat release, smoke production and mass loss rate —Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement)**	**ISO 5660-1**	**2015+Amd1 :2019**
[23.1]	Testing of rubber parts of bogies	6.2.2.8.2	5 to 13
[24]	**Railway applications - Railway rolling stock cables having special fire performance -Guide to use**	**EN 50355**	**2013**
[24.1]	Cables	6.2.2.8.3	1, 4 to 9
[25]	**Railway applications -Rolling stock -Rules for installation of cabling**	**EN 50343**	**2014 /A1 :2017**
[25.1]	Cables	6.2.2.8.3	1, 4 to 7
[26]	**Railway applications -Fire protection on railway vehicles -Part 7: Fire safety requirements for flammable liquid and flammable gas installations**	**EN 45545-7**	**2013**
[26.1]	Flammable liquids	6.2.2.8.4	4 to 9
[27]	**Railway applications -Rolling stock -Protective provisions relating to electrical hazards**	**EN 50153**	**2014+A2:2020**
[27.1]	Protective measures against indirect contact (protective bonding)	4.2.6.2.1	6.4
[27.2]	Protective measures against direct contact	4.2.6.2.2	5
[28]	**Railway applications - Design requirements for steps, handrails and associated access for staff - Part 2: Freight wagons**	**EN 16116-2**	**2021**
[28.1]	Attachment devices for rear-end signal	4.2.6.3	Figure 10

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[28.2]	UIC footsteps and handrails Clearances	C.2	4, 5 6.2
[29]	**Railway applications -External visible and audible warning devices for trains -Part 1: Head, marker and tail lamps**	**EN 15153-1**	**2013+A1:2016**
[29.1]	Rear-end signal - colour of tail lamps	E.1	5.5.3
[29.2]	Rear-end signal - lighting intensity of tail lamps	E.1	Table 8
[30]	**Fixed, vertical road traffic signs - Part 1: Fixed signs**	**EN 12899-1**	**2007**
[30.1]	Reflective plates	E.2	Class Ref. 2
[31]	**Railway applications - Railway rolling stock - Draw gear and screw coupling**	**EN 15566**	**2022**
[31.1]	Manual coupling system	C.1	4, 5, 6, 7 except clause 4.3 and the dimension ‘a’ in Annex B Figure B.1 which shall be treated as informative.
[32]	**Railway applications - Railway rolling stock - Buffers**	**EN 15551**	**2022**
[32.1]	Buffers	C.1	4 (except 4.3), 6 (except 6.2.2.3 and E.4), and 7
[33]	**Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Freight wagons - Testing of running safety under longitudinal compressive forces**	**EN 15839**	**2012+A1:2015**
[33.1]	Tests concerning longitudinal compressive forces	C.8	All

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[34]	**Railway applications - Braking - Distributor valves and distributor-isolating devices**	**EN 15355**	**2019**
[34.1]	Distributor and distributor isolating device	C.9 (h)	5, 6
[35]	**Railway applications - Braking - Relay valves**	**EN 15611**	**2020**
[35.1]	Variable load relay	C.9 - Table C.3	5, 6, 7, 10
[35.2]	Type of relay valve	C.9 (o)	
[36]	**Brakes - Air brakes for freight trains and passenger trains**	**UIC 540**	**2016**
[36.1]	UIC brake	C.9 (c), (e)	2
[37]	**Railway applications - Methods for calculation of stopping and slowing distances and immobilization braking - Part 2: Step by step calculations for train sets or single vehicles**	**EN 14531-2**	**2015**
[37.1]	Service brake	4.2.4.3.2.1	4 & 5
[38]	**Railway applications - Braking - Empty-loaded changeover devices**	**EN 15624**	**2021**
[38.1]	Changeover specification	C.9 - Table C.3	4, 5, 8
[39]	**Railway applications - Braking - Automatic variable load sensing devices**	**EN 15625**	**2021**
[39.1]	Variable load sensing devices	C.9 - Table C.3	5, 6, 9
[40]	**Simple unfired pressure vessels designed to contain air or nitrogen – Part 3: Steel pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock**	**EN 286-3**	**1994**
[40.1]	Air reservoirs - steel	C.9 (f)	4, 5, 6, 7
[41]	**Simple unfired pressure vessels designed to contain air or nitrogen – Part 4: Aluminium alloy pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock**	**EN 286-4**	**1994**
[41.1]	Air reservoirs - aluminium	C.9 (f)	4, 5, 6, 7

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[42]	**Railway applications - Pneumatic half couplings**	**EN 15807**	**2021**
[42.1]	Interface of the brake pipe	C.9 (i)	5, 6, 9
[43]	**Railway applications - Straight and angled end cocks for brake pipe and main reservoir pipe**	**EN 14601**	**2005+A1:2010+ A2 :2021**
[43.1]	End cocks	C.9 (i)	4, 5, 7, 9
[44]	**Brakes - Regulations concerning the design of brake components**	**UIC 541-1**	**2013**
[44.1]	Brake mode switching device	C.9 (j)	Appendix E
[45]	**Brake parts - Interchangeability**	**UIC 542**	**2015**
[45.1]	Brake block holders	C.9 (k)	1 to 5
[46]	**Composite brake blocks - General conditions for certification and use**	**UIC 541-4**	**2020**
[46.1]	Friction element for wheel tread brakes	C.9 (l)	1, 2
[47]	**Railway applications - Braking - Brake blocks**	**EN 16452**	**2015+A1:2019**
[47.1]	Friction element for wheel tread brakes	C.9 (l)	4 to 11
[48]	**Railway applications - Slack adjuster**	**EN 16241**	**2014+A1 :2016**
[48.1]	Slack adjusters Assessment of conformity	C.9 (m)	4, 5, 6.2 6.3.2 to 6.3.5
[49]	**Railway applications - Braking - Wheel slide protection**	**EN 15595**	**2018+AC :2021**
[49.1]	Wheel slide protection system	C.9 (n)	5 to 9, 11
[50]	**Railway applications -Welding of railway vehicles and components -Part 1: General**	**EN 15085-1**	**2007+A1:2013**
[50.1]	Welding	C.12	4
[51]	**Railway applications - Welding of railway vehicles and components - Part 2: Requirements for welding manufacturer**	**EN 15085-2**	**2020**
[51.1]	Welding	C.12	4, 5, 6, 7

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[52]	**Railway applications - Welding of railway vehicles and components - Part 3: Design requirements**	**EN 15085-3**	**2007/AC :2009**
[52.1]	Welding	C.12	4, 5, 6, 7
[53]	**Railway applications - Welding of railway vehicles and components - Part 4: Production requirements**	**EN 15085-4**	**2007**
[53.1]	Welding	C.12	4, 5, 6
[54]	**Railway applications - Welding of railway vehicles and components - Part 5: Inspection, testing and documentation**	**EN 15085-5**	**2007**
[54.1]	Welding	C.12	4 to 10
[55]	**Railway applications - Wheelsets and bogies - Wheels - Product requirements**	**EN 13262**	**2020**
[55.1]	Specific product properties concerning the wheel	C.15	4, 5 and 6
[56]	**Standardisation and positioning on wagons of steps, end platforms, gangways, handrails, tow hooks, automatic coupler (AC), draw-only automatic coupler (DAC) and brake valve controls on the UIC member RUs and OSJD member RUs**	**UIC 535-2**	**2006**
[56.1]	Tow hooks Conditions for alternative solutions	C.16	1.4 1.4.2 to 1.4.9
[56.2]	Protective devices on protruding parts	C.17	1.3
[57]	**Wagons – Label-holders (interchangeability) and hazard identification panels**	**UIC 575**	**1995**
[57.1]	Label holders and attachment devices for rear end signal	C.18	1
[58]	**Railway applications - Braking – Brake performance**	**EN 16834**	**2019**
[58.1]	Service brake	4.2.4.3.2.1	Annex D

Index	Characteristics to be assessed	NTSN point	Mandatory standard point
[58.2]	Validation of brake performance calculated with Index [17]	4.2.4.3.2.1	6, 8, 9, 10, 12
[58.3]	Assessment of braking mode G	C.9 - Table C.3	6, 8, 9, 12
[59]	**Railway applications - Rolling stock - Head stock layout**	**EN 16839**	**2022**
[59.1]	Head stock layout	Appendix C, point 1	4 except 4.3, 5 except 5.5.2.3 and 5.5.2.4, 6, 7, 8

D.2 Technical documents (available on ERA website)

Index	Characteristics to be assessed	NTSN point	Mandatory technical document point
	Parameter	NTSN Point	Standard Point
[A]	**Interfaces between Control-Command and Signalling Trackside and other Subsystems** **Appendix A of CCS TSI, index [77]** **ERA/ERTMS/033281 V5.0**		
[A.1]	train detection system based on track circuits	4.2.3.3(a)	axle distances (3.1.2.1, 3.1.2.3, 3.1.2.4, 3.1.2.5), vehicle axle load (3.1.7.1), impedance between wheels (3.1.9), use of composite brake blocks (3.1.6), if the rolling stock is equipped: use of shunt assisted devices (3.1.8), if the rolling stock has electrical or electronic equipment on board creating interference current in the rail: conducted interference (3.2.2).
[A.2]	train detection system based on axle counters	4.2.3.3(b)	axle distances (3.1.2.1, 3.1.2.2, 3.1.2.4, 3.1.2.5), wheel geometry (3.1.3.1-3.1.3.4),

Index	Characteristics to be assessed	NTSN point	Mandatory technical document point
	Parameter	NTSN Point	Standard Point
			metal/inductive components-free space between wheels (3.1.3.5), wheel material (3.1.3.6), if the rolling stock has electrical or electronic equipment on board creating interference electromagnetic fields close to the wheel sensor: electromagnetic fields (3.2.1).
[A.3]	train detection system based on loop equipment	4.2.3.3(c)	vehicle metal construction (3.1.7.2).
[A.7]	Influencing unit	Appendix C, point 7	Point 3.2
[A.8]	Vehicle impedance	Appendix C, point 7	Point 3.2.2
[A.9]	Harmonised test method	Appendix C, point 7	Point 3.2.1
[B]	**ERA Technical Document on codification of combined transport ERA/TD/CT version 1.1 (released on 2023-03-21)**		
[B.1]	Codification of units intended to be used in combined transport	4.2.3.1 Appendix H	2.2

Appendix E Rear-end signal

1. Lamps

The colour of tail lamps shall be in accordance with the specification referenced in Appendix D Index [29].

The tail lamp shall be designed to display a lighting intensity in accordance with the specification referenced in Appendix D Index [29].

The lamp shall be suitable to be attached to units complying with the attachment devices and the clearance set out in point 4.2.6.3. The lamp shall be equipped with:

— a switch (on/off),

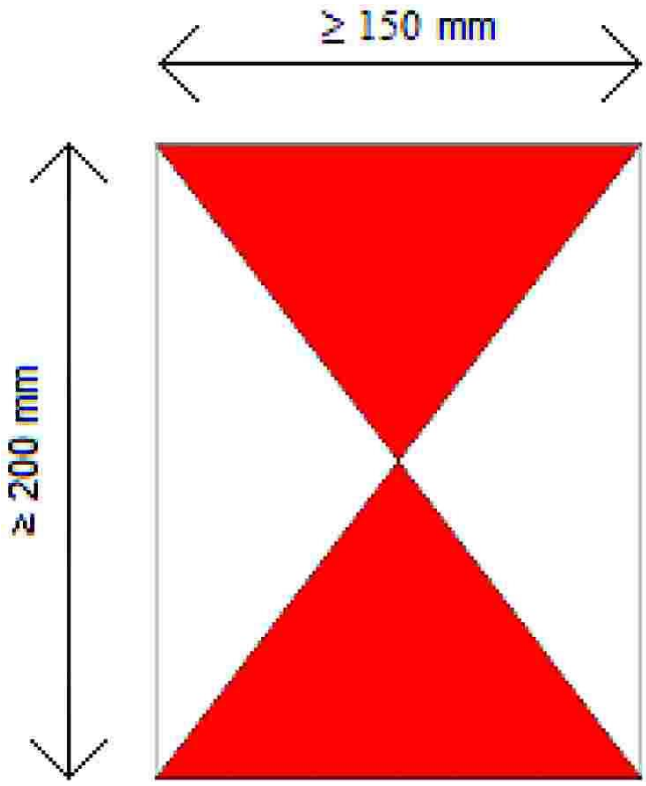
— a warning light which indicates the battery status.

2. Reflective plates

The reflective plates shall be suitable to be attached to units complying with the attachment devices and the clearance set out in point 4.2.6.3. The reflective section of the plates shall be at least 150 by at least 200 mm as illustrated in Figure E.1. The side triangles shall be white, the top and the bottom triangles shall be red. The plate shall be retro-reflective in accordance with the specification referenced in Appendix D Index [30].

Figure E.1

Reflective plate



Appendix F Assessment assigned to the production phases

Table F.1

Assessment assigned to the production phases

Characteristics to be assessed, as specified in Section 4.2		**Design and development phase**		**Production phase**	**Particular assessment procedure**
		Design review	**Type test**	**Routine test**	
Element of the Rolling Stock sub-system	**Point**				**Point**
Structure and mechanical part	4.2.2				
End coupling	4.2.2.1.1	X	n.a.	n.a.	—
Inner coupling	4.2.2.1.2	X	n.a.	n.a.	—
Strength of unit	4.2.2.2	X	X	n.a.	6.2.2.1
Integrity of the unit	4.2.2.3	X	n.a.	n.a.	—
Vehicle track interaction and gauging	4.2.3				
Gauging	4.2.3.1	X	n.a.	n.a.	—
Compatibility with load carrying capacity of lines	4.2.3.2	X	X	n.a	—
Compatibility with train detection systems	4.2.3.3	X	X	n.a	—
Axle bearing condition monitoring	4.2.3.4	X	X	n.a.	—
Safety against derailment running on twisted track	4.2.3.5.1	X	X	n.a.	6.2.2.2
Running dynamic behaviour	4.2.3.5.2	X	X	n.a.	6.1.2.1/6.2.2.3
Structural design of bogie frame	4.2.3.6.1	X	X.	n.a.	6.1.2.1

Characteristics to be assessed, as specified in Section 4.2		Design and development phase		Production phase	Particular assessment procedure
		Design review	Type test	Routine test	
Element of the Rolling Stock sub-system	**Point**				**Point**
Characteristics of wheelsets	4.2.3.6.2	X	X	X	6.1.2.2
Characteristics of wheels	4.2.3.6.3	X	X	X	6.1.2.3
Characteristics of axles	4.2.3.6.4	X	X	X	6.1.2.4
Axle boxes/bearings	4.2.3.6.5	X	X	X	6.2.2.4
Automatic variable gauge system	4.2.3.6.6	X	X	X	6.1.2.6/6.2.2.4a
Running gear for manual change of wheelsets	4.2.3.6.7	X	X	X	6.2.2.5
Brake	4.2.4				
Safety requirements	4.2.4.2	X	n.a	n.a	—
Functional and technical requirements	4.2.4.3	X	X	n.a	—
In-service brake	4.2.4.3.2.1	X	X	n.a.	—
Parking brake	4.2.4.3.2.2	X	n.a	n.a	—
Thermal capacity	4.2.4.3.3	X	X	n.a	6.2.2.6
Wheel slide protection (WSP)	4.2.4.3.4	X	X	n.a	—
Friction elements for wheel tread brakes	4.2.4.3.5	X	X	X	6.1.2.5
Environmental conditions	4.2.5				
Environmental conditions	4.2.5	X	n.a. /X ([1])	n.a.	6.2.2.7
System protection	4.2.6				

Characteristics to be assessed, as specified in Section 4.2		Design and development phase		Production phase	Particular assessment procedure
		Design review	Type test	Routine test	
Element of the Rolling Stock sub-system	**Point**				**Point**
Fire safety	4.2.6.1	X	X	n.a	6.2.2.8
Protection against electric hazard	4.2.6.2	X	X	n.a	—
Attachment devices for rear-end signal	4.2.6.3	X	X	n.a	—

(1) Type test if and as defined by the applicant.

Appendix G List of composite brake blocks exempted of a declaration of conformity as referred in Article 4

This is published on the Safety Authority's website.

Appendix H *Not used*