



EUROPEAN  
COMMISSION

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WAG  
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ANNEX 1

**ANNEX**

**to the**

**COMMISSION IMPLEMENTING REGULATION**

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

## ANNEX I

The Annex to Regulation (EU) No 321/2013 is amended as follows:

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

### “1. INTRODUCTION

A Technical Specification for Interoperability (TSI) is a specification that covers a subsystem (or part of it) as described in Article 2(11) of Directive (EU) 2016/797 in order:

- to ensure the interoperability of the rail system, and
- to meet the essential requirements.”;

- (2) point 1.2 is replaced by the following:

### “1.2. Geographical scope

This Regulation applies to the Union rail system.”;

- (3) in point 1.3., the introductory phrase and point (a) are replaced by the following:

“In accordance with Article 4(3) of Directive (EU) 2016/797, this TSI:

(a) covers the ‘rolling stock-freight wagons’ subsystem;”;

- (4) in point 2.1, second paragraph, point (a) is replaced by the following:

“(a) special vehicles;”;

- (5) Chapter 3 is amended as follows:

- (a) the introductory paragraph is replaced by the following:

“Article 3(1) of Directive (EU) 2016/797 provides that the rail system, its subsystems and their interoperability constituents are to meet the relevant essential requirements. The essential requirements are set out in general terms in Annex III to that Directive. Table 1 of this Annex indicates the basic parameters specified in this TSI and their correspondence to the essential requirements as explained in Annex III to Directive (EU) 2016/797.”;

- (b) in Table 1, the following row 4.2.3.5.3 is inserted:

“

4.2.3.5.3	Derailment detection and prevention function	1.1.1 1.1.2				2.4.3
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”;

- (6) point 4.1 is replaced by the following:

### “4.1. Introduction

The rail system, to which Directive (EU) 2016/797 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 (Section 4.2), its

interfaces in relation to the other subsystems of the rail system in which it is integrated (Sections 4.2 and 4.3), as well as the initial operating and maintenance rules (Sections 4.4 and 4.5) as requested by Article 15(4) of Directive (EU) 2016/797.

The technical file, as set out in Article 15(4) of Directive (EU) 2016/797 and in point 2.4 of Annex IV to that Directive, shall contain in particular design related values concerning the compatibility with the network.”;

- (7) in point 4.2.1, the third paragraph is deleted;
- (8) point 4.2.2.2 is amended as follows:
  - (a) the first paragraph is replaced by the following:

“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].”;
  - (b) the fourth paragraph is replaced by the following:

“The lifting and jacking positions shall be marked on the unit. The marking shall comply with the specification referenced in Appendix D Index [2].”;
- (9) in point 4.2.2.3, the following paragraph is added:

“Units intended to be used for combined transport and requiring a wagon compatibility code shall be equipped with devices for securing the Intermodal Loading Unit.”;
- (10) point 4.2.3.1 is amended as follows:
  - (a) the second and third paragraphs are replaced by the following:

“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.”;
  - (b) the following paragraph is added:

“Units intended to be used for combined transport shall be codified in accordance with the requirements of Appendix H and the specification referenced in Appendix D.2, index [B].”;
- (11) in point 4.2.3.2, the second paragraph is replaced by the following:

“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].”;

- (12) point 4.2.3.3 is replaced by the following:

“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 section 7.7 of the CCS TSI.

- (13) in point 4.2.3.4, the second and third paragraphs are replaced by the following:

“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.

For units intended to be operated on the networks with track gauges of 1 524 mm, 1 600 mm, 1 668 mm, the corresponding values in Table 2 referring to the parameters of the specification referenced in Appendix D Index [6] shall be applied.”;

- (14) in point 4.2.3.5.2, second paragraph, the first indent is replaced by the following:

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

- (15) the following point 4.2.3.5.3 is inserted:

“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 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 those requirements 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 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.

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].”;

- (16) in point 4.2.3.6.1, the first paragraph is replaced by the following:

“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]”;

- (17) in point 4.2.3.6.2, Table 3 is replaced by the following:

“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 ( $S_R$ )  $S_R = A_R + S_{d,left} + S_{d,right}$	$330 \leq D \leq 760$	1 415	1 426
		$760 < D \leq 840$	1 412	1 426
		$D > 840$	1 410	1 426
	Back-to-back distance ( $A_R$ )	$330 \leq D \leq 760$	1 359	1 363
		$760 < D \leq 840$	1 358	1 363
		$D > 840$	1 357	1 363
1 524 mm	Front-to-front dimension ( $S_R$ )  $S_R = A_R + S_{d,left} + S_{d,right}$	$400 \leq D < 840$	1 492	1 514
		$D \geq 840$	1 487	1 514
	Back-to-back distance ( $A_R$ )	$400 \leq D < 840$	1 444	1 448
		$D \geq 840$	1 442	1 448

1 600 mm	Front-to-front dimension ( $S_R$ )	$690 \leq D \leq 1\,016$	1 573	1 592
	$S_R = A_R + S_{d, \text{left}} + S_{d, \text{right}}$			
	Back-to-back distance ( $A_R$ )	$690 \leq D \leq 1\,016$	1 521	1 526
1 668 mm	Front-to-front dimension ( $S_R$ )	$330 \leq D < 840$	1 648 <sup>(1)</sup>	1 659
	$S_R = A_R + S_{d, \text{left}} + S_{d, \text{right}}$	$840 \leq D \leq 1\,250$	1 648 <sup>(1)</sup>	1 659
	Back-to-back distance ( $A_R$ )	$330 \leq D < 840$	1 592	1 596
		$840 \leq D \leq 1\,250$	1 590	1 596
<sup>(1)</sup> Two-axle wagons with axle load up to 22,5 t the value shall be taken as 1 651 mm.				

”;

- (18) in point 4.2.4.3.2.1, the second and third paragraphs are replaced by the following:

„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].

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].”;

- (19) point 4.2.4.3.2.2 is amended as follows:

- (a) the second paragraph is replaced by the following:

„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].”;

- (b) the following paragraph is added:

“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.”;

- (20) in point 4.2.5, the eighth paragraph is replaced by the following:  
 “The unit shall meet the requirements of this TSI 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.”;
- (21) in point 4.2.6.2.1, the second paragraph is replaced by the following:  
 “Units shall be bonded in accordance with the provisions as described in the specification referenced in Appendix D Index [27].”;
- (22) in point 4.2.6.2.2, the second paragraph is replaced by the following:  
 “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].”;
- (23) in point 4.2.6.3, the second sentence is replaced by the following:  
 “The dimensions and clearance of these attachment devices shall be as described in the specification referenced in Appendix D Index [28].”;
- (24) in point 4.3.1, Table 5 is amended as follows:
- (a) the heading of the first column is replaced by the following:  
 “Reference in WAG TSI”
  - (b) the heading of the second column is replaced by the following:  
 “Reference in INF TSI”;
  - (c) the last row is deleted;
- (25) in point 4.3.2, Table 6 is amended as follows:
- (a) the heading of the first column is replaced by the following:  
 “Reference in WAG TSI”
  - (b) the heading of the second column is replaced by the following:  
 “Reference in OPE TSI”;
  - (c) the last row is deleted;
- (26) in point 4.3.3, Table 7, is amended as follows:
- (a) the heading of the first column is replaced by the following:  
 “Reference in WAG TSI”;
  - (b) the second column is replaced by the following:  
 “

Reference in CCS TSI	
–	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

–	4.2.10 : Compatibility with trackside train detection systems: vehicle design
–	4.2.11 : Electromagnetic compatibility between rolling stock and Control-Command and Signalling trackside equipment
–	4.2.10 : Compatibility with trackside train detection systems: vehicle design

”;

- (27) in point 4.4, in the last paragraph, the following sentence is deleted:  
 “The Notified Body shall verify only that the documentation on operation is provided.”
- (28) in point 4.5, in the third paragraph, the following sentence is deleted:  
 “The Notified Body shall verify only that the documentation on maintenance is provided.”
- (29) in point 4.5.1, the introductory phrase is replaced by the following:  
 “The general documentation comprises:”;
- (30) in point 4.5.2, the third sentence of the introductory paragraph is replaced by the following:  
 “The maintenance design justification file comprises:”;
- (31) point 4.8, the first paragraph, is amended as follows:
- (a) the twentieth indent is deleted;
  - (b) the following indents are added:
    - “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
    - 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.”;
- (32) point 6.1.2.1 is replaced by the following:  
 “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].”;

- (33) point 6.1.2.2 is replaced by the following:

“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.”;

- (34) in point 6.1.2.3(a), the first, second and third paragraphs are replaced by the following:

“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”;

- (35) in point 6.1.2.4, the first and second paragraphs are replaced by the following:

“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.”;

- (36) in point 6.2.2.1, the first paragraph is replaced by the following:

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

- (37) point 6.2.2.2 is replaced by the following:

“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].”;

(38) point 6.2.2.3 is amended as follows:

(a) the first paragraph is replaced by the following:

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

(b) in the second paragraph, the introductory phrase is replaced by the following:

“For units operated on the 1 668 mm track gauge network, the evaluation of the estimated value for the guiding force normalized to the radius  $R_m = 350$  m in accordance with that specification, shall be calculated in accordance with the following formula.”;

(c) the fifth paragraph is replaced by the following:

“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.”;

(39) in point 6.2.2.4, the first paragraph is replaced by the following:

“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].”;

(40) point 6.2.2.5 is replaced by the following:

“6.2.2.5. Running gear for manual change of wheelsets

Changeover between 1435 mm and 1668 mm track gauges

The technical solutions described in the specification referenced in Appendix D Index [14] for axle units and for bogie units are deemed to be compliant with the requirements in point 4.2.3.6.7.

Changeover between 1435 mm and 1524 mm track gauges

The technical solution described in the specification referenced in Appendix D Index [15] is deemed to be compliant with the requirements in point 4.2.3.6.7.”;

(41) in point 6.2.2.8.1, the first sentence is replaced by the following:

“Barriers shall be tested in accordance with the specification referenced in Appendix D Index [19].”;

(42) point 6.2.2.8.2 is amended as follows:

(a) the first and second paragraphs are replaced by the following:

“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  $CFE \geq 18$  kW/m<sup>2</sup>.

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  $MARHE \leq 90$  kW/m<sup>2</sup> under the test conditions set out in the specification referenced in Appendix D Index [22].”;

- (b) in the third paragraph, the sixth indent is replaced by the following:
- “– materials that meet the requirements of category C-s3, d2 or higher in accordance with the specification referenced in Appendix D Index [21].”;
- (43) point 6.2.2.8.3 is replaced by the following:
- “6.2.2.8.3 Cables
- The electrical cables shall be selected and installed in accordance with the specification referenced in Appendix D Indexes [24] and [25].”;
- (44) point 6.2.2.8.4 is replaced by the following:
- “6.2.2.8.4 Flammable liquids
- The measures taken shall be in accordance with the specification referenced in Appendix D Index [26].”;
- (45) point 7.1 is replaced by the following:
- “7.1 Authorisation for placing on the market
- (1) This TSI is applicable to the subsystem ‘rolling stock — freight wagons’ within the scope set out in its points 1.1, 1.2 and 2.1, which are placed on the market after the date of application of this TSI, except where point 7.1.1 ‘Application to ongoing projects’ applies.
- (2) This TSI 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 TSI, and
  - units as defined in point 2.1(c), in case they are in empty configuration.
- In case the applicant chooses to apply this TSI, the corresponding EC declaration of verification shall be recognised as such by Member States.
- (3) Compliance with this Annex in its version applicable before [*Publications Office: please insert the date of entry into force of this amending act*] is deemed equivalent to compliance with this TSI, except for changes listed in Appendix A.”;
- (46) point 7.1.1 is replaced by the following:
- “7.1.1 Application to ongoing projects
- (1) The application of this TSI applicable from [*Publications Office: please insert the date of entry into force of this amending act*] is not mandatory for projects that, on that date, are in phase A or phase B as defined in points 7.2.3.1.1 and 7.2.3.1.2 of the ‘previous TSI’ (i.e. this Regulation, as amended by Commission Implementing Regulation (EU) 2020/387<sup>1</sup>).
- (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.

<sup>1</sup> Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulation (EU) No 321/2013 as regards application of the technical specification for interoperability relating to the subsystem ‘rolling stock — freight wagons’ (OJ L 73 10.3.2020, p. 6).

- (3) If the applicant chooses not to apply this TSI version to an ongoing project, the version of this TSI applicable at the beginning of phase A as referred to in point (1) remains applicable.”;
- (47) point 7.1.2, the third paragraph, is amended as follows:
- (a) the following points (d1) and (d2) are inserted after point (d):
- “(d1) 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 under Article 13 of CCS TSI 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 can be demonstrated based on the technical document referred in Article 13 of CCS TSI and is checked by the Notified Body as part of EC verification.
- (d2) 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 notified under Article 13 of CCS TSI by applying the harmonised vehicle test methods referred in the technical document referenced in appendix D.2 index [A]. Compliance of the unit can be demonstrated based on the technical document referred in Article 13 of CCS TSI and is checked by the Notified Body as part of EC verification.”;
- (b) point (e) is replaced by the following:
- “(e) The unit must be equipped with the manual coupling system in accordance with the prescriptions set out in Appendix C, Section 1, including the fulfilment of Section 8 or with any semi-automatic or automatic coupling system.”;
- (c) point (g) is replaced by the following:
- “(g) The unit must be marked with all applicable markings in accordance with the specification referenced in Appendix D Index [2].”;
- (d) point (h) is replaced by the following:
- “(h) The minimum and, where relevant maximum parking brake force, the number of wheelsets (N) and the number of wheelsets on which the parking brake is applied (n) shall be marked as set out in Figure 1:

Figure 1

Marking of the parking brake force



”;

- (48) in point 7.2.1, the fifth paragraph is replaced by the following:  
 “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 8”;
- (49) in point 7.2.2, the heading is replaced by the following:  
 “7.2.2. Changes to a unit in operation or to an existing unit type”;
- (50) in point 7.2.2.1, the second paragraph, the first sentence is replaced by the following:  
 “This point 7.2.2 applies in case of any change(s) to a unit in operation or to an existing unit type, including renewal or upgrade.”;
- (51) point 7.2.2.2 is amended as follows:
- (a) the second paragraph is replaced by the following:  
 “Without prejudice to clause 7.2.2.3, compliance with the requirements of this TSI or Commission Regulation (EU) No 1304/2014\* (TSI NOI, see clause 7.2 of that TSI) shall only be needed for the basic parameters in this TSI which may be affected by the change(s).”

\* Commission Regulation (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ amending Decision 2008/232/EC and repealing Decision 2011/229/EU (OJ L 356, 12.12.2014, p. 421).”;

- (b) in Table 11a, the following row 4.2.3.5.3 is inserted:  
 “

4.2.3.5.3 Derailment detection and prevention function	Presence and type of derailment detection and prevention function(s)	Fitting/removing of prevention/detection function	N/A
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”;

- (c) the twelfth and thirteenth paragraphs are replaced by the following:  
 “In order to establish the EC type or design examination certificate, the notified body selected by the entity managing the change may refer to:
- the original EC type or design examination certificate for parts of the design that are unchanged or those that are changed but do not affect the conformity of the subsystem, as far as it is still valid,

- additional EC type or design examination certificate (amending the original certificate) for modified parts of the design that affect the conformity of the subsystem with the TSIs referred to in the certification framework defined in point 7.2.3.1.1.

In case the validity period of the EC type or design examination certificate for the original type is limited to 10 years (due to the application of the former Phase A/B concept), the validity period of the EC type or design examination certificate for the modified type, type variant or type version shall be limited to 14 years after the date of appointment of a notified body by the applicant for the initial rolling stock type (beginning of phase A of the original EC type or design examination certificate).”;

- (52) in point 7.2.2.3, the heading and the first paragraph are replaced by the following:  
 “7.2.2.3. Particular rules for units in operation not covered by an EC declaration of verification with a first authorisation for placing in service before 1 January 2015  
 The following rules apply, in addition to clause 7.2.2.2, to units in operation with a first authorisation for placing in service before 1 January 2015, where the scope of the change has an impact on basic parameters not covered by the EC declaration.”;
- (53) point 7.2.2.4 is amended as follows:
- (a) the heading is replaced by the following:  
 “7.2.2.4. Rules for the extension of the area of use for units in operation having an authorisation in accordance with Directive 2008/57/EC or in operation before 19 July 2010”;
  - (b) in point (4), point (a) is replaced by the following:  
 “(a) specific cases relating to any part of the extended area of use, listed in this TSI, TSI NOI and CCS TSI;”;
- (54) point 7.2.3.1 is replaced by the following:  
 “7.2.3.1. Rolling stock subsystem  
 This point concerns a rolling stock type (unit type in the context of this TSI), as defined in Article 2(26) of Directive (EU) 2016/797, which is subject to an EC type or design verification procedure in accordance with section 6.2 of this TSI. It also applies to the EC type or design verification procedure in accordance with the TSI NOI, which refers to this TSI for its scope of application to freight units.  
 The TSI assessment basis for an EC type or design examination is defined in columns ‘Design review’ and ‘Type test’ of Appendix F of this TSI and of Appendix C of the TSI NOI.”;
- (55) points 7.2.3.1.1 and 7.2.3.1.2 are replaced by the following:  
 “7.2.3.1.1. Definitions  
 (1) Initial assessment framework  
 The initial assessment framework is the set of TSIs (this TSI and the TSI NOI) applicable at the beginning of the design phase when the notified body is contracted by the applicant.

(2) Certification framework

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

(3) Design phase

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

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

(4) Production phase

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

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

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

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

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

- For changes in the TSIs that are not referenced in Appendix A, conformity with the initial assessment framework leads to conformity to the certification framework. The Notified Body shall issue the EC type or design examination certificate referring to the certification framework without additional assessment.
- For changes in the TSIs that are referenced in Appendix A, their application is mandatory in accordance with the transition regime laid down in that Appendix. During the transition period, the Notified Body may issue the EC type or design examination certificate referring to the certification framework without additional assessment. The Notified Body shall list in the EC type or design examination certificate all the points assessed in accordance with the initial assessment framework.

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

(4) It is always permissible (but not mandatory) to use a most recent version of any TSI, either totally or for particular sections, unless explicitly otherwise

specified in the revision of those TSIs; in case of application limited to particular sections, the applicant has to justify and document that applicable requirements remain consistent, and that has to be approved by the notified body.”;

(56) the following point 7.2.3.1.3 is inserted:

“7.2.3.1.3 Validity of the EC type or design examination certificate

- (1) When a revision of this TSI or of the TSI NOI comes into force, the EC 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 a TSI change.
- (2) Only the changes to the TSIs with a specific transition regime can apply to units in production phase or to units in operation.”;

(57) point 7.2.3.2 is replaced by the following:

“7.2.3.2 Interoperability constituents

- (1) This point concerns interoperability constituents which are subject to type examination or design examination or to suitability for use.
- (2) The type or design examination or suitability for use remains valid even if a revision of this TSI or of the TSI NOI comes into force, unless explicitly otherwise specified in the revision of those TSIs.

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

(58) in point 7.3.1, the first paragraph is replaced by the following:

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

- ‘P’ cases: ‘permanent’ cases.
- ‘T0’: ‘temporary’ cases of indefinite duration, where the target system shall be reached by a date still to be determined.
- ‘T2’ cases: ‘temporary’ cases, where the target system shall be reached by 31 December 2035.”

(59) point 7.3.2.2 is amended as follows:

(a) “EN 15437-1:2009” is replaced by “EN 15437-1:2009+A1:2022”

(b) in point (a) the first sentence is replaced by the following:

“(‘T2’) Units intended to operate on the Swedish railway network shall be compliant with the target and prohibitive zones as set out in Table 12.”

(c) the following point (b) is added:

“(b) Specific case France (‘T0’)

This specific case is applicable to all units intended to operate on the French railway network.

Clauses 5.1 and 5.2 of standard EN 15437-1:2009+A1:2022 apply with the following specificities. The notations are the ones used in picture 3 of the standard.

$$W_{TA} = 70 \text{ mm}$$

$$Y_{TA} = 1092,5 \text{ mm}$$

$$L_{TA} = V_{\max} \times 0,56 \text{ (} V_{\max} \text{ being the maximal line speed at the level of the Hot Axle Box Detector (HABD), expressed in km/h).}$$

Units mutually recognised in accordance with point 7.1.2 and units equipped with on-board axle bearing condition monitoring equipment are exempted from this specific case. The exemption of units in accordance with point 7.1.2 is not applicable when using other conformity assessment methods in accordance with point 6.1.2.4a.”;

(60) in point 7.3.2.4, the heading “Specific case UK for Great Britain” and the following two paragraphs are deleted;

(61) point 7.3.2.5 is replaced by the following:

“7.3.2.5 Brake safety requirements (point 4.2.4.2)

Specific case Finland

For freight wagon intended to operate only on 1524 mm network, the safety requirement defined in point 4.2.4.2 is deemed fulfilled if the unit complies with conditions defined in point 9 of Appendix C with the following modifications:

- (1) (point 9(d) of Appendix C) the braking performance shall be determined on the basis of the minimum distance of 1 200 m between signals on the Finnish network. The minimum percentage of braked weight is 55 % for 100 km/h and 85 % for 120 km/h;
- (2) (point 9(l) of Appendix C) if the brake system requires an interoperability constituent ‘friction element for wheel tread brakes’, the interoperability constituent shall comply with the requirements of point 6.1.2.5 or be made of cast iron.”;

(62) point 7.3.2.7 is deleted;

(63) point 7.6 is deleted;

(64) Appendix A is replaced by the following:

## **“Appendix A**

### **Changes of requirements and transition regimes**

For other TSI points than these listed in Table A.1 and Table A.2, compliance with the ‘previous TSI’ (i.e. this Regulation, as amended by Commission Implementing Regulation (EU) 2020/387<sup>2</sup>) imply compliance with this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]*.

<sup>2</sup> Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulation (EU) No 321/2013 as regards application of the technical specification for interoperability relating to the subsystem ‘rolling stock — freight wagons’ (OJ L 73 10.3.2020, p. 6).

### Changes with a generic transition regime of 7 years:

For TSI points listed in Table A.1, compliance with the previous TSI does not imply compliance with the version of this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]*.

Projects already in design phase on *[Publications Office: please insert the date of entry into force of this amending act]* shall comply with the requirement of this TSI from *[Publications Office: please insert the date of entry into force of this amending act + 7 years]*.

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

Table A.1 – transition regime of 7 years

TSI point(s)	TSI point(s) in previous TSI	Explanation of the TSI 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 point	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]
7.1.2 (h) Marking of the parking brake	7.1.2 (h) Marking of the parking brake	Change in the required marking
Point 9 of Appendix C	Point 9 of Appendix C	Evolution of the specification referenced in Appendix D.1, Indexes [38], [39], [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
Points referring to Appendix D.2 index [A] except to point 3.2.2	Points referring to ERA/ERTMS/033281 V4 except to point 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 TSI points listed in Table A.2, compliance with the previous TSI does not imply compliance with this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]*.

Projects already in design phase on *[Publications Office: please insert the date of entry into force of this amending act]*, projects in production phase, and units in operation shall comply with the requirement of this TSI in accordance with the respective transition regime set out in Table A.2 starting from *[Publications Office: please insert the date of entry into force of this amending act]*.

Table A.2 – Specific transition regime

TSI point(s)	TSI points(s) in previous TSI	Explanation on TSI change	Transition regime			
			Design phase not started	Design phase started	Production phase	units in operation
Points referring to point 3.2.2 Appendix D.2 Index [A]	Points referring to point 3.2.2 of ERA/ERTMS/033281 V4	ERA/ERTMS/033281 V5 replaces ERA/ERTMS/033281 V4	Transition regime is defined in Table B1 in Appendix B to the CCS TSI			

”;

(65) Appendix C is amended as follows:

- (a) in the section ‘Additional optional conditions’, “C.18” is replaced by “C.20”;
- (b) point 1 is replaced by the following:

“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 defined 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, 1 790 mm (Finland) and 1 850 mm (Portugal and Spain) taking into account the specification referenced in Appendix D Index [32]”;

- (c) point 2 is replaced by the following:

“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”;

- (d) point 3 is replaced by the following:

“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”;

- (e) in point 7, the following points (c) and (d) are added:

“(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 under Article 13 of CCS TSI 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 can be demonstrated based on the technical document referred in Article 13 of CCS TSI and is checked by the Notified Body as part of EC 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 notified under Article 13 of CCS TSI by applying the harmonised vehicle test methods referred in the technical document referenced in Appendix D.2 Index [A]. Compliance of the unit can be demonstrated based on the technical document referred in Article 13 of CCS TSI and is checked by the Notified Body as part of EC verification.”;

- (f) point 8 is replaced by the following:

“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].”;

- (g) point 9 is amended as follows:
- (i) point (c) is replaced by the following:

“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].”;
  - (ii) in point (e), the second sentence is replaced by the following:

“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.”;
  - (iii) in point (f), the second sentence is replaced by the following:

“Details for standardised air reservoirs are set out in the specifications referenced in Appendix D Index [40] and Index [41].”;
  - (iv) in point (h), the first sentence is replaced by the following:

“The distributor and distributor isolating device shall be in accordance with the specification referenced in Appendix D Index [34].”;
  - (v) point (i) is amended as follows:
    - point (i) is replaced by the following:

“(i) The interface of the brake pipe shall be in accordance with the specification referenced in Appendix D Index [42].”;
    - point (iv) is replaced by the following:

“(iv) The end cocks shall be in accordance with the specification referenced in Appendix D Index [43].”;
  - (vi) points (j) and (k) are replaced by the following:

“(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].”;
  - (vii) point (l) is replaced by the following:

“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].”;
  - (viii) in point (m), the first and second sentences are replaced by the following:

“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”;
  - (ix) point (n) is replaced by the following:

“(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].

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	$S_{\max} = 700 \text{ m}$ $\lambda_{\min} = 65 \%$ $a_{\min} = 0,60 \text{ m/s}^2$	$S_{\min} = 390 \text{ m}$ $\lambda_{\max} = 125 \%$ , (130 %)(3) $a_{\max} = 1,15 \text{ m/s}^2$	$S_{\max} = 700 \text{ m}$ $\lambda_{\min} = 100 \%$ $a_{\min} = 0,88 \text{ m/s}^2$	$S_{\min} = 580 \text{ m}$ $\lambda_{\max} = 125 \%$ , (130 %)(3) $a_{\max} = 1,08 \text{ m/s}^2$
			Inter-mediate	$S_{\max} = 810 \text{ m}$ $\lambda_{\min} = 55 \%$ $a_{\min} = 0,51 \text{ m/s}^2$	$S_{\min} = 390 \text{ m}$ $\lambda_{\max} = 125 \%$ $a_{\max} = 1,15 \text{ m/s}^2$		
			Loaded	$S_{\max} = 700 \text{ m}$ $\lambda_{\min} = 65 \%$ $a_{\min} = 0,60 \text{ m/s}^2$	$S_{\min} = \text{Max} [(S = 480 \text{ m}, \lambda_{\max} = 100 \%, a_{\max} = 0,91 \text{ m/s}^2) (S \text{ obtained with a mean retardation force of } 16,5 \text{ kN per axle})](4)$		
	Variable load Relay(5)	'SS' 'S2'	Empty	$S_{\max} = 480 \text{ m}$ $\lambda_{\min} = 100 \%$ (6) $a_{\min} = 0,91 \text{ m/s}^2$ (6)	$S_{\min} = 390 \text{ m}$ $\lambda_{\max} = 125 \%$ , (130 %) (1) $a_{\max} = 1,15 \text{ m/s}^2$	$S_{\max} = 700 \text{ m}$ $\lambda_{\min} = 100 \%$ $a_{\min} = 0,88 \text{ m/s}^2$	$S_{\min} = 580 \text{ m}$ $\lambda_{\max} = 125 \%$ , (130 %)(1) $a_{\max} = 1,08 \text{ m/s}^2$
			Loaded	$S_{\max} = 700 \text{ m}$ $\lambda_{\min} = 65 \%$ $a_{\min} = 0,60 \text{ m/s}^2$	$S_{\min} = \text{Max} [(S = 480 \text{ m}, \lambda_{\max} = 100 \%, a_{\max} = 0,91 \text{ m/s}^2) (S \text{ obtained$		
		'S2' (7)					

					with a mean retardation force of 16,5 kN per axle)] (8)		
		‘SS’ (9)	Loaded (18 t per axle for brake blocks)			$S_{\max}(10) = \text{Max} [S = 700 \text{ m}, \lambda_{\max} = 100 \%, a_{\max} = 0,88 \text{ m/s}^2]$ (S obtained with a mean retardation force of 16 kN per axle)] (11)	
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])		
<p>(1) Changeover in accordance with the specification referenced in Appendix D Index [38].</p> <p>(2) An ‘S1’ unit is a unit with empty/load device. The maximum load per axle is 22,5 t.</p> <p>(3) Only for two stage load brake (changeover command) and P10 (cast iron blocks with 10 % phosphor)- or LL-brake blocks.</p> <p>(4) The maximum mean retardation force allowed (for running speed at 100 km/h) is <math>18 \times 0,91 = 16,5 \text{ kN/axle}</math>. 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; 1000 mm] during braking (the brake weight shall be limited to 18 tonnes/axle).</p> <p>(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].</p>							

- (6) 
$$a = \left( \left( \frac{\text{Speed (km/h)}}{3,6} \right)^2 \right) / (2 \times (S - ((T_e) \times (\text{Speed (km/h)} / 3,6))))$$
, with  $T_e = 2$  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  $\lambda = 100\%$ , 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  $\lambda=100$ : 15 t  
  
Max 840 mm; minimal worn 760 mm,  
max axle load 20 t, Max axle load for  $\lambda=100$ : 13 t  
  
Max 760 mm; minimal worn 680 mm,  
max axle load 18 t, Max axle load for  $\lambda=100$ : 12 t  
  
Max 680 mm; minimal worn 620 mm  
Max axle load 16 t, Max axle load for  $\lambda=100$ : 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)  $\lambda$  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 fulfil  $\lambda = 100$  % 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  $\lambda = 90$  % 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.

”;

(x) the following point (o) is added:

“(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.”;

(h) point 12 is replaced by the following:

“12. Welding

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

(i) in point 14, the second paragraph, the introductory phrase is replaced by the following:

“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.”;

- (j) points 15 to 18 are replaced by the following:

“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 specification 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.”;

- (k) point 20 is replaced by the following:

“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 point 6.1.2.1 are presumed to be in conformity with this requirement.”;

(66) Appendix D is replaced by the following:

**“Appendix D**

***D.1 MANDATORY STANDARDS OR NORMATIVE DOCUMENTS REFERRED TO IN THIS TSI***

<b>Index</b>	<b>Standard name</b>	<b>Standard reference</b>	<b>Standard version</b>
	Parameter	TSI Point	Standard Point
<b>[1]</b>	<b>EN 12663-2:2010</b> <b>Railway applications - Structural requirements of railway vehicle bodies - Part 2: Freight wagons</b>		
[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	Appendix point 3 C,	8
[1.4]	Classification	Appendix point 3 C,	5.1
[1.5]	Requirements concerning the buffing tests	Appendix point 3 C,	8.2.5.1
<b>[2]</b>	<b>EN 15877-1:2012+A1:2018</b> <b>Railway applications - Marking on railway vehicles - Part 1: Freight wagons</b>		
[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
[2.3]	Applicable markings	7.1.2 (g)	all points except 4.5.25(b)
[2.4]	Marking for combined automatic and screw coupler	Appendix point 1 C,	Figure 75

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[3]	<b>EN 12663-1:2010+A1:2014</b> <b>Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)</b>		
[3.1]	Strength of unit – demonstration of conformity	6.2.2.1	9.2, 9.3
[3.2]	Strength of unit - fatigue strength	6.2.2.1	5.6
[4]	<b>EN 15273-2:2013+A1 :2016</b> <b>Railway applications - Gauges - Part 2: Rolling stock gauge</b>		
[4.1]	Gauging	4.2.3.1	5, annexes A to J, L, M, P
[5]	<b>EN 15528:2021</b> <b>Railway applications - Line categories for managing the interface between load limits of vehicles and infrastructure</b>		
[5.1]	Compatibility with load carrying capacity of lines	4.2.3.2	6.1, 6.2
[6]	<b>EN 15437-1:2009+A1:2022</b> <b>Railway applications – Axle box condition monitoring – Interface and design requirements - Part 1: Track side equipment and rolling stock axle box</b>		
[6.1]	Axle bearing condition monitoring	4.2.3.4	5.1, 5.2
[7]	<b>EN 14363:2016+A2:2022</b> <b>Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests</b>		
[7.1]	Safety against derailment running on twisted track	6.2.2.2	4, 5, 6.1
[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

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[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
<b>[8]</b>	<b>EN 16235:2013</b> <b>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 in accordance with EN 14363</b>		
[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
<b>[9]</b>	<b>EN 13749:2021</b> <b>Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames</b>		
[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
<b>[10]</b>	<b>EN 13260:2020</b> <b>Railway applications - Wheelsets and bogies - Wheelsets - Product requirements</b>		
[10.1]	Characteristics of wheelsets	6.1.2.2	4.2.1
<b>[11]</b>	<b>EN 13979-1:2020</b> <b>Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Part 1: Forged and rolled wheels</b>		
[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	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[11.3]	Specific product properties concerning the wheel	Appendix C, point 15	7
[11.4]	Specific product properties concerning the wheel - Thermomechanical type test	Appendix C, point 15	Table A.1
[12]	<b>EN 13103-1:2017+A1:2022</b> <b>Railway applications - Wheelsets and bogies - Part 1: Design method for axles with external journals</b>		
[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]	<b>EN 12082:2017+A1:2021</b> <b>Railway applications – Axle boxes - Performance testing</b>		
[13.1]	Mechanical resistance and fatigue characteristics of the rolling bearing	6.2.2.4	7
[14]	<b>UIC 430-1:2012</b> <b>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</b>		
[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]	<b>UIC 430-3:1995</b> <b>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</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[15.1]	Changeover between 1435 mm and 1524 mm track gauges	6.2.2.5	Annex 7
[16]	<b>EN 14531-1:2015+A1 :2018</b> <b>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</b>		
[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	Appendix C, point 9, Table C.3	4
[17]	<b>UIC 544-1:2014</b> <b>Brakes - Braking performance</b>		
[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]	<b>EN 50125-1:2014</b> <b>Railway applications - Environmental conditions for equipment -Part 1: Rolling stock and on-board equipment</b>		
[18.1]	Environmental conditions	4.2.5	4.7
[19]	<b>EN 1363-1:2020</b> <b>Fire resistance tests - Part 1: General Requirements</b>		
[19.1]	Barriers	6.2.2.8.1	4 to 12
[20]	<b>ISO 5658- 2:2006/Am1:2011</b> <b>Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[20.1]	Testing of the materials ignitability and flame spread properties	6.2.2.8.2	5 to 13
[21]	<b>EN 13501-1:2018</b> <b>Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests</b>		
[21.1]	Material properties	6.2.2.8.2	8
[22]	<b>EN 45545-2:2020</b> <b>Railway applications - Fire protection on railway vehicles -Part 2: Requirements for fire behaviour of materials and components</b>		
[22.1]	Test conditions	6.2.2.8.2	Ref T03.02 of Table 6
[23]	<b>ISO 5660-1:2015+Amd1:2019</b> <b>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)</b>		
[23.1]	Testing of rubber parts of bogies	6.2.2.8.2	5 to 13
[24]	<b>EN 50355:2013</b> <b>Railway applications - Railway rolling stock cables having special fire performance -Guide to use</b>		
[24.1]	Cables	6.2.2.8.3	1, 4 to 9
[25]	<b>EN 50343:2014/A1:2017</b> <b>Railway applications -Rolling stock -Rules for installation of cabling</b>		
[25.1]	Cables	6.2.2.8.3	1, 4 to 7
[26]	<b>EN 45545-7:2013</b> <b>Railway applications -Fire protection on railway vehicles -Part 7: Fire safety requirements for flammable liquid and flammable gas installations</b>		
[26.1]	Flammable liquids	6.2.2.8.4	4 to 9

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[27]	<b>EN 50153:2014+A2:2020</b> <b>Railway applications -Rolling stock -Protective provisions relating to electrical hazards</b>		
[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]	<b>EN 16116-2:2021</b> <b>Railway applications - Design requirements for steps, handrails and associated access for staff - Part 2: Freight wagons</b>		
[28.1]	Attachment devices for rear-end signal	4.2.6.3	Figure 10
[28.2]	UIC footsteps and handrails Clearances	Appendix C, point 2	4, 5 6.2
[29]	<b>EN 15153-1:2020</b> <b>Railway applications -External visible and audible warning devices for trains -Part 1: Head, marker and tail lamps</b>		
[29.1]	Rear-end signal - colour of tail lamps	Appendix E, point 1	5.5.3
[29.2]	Rear-end signal - lighting intensity of tail lamps	Appendix E, point 1	Table 8
[30]	<b>EN 12899-1:2007</b> <b>Fixed, vertical road traffic signs - Part 1: Fixed signs</b>		
[30.1]	Reflective plates	Appendix E, point 2	Class Ref. 2
[31]	<b>EN 15566:2022</b> <b>Railway applications - Railway rolling stock - Draw gear and screw coupling</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[31.1]	Manual coupling system	Appendix point 1 C,	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]	<b>EN 15551:2022</b> <b>Railway applications - Railway rolling stock - Buffers</b>		
[32.1]	Buffers	Appendix point 1 C,	4 (except 4.3), 5, 6 (except 6.2.2.3 and E.4), and 7
[33]	<b>EN 15839:2012+A1:2015</b> <b>Railway applications - Testing for the acceptance of running characteristics of railway vehicles - Freight wagons - Testing of running safety under longitudinal compressive forces</b>		
[33.1]	Tests concerning longitudinal compressive forces	Appendix point 8 C,	All
[34]	<b>EN 15355:2019</b> <b>Railway applications - Braking - Distributor valves and distributor-isolating devices</b>		
[34.1]	Distributor and distributor isolating device	Appendix point 9(h) C,	5, 6
[35]	<b>EN 15611:2020+A1:2022</b> <b>Railway applications - Braking - Relay valves</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[35.1]	Variable load relay	Appendix C, point 9, Table C.3	5, 6, 7, 10
[35.2]	Type of relay valve	Appendix C, point 9(o)	5, 6, 7, 10
<b>[36]</b>	<b>UIC 540:2016</b> <b>Brakes - Air brakes for freight trains and passenger trains</b>		
[36.1]	UIC brake	Appendix C, points 9(c) and (e)	2
<b>[37]</b>	<b>EN 14531-2:2015</b> <b>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</b>		
[37.1]	Service brake	4.2.4.3.2.1	4 & 5
<b>[38]</b>	<b>EN 15624:2021</b> <b>Railway applications - Braking - Empty-loaded changeover devices</b>		
[38.1]	Changeover specification	Appendix C, point 9, Table C.3	4, 5, 8
<b>[39]</b>	<b>EN 15625:2021</b> <b>Railway applications - Braking - Automatic variable load sensing devices</b>		
[39.1]	Variable load sensing devices	Appendix C, point 9, Table C.3	5, 6, 9
<b>[40]</b>	<b>EN 286-3:1994</b> <b>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</b>		
[40.1]	Air reservoirs - steel	Appendix C, point 9(f)	4, 5, 6, 7

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[41]	<b>EN 286-4:1994</b> <b>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</b>		
[41.1]	Air reservoirs - aluminium	Appendix point 9(f)	C, 4, 5, 6, 7
[42]	<b>EN 15807:2021</b> <b>Railway applications - Pneumatic half couplings</b>		
[42.1]	Interface of the brake pipe	Appendix point 9 (i)	C, 5, 6, 9
[43]	<b>EN 14601:2005+A1:2010+A2 :2021</b> <b>Railway applications - Straight and angled end cocks for brake pipe and main reservoir pipe</b>		
[43.1]	End cocks	Appendix point 9(i)	C, 4, 5, 7, 9
[44]	<b>UIC 541-1:2013</b> <b>Brakes - Regulations concerning the design of brake components</b>		
[44.1]	Brake mode switching device	Appendix point 9(j)	C, Appendix E
[45]	<b>UIC 542:2015</b> <b>Brake parts – Interchangeability</b>		
[45.1]	Brake block holders	Appendix point 9 (k)	C, 1 to 5
[46]	<b>UIC 541-4:2020</b> <b>Composite brake blocks - General conditions for certification and use</b>		
[46.1]	Friction element for wheel tread brakes	Appendix point 9(l)	C, 1, 2
[47]	<b>EN 16452:2015+A1:2019</b> <b>Railway applications - Braking - Brake blocks</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[47.1]	Friction element for wheel tread brakes	Appendix point 9(l)	C, 4 to 11
[48]	<b>EN 16241:2014+A1 :2016</b> <b>Railway applications - Slack adjuster</b>		
[48.1]	Slack adjusters Assessment of conformity	Appendix point 9(m)	C, 4, 5, 6.2 6.3.2 to 6.3.5
[49]	<b>EN 15595:2018+AC :2021</b> <b>Railway applications - Braking - Wheel slide protection</b>		
[49.1]	Wheel slide protection system	Appendix point 9 (n)	C, 5 to 9, 11
[50]	<b>EN 15085-1:2007+A1:2013</b> <b>Railway applications -Welding of railway vehicles and components -Part 1: General</b>		
[50.1]	Welding	Appendix point 12	C, 4
[51]	<b>EN 15085-2:2020</b> <b>Railway applications - Welding of railway vehicles and components - Part 2: Requirements for welding manufacturer</b>		
[51.1]	Welding	Appendix point 12	C, 4, 5, 6, 7
[52]	<b>EN 15085-3:2022</b> <b>Railway applications - Welding of railway vehicles and components - Part 3: Design requirements</b>		
[52.1]	Welding	Appendix point 12	C, 4, 5, 6, 7
[53]	<b>EN 15085-4:2007</b> <b>Railway applications - Welding of railway vehicles and components - Part 4: Production requirements</b>		

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	Standard Point
[53.1]	Welding	Appendix point 12	C, 4, 5, 6
[54]	<b>EN 15085-5:2007</b> <b>Railway applications - Welding of railway vehicles and components - Part 5: Inspection, testing and documentation</b>		
[54.1]	Welding	Appendix point 12	C, 4 to 10
[55]	<b>EN 13262:2020</b> <b>Railway applications - Wheelsets and bogies - Wheels - Product requirements</b>		
[55.1]	Specific product properties concerning the wheel	Appendix point 15	C, 4, 5 and 6
[56]	<b>UIC 535-2:2006</b> <b>Standardisation and positioning on wagons of steps, end platforms, gangways, handrails, tow hooks, automatic coupler (AC), draw-only automatic coupler and brake valve controls on the UIC member RUs and OSJD member RUs</b>		
[56.1]	Tow hooks Conditions for alternative solutions	Appendix point 16	C, 1.4 1.4.2 to 1.4.9
[56.2]	Protective devices on protruding parts	Appendix point 17	C, 1.3
[57]	<b>IRS 50575:2020, Ed1</b> <b>Railway applications -Wagons – Label-holders and hazard identification panels: interchangeability</b>		
[57.1]	Label holders and attachment devices for rear end signal	Appendix point 18	C, 2
[58]	<b>EN 16834:2019</b> <b>Railway applications - Braking – Brake performance</b>		
[58.1]	Service brake	4.2.4.3.2.1	Annex D

Index	Standard name	Standard reference	Standard version
	Parameter	TSI Point	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	Appendix C, point 9, Table C.3	6, 8, 9, 12
<b>[59]</b>	<b>EN 16839:2022</b> <b>Railway applications - Rolling stock - Head stock layout</b>		
[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***

Index	Document name	reference	version
	Parameter	TSI Point	Standard Point
<b>[A]</b>	<b>Interfaces between Control-Command and Signalling Trackside and other Subsystems</b> <b>Appendix A of CCS TSI, index [77]</b> <b>ERA/ERTMS/033281 V5.0</b>		
[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

Index	Document name	reference	version
	Parameter	TSI Point	Standard Point
			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), 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.4]	Influencing unit	7.1.2 (d1)	Point 3.2
[A.5]	Vehicle impedance	7.1.2 (d1)	Point 3.2.2
[A.6]	Harmonised test method	7.1.2 (d1)	Point 3.2.1
[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]	<b>ERA Technical Document on codification of combined transport ERA/TD/CT version 1.1 (realased on 2023-03-21)</b>		
[B.1]	Codification of units intended to be used in combined transport	4.2.3.1 Appendix H	2.2

”;

(67) Appendix E is amended as follows:

(a) in point 1, the first and second paragraphs are replaced by the following:

“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].”;

(b) in point 2, the fourth sentence is replaced by the following:

“The plate shall be retro-reflective in accordance with the specification referenced in Appendix D Index [30].”;

(68) Appendix F is amended as follows:

A new line is added after “Running dynamic behaviour” as follows:

Derailment detection and prevention function	4.2.3.5.3	x	x	n.a.	-
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(69) Appendix G is replaced by the following:

#### **“Appendix G**

##### **LIST OF COMPOSITE BRAKE BLOCKS EXEMPTED OF A DECLARATION OF CONFORMITY AS REFERRED IN ARTICLE 8B**

This Appendix, referenced ERA/TD/2009-02/INT, Version 15.0 is published on the ERA website (<http://www.era.europa.eu>).”

(70) the following Appendix H is added:

#### **“Appendix H**

##### **Codification of units intended to be used in combined transport**

The codification of units intended to be used in combined transport shall be in accordance with the specification referenced in Appendix D.2, index [B].

The following requirements are applicable to units intended to be used in combined transport and requiring a Wagon Compatibility Code.

##### **H.1 Wagon Compatibility Code**

- (1) The Wagon Compatibility Code (WCC) specifies the type of Intermodal Loading Unit that can be loaded on the unit.
- (2) The WCC shall be determined for all units and assessed by a Notified Body.

##### **H.2 Wagon Correction Digit**

- (1) The Wagon Correction Digit (WCD) is the result of a comparison between the geometric characteristics of the unit under assessment and the characteristics of the reference wagons defined in point H.3.

- (2) This comparison shall be performed for all units and assessed by a Notified Body. The result of the assessment shall be included in the report of the Notified Body.
- (3) On the basis of the assessment:
- For units having equivalent or more favourable geometric characteristics than the reference wagon, the WCD may be calculated if requested by the applicant.
- For units having less favourable geometric characteristics than the reference wagon, the calculation of the WCD is not required by this TSI.

### H.3 Characteristics of the reference wagons

The combined transport 'P' profiles are calculated on the basis of the characteristics of the reference recess wagon defined as:

- Distance between bogie pivots (a) 11200mm
- Bogie wheelbase (p) 1800mm
- Height of semi-trailer (ST) loading plane 330mm
- Maximum overhang (na) 2000mm
- Load tolerance 10mm
- Dissymmetry 1°
- Height of ST + wagon roll centre (Hc) 1000mm
- q+w play 11.5mm
- Play in side bearers (J) 12mm
- Half-distance between side bearers (bG) 850mm
- ST + wagon flexibility (s) 0.3

The combined transport 'C' and ISO profiles are calculated on the basis of the characteristics of the reference wagon defined as:

- Distance between bogie pivots (a) 13500mm
- Bogie wheelbase (p) 1800mm
- Height of swap body loading plane 1175mm
- Maximum overhang (na) 2000mm
- Load tolerance 10mm
- Dissymmetry 1°
- Height of wagon roll centre (Hc) 500mm
- q+w play 11.5mm
- Play in side bearers (J) 12mm
- Half-distance between side bearers (bG) 850mm
- Wagon flexibility (s) 0.15”.