EUROPEAN UNION AGENCY FOR RAILWAYS

Making the railway system
work better for society.

TSI revision 2022
Digital Rail and Green Freight

Changes proposed to the TSI NOI

Based on Commission Regulation (EU) No 1304/2014–

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TABLE OF CONTENTS

Contents

🡻 1304/2014
➔1 774/2019 Art. 1.4 and Annex .1

1. INTRODUCTION

In general Technical Specifications for Interoperability (TSI) lay down for each subsystem (or part of it) the optimal level of harmonised specifications in order to ensure the interoperability of the rail system. Therefore TSIs harmonise only the specifications concerning parameters which are critical to interoperability (basic parameters). The specifications of the TSIs must meet the essential requirements as set out in Annex III of ➔1 Directive (EU) 2016/797 ←.

In line with the proportionality principle this TSI sets out the optimal level of harmonisation related to specifications on the rolling stock subsystem as defined in Section 1.1 intended to limit the noise emission of the rail system within the Union.

🡻 774/2019 Art. 1.4 and Annex .2

1.1. Technical scope

1.1.1. Scope related to rolling stock

This TSI applies to all rolling stock within the scope of Regulation (EU) No 1302/2014 (LOC&PAS TSI) and Regulation (EU) No 321/2013 (WAG TSI);

1.1.2. Scope related to operational aspects

Alongside with Commission Decision 2012/757/EU[1] (OPE TSI), this TSI applies to the operation of freight wagons which are used on railway infrastructure designated as ‘quieter routes’.

🡻 1304/2014

1.2. Geographical scope

The geographical scope of this TSI corresponds to the scopes defined in Section 1.2 of Regulation (EU) No 1302/2014 and in Section 1.2 of Regulation (EU) No 321/2013, each for their rolling stock (RST) concerned.

[1] Commission Decision 2012/757/EU of 14 November 2012 concerning the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system in the European Union and amending Decision 2007/756/EC (OJ L 345, 15.12.2012, p. 1).

🡻 774/2019 Art. 1.4 and Annex .3

2. DEFINITION OF THE SUBSYSTEM

A 'unit' means the rolling stock which is subject to the application of this TSI, and therefore subject to the 'EC' verification procedure. Chapter 2 in the annex to Regulation (EU) No 1302/2014 and chapter 2 in the annex to Regulation (EU) No 321/2013 describe what a unit can consist of.

The requirements of this TSI apply to the following categories of rolling stock set out in section 2 in Annex I of Directive (EU) 2016/797:

(a) Locomotives and passenger rolling stock including thermal or electric traction units, self-propelling thermal or electric passenger trains, and passenger coaches. This category is further defined in chapter 2 in the annex to Regulation (EU) No 1302/2014 and shall be referred to in this TSI as locomotives, electric multiple units (EMU), diesel multiple units (DMU) and coaches;

(b) Freight wagons, including low-deck vehicles designed for the entire network and vehicles designed to carry lorries. This category is further defined in chapter 2 in the annex to Regulation (EU) No 321/2013 and shall be referred to in this TSI as wagons;

(c) Special vehicles, such as on-track machines. This category is further defined in chapter 2 in the annex to Regulation (EU) No 1302/2014 and consists of on-track machines (referred to in this TSI as OTMs) and infrastructure inspection vehicles, which belong to the categories in points (a) or (b) depending on their design.

🡻 774/2019 Art. 1.4 and Annex .4

3. ESSENTIAL REQUIREMENTS

All basic parameters set out in this TSI shall be linked to at least one of the essential requirements as set out in Annex III of Directive (EU) 2016/797. Table 1 indicates the allocation.

Table 1

Basic parameters and their link to the essential requirements

Point	Basic parameter	Essential requirements					
		Safety	Reliability and availability	Health	Environmental protection	Technical compatibility	Accessibility

4.2.1	Limits for stationary noise				1.4.4		
4.2.2	Limits for starting noise				1.4.4		
4.2.3	Limits for pass-by noise				1.4.4		
4.2.4	Limits for driver's cab interior noise				1.4.4		

🡻 1304/2014
➔$_1$ 774/2019 Art. 1.4 and Annex .5(a)

4. CHARACTERISATION OF THE SUBSYSTEM

4.1. Introduction

This Chapter sets out the optimal level of harmonisation related to specifications on the rolling stock subsystem intended to limit the noise emission of the Union rail system and to achieve interoperability.

4.2. Functional and technical specifications of the subsystems

The following parameters have been identified as critical for the interoperability (basic parameters):

(a) ‘stationary noise’;

(b) ‘starting noise’;

(c) ‘pass-by noise’;

(d) ‘driver's cab interior noise’.

The corresponding functional and technical specifications allocated to the different categories of rolling stock are set out in this section. In case of units equipped with both thermal and electric power the relevant limit values under all normal operation modes shall be respected. If

one of these operation modes foresees the use of both thermal and electric power at the same time the less restrictive limit value applies. In accordance with ➔1 Articles 4(5) and 2(13) of Directive (EU) 2016/797 ←, provision may be made for specific cases. Such provisions are indicated in Section 7.3.

The assessment procedures for the requirements in this section are defined in the indicated points and sub points of Chapter 6.

4.2.1. Limits for stationary noise

The limit values for the following sound pressure levels under normal vehicle conditions concerning the stationary noise allocated to the categories of the rolling stock subsystem are set out in Table 2:

(a) the A-weighted equivalent continuous sound pressure level of the unit ($L_{pAeq,T[unit]}$);

(b) the A-weighted equivalent continuous sound pressure level at the nearest measuring position i considering the main air compressor ($L^{i}_{pAeq,T}$); and

(c) the AF-weighted sound pressure level at the nearest measuring position i considering impulsive noise of the exhaust valve of the air dryer (L^{i}_{pAFmax}).

The limit values are defined at a distance of 7,5 m from the centre of the track and 1,2 m above top of rail.

Table 2

Limit values for stationary noise

Category of the rolling stock subsystem	$L_{pAeq,T[unit]}$ [dB]	$L^{i}_{pAeq,T}$ [dB]	L^{i}_{pAFmax} [dB]
Electric locomotives and OTMs with electric traction	70	75	85
Diesel locomotives and OTMs with diesel traction	71	78	
EMUs	65	68	
DMUs	72	76	
Coaches	64	68	
Wagons	65	n.a.	n.a.

The demonstration of conformity is described in point 6.2.2.1.

4.2.2. Limits for starting noise

The limit values for the AF-weighted maximum sound pressure level ($L_{pAF,max}$) concerning the starting noise allocated to the categories of the rolling stock subsystem are set out in Table 3. The limit values are defined at a distance of 7,5 m from the centre of the track and 1,2 m above top of rail.

Table 3

Limit values for starting noise

Category of the rolling stock subsystem	$L_{pAF,max}$ [dB]
Electric locomotives with total tractive power P < 4500 kW	81
Electric locomotives with total tractive power P ≥ 4500 kW OTMs with electric traction	84
Diesel locomotives P < 2000 kW at the engine output shaft	85
Diesel locomotives P ≥ 2000 kW at the engine output shaft OTMs with diesel traction	87
EMUs with a maximum speed v_{max} < 250 km/h	80
EMUs with a maximum speed v_{max} ≥ 250 km/h	83
DMUs P < 560 kW/engine at the engine output shaft	82
DMUs P ≥ 560 kW/engine at the engine output shaft	83

The demonstration of conformity is described in point 6.2.2.2.

4.2.3. Limits for pass-by noise

The limit values for the A-weighted equivalent continuous sound pressure level at a speed of 80 km/h ($L_{pAeq,Tp,(80\ km/h)}$) and, if applicable, at 250 km/h ($L_{pAeq,Tp,(250\ km/h)}$) concerning the pass-by noise allocated to the categories of the rolling stock subsystem are set out in Table 4. The limit values are defined at a distance of 7,5 m from the centre of the track and 1,2 m above top of rail.

Measurements at speeds higher than or equal to 250 km/h shall also be made at the ‘additional measurement position’ with a height of 3,5 m above top of rail in accordance with Chapter 6 of EN ISO 3095:2013 and assessed against the applicable limit values of Table 4.

Table 4

Limit values for pass-by noise		
Category of the rolling stock subsystem	$L_{pAeq,Tp\ (80\ km/h)}$ [dB]	$L_{pAeq,Tp\ (250\ km/h)}$ [dB]
Electric locomotives and OTMs with electric traction	84	99
Diesel locomotives and OTMs with diesel traction	85	n.a.
EMUs	80	95
DMUs	81	96
Coaches	79	n.a.
Wagons (normalised to APL = 0,225)[2]	83	n.a.

The demonstration of conformity is described in point 6.2.2.3.

4.2.3.a. Friction elements for wheel tread brakes

The friction element for wheel tread brakes (i.e. brake block) has an influence on the pass-by noise by creating roughness on the wheel tread when braking.

If wheel tread brakes are used the characteristics of the friction element for wheel tread brakes shall contribute to achieving the intended pass-by noise, unless it is demonstrated at subsystem level that the wagon fulfils the requirement set out in clause 4.2.3 of this TSI.

The demonstration of conformity is described in clause 6.1.2.1 of this TSI.

This requirement above does not exempt the unit under assessment from the requirements set out in clause 4.2.3 and the demonstration of conformity set out in clause 6.2.2.3.

4.2.4. Limits for the driver's cab interior noise

The limit values for the A-weighted equivalent continuous sound pressure level ($L_{pAeq,T}$) concerning the noise within the driver's cab of electric and diesel locomotives, OTMs, EMUs, DMUs and coaches fitted with a cab are set out in Table 5. The limit values are defined in the vicinity of the driver's ear.

[2] APL: the number of axles divided by the length over the buffers (m^{-1})

Table 5	
Limit values for driver's cab interior noise	
Noise within the driver's cab	$L_{pAeq,T}$ [dB]
At standstill with horns sounding	95
At maximum speed v_{max} if $v_{max} < 250$ km/h	78
At maximum speed v_{max} if 250 km/h ≤ $v_{max} < 350$ km/h	80

The demonstration of conformity is described in point 6.2.2.4.

↓ 774/2019 Art. 1.4 and Annex .5(b)

4.3. Functional and technical specifications of the interfaces

This TSI has the following interfaces with the rolling stock subsystem:

Interface with subsystems of points (a), (b), (c) and (e) of chapter 2 (dealt with in Regulation (EU) No 1302/2014) with regard to:

– stationary noise,

– starting noise (not applicable to coaches),

– pass-by noise,

– interior noise within the driver's cab, where applicable.

Interface with subsystems of point (d) of chapter 2 (dealt with in Regulation (EU) No 321/2013) with regard to:

– pass-by noise,

– stationary noise.

This TSI has the following interface with the operation and traffic management subsystem (dealt with in Decision 2012/757/EU) with regard to:

– pass-by noise.

🡻 774/2019 Art. 1.4 and Annex .5(c)

4.4. Operating rules

Requirements concerning the operating rules for the subsystem rolling stock are set out in section 4.4 of the Annex of Regulation (EU) No 1302/2014 and in section 4.4 of the Annex of Regulation (EU) No 321/2013.

4.4.1. Specific rules for the operation of wagons on quieter routes in case of degraded operation

The contingency arrangements as defined in point 4.2.3.6.3 of the Annex of Decision 2012/757/EU include the operation of wagons not compliant with point 7.2.2.2 on quieter routes.

This measure can be applied to address capacity restrictions or operational constraints caused by rolling stock failures, extreme weather conditions, accidents or incidents and infrastructure failures.

4.4.2. Specific rules for the operation of wagons on quieter routes in case of infrastructure works and wagons maintenance

The operation of wagons not compliant with point 7.2.2.2 on quieter routes shall be possible in case of wagons maintenance activities where only a quieter route is available in order to access the maintenance workshop.

Contingency arrangements set out in point 4.4.1 are applicable in case of infrastructure works where a quieter route is the only suitable alternative.

🡻 774/2019 Art. 1.4 and Annex .5(d)

4.5. Maintenance rules

Requirements concerning the maintenance rules for the subsystem rolling stock are set out in section 4.5 of the Annex of Regulation (EU) No 1302/2014 and in section 4.5 of the Annex of Regulation (EU) No 321/2013.

🡻 1304/2014
➔1 774/2019 Art. 1.4 and Annex .6

4.6. Professional qualifications

Not applicable.

4.7. Health and safety conditions

See Article 6 of this Regulation.

4.8. European register of authorised types of vehicles

The data of the rolling stock that must be recorded in the 'European register of authorised types of vehicles (ERATV)' are set out in Decision 2011/665/EU.

5. INTEROPERABILITY CONSTITUENTS

~~There is no interoperability constituent specified in this TSI.~~

5.1. General

Interoperability constituents (ICs), as defined in Article 2(7) of Directive (EU) 2016/797, are listed in section 5.2 together with the reference to corresponding requirements defined in section 4.2.

5.2. Interoperability constituent specifications

5.2.1. Friction element for wheel tread brakes

This interoperability constituent is only applicable to the 'rolling stock - freight wagons' subsystem.

A friction element for wheel tread brakes shall comply with the requirements defined in clause 4.2.3.a. These requirements shall be assessed at IC level.

6. CONFORMITY ASSESSMENT AND EC VERIFICATION

6.1. Interoperability constituents

~~Not applicable.~~

6.1.1. Modules

The conformity assessment of an interoperability constituent shall be performed in accordance with the module(s) described in Table 5a.

Table 5a

Modules for conformity assessment of interoperability constituents

Module CB	EC-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 CH1	Conformity based on full quality management system plus design examination

These modules are specified in detail in Decision 2010/713/EU.

6.1.2. Conformity assessment procedures

The manufacturer or his authorised representative established within the Union shall choose one of the modules or module combinations indicated below for the constituent 'Friction element for wheel tread brakes':

- CB+CD

- CB+CF

- CH1

Within the application of the chosen module or combination of modules, 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 defined in the following clauses.

6.1.2.1. Friction element for wheel tread brakes

A friction element for wheel tread brakes shall comply with the requirements defined in appendix F.

Until the end of the transition period set out in Appendix G, the types of friction elements for wheel tread brakes listed in Appendix G are deemed compliant with the requirements above without testing.

6.2. Subsystem rolling stock regarding noise emitted by rolling stock

6.2.1. Modules

The EC verification shall be performed in accordance with the module(s) described in Table 6.

Table 6	
Modules for EC verification of subsystems	
SB	EC-Type Examination

SD	EC verification based on quality management system of the production process
SF	EC verification based on product verification
SH1	EC verification based on full quality management system plus design examination

These modules are specified in detail in Decision 2010/713/EU.

6.2.2. EC verification procedures

The applicant shall choose one of the following assessment procedures consisting of one or more modules for the EC verification of the subsystem:

– (SB+SD),

– (SB+SF),

– (SH1).

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

6.2.2.1. Stationary noise

The demonstration of conformity with the limit values on stationary noise as set out in point 4.2.1 shall be carried out in accordance with Sections 5.1, 5.2, 5.3, 5.4, 5.5 (without clause 5.5.2), 5.7 and clause 5.8.1 of EN ISO 3095:2013.

For the assessment of the main air compressor noise at the nearest measuring position i, the $L^{i}_{pAeq,T}$ indicator shall be used with T representative of one operating cycle as defined in Section 5.7 of EN ISO 3095:2013. Only the train systems that are required for the air compressor to run under normal operating conditions shall be used for this. The train systems which are not needed for the operation of the compressor may be switched off to prevent contribution to the noise measurement. The demonstration of conformity with the limit values shall be carried out under the conditions solely necessary for operation of the main air compressor at the lowest rpm.

For the assessment of the impulsive noise sources at the nearest measuring position i, the L^{i}_{pAFmax} indicator shall be used. The relevant noise source is the exhaust from the valves of the air dryer.

6.2.2.2. Starting noise

The demonstration of conformity with the limit values on starting noise as set out in point 4.2.2 shall be carried out in accordance with Chapter 7 (without clause 7.5.1.2) of EN ISO 3095:2013.

The maximum level method referring to Section 7.5 of EN ISO 3095:2013 shall apply. Deviating from clause 7.5.3 of EN ISO 3095:2013 the train shall accelerate from standstill up to 30 km/h and then maintain the speed.

In addition the noise shall be measured at a distance of 7,5 m from the centre of the track and a height of 1,2 m above top of rail. The ‘averaged level method’ and the ‘maximum level method’ in accordance with Section 7.6 and 7.5 respectively of EN ISO 3095:2013 shall apply and the train shall accelerate from standstill up to 40 km/h and then maintain the speed. The measured values are not assessed against any limit value and shall be recorded in the technical file and communicated to the Agency.

For OTMs the starting procedure shall be performed without additional trailer loads.

6.2.2.3. Pass-by noise

The demonstration of conformity with the limit values on pass-by noise as set out in point 4.2.3 shall be carried out in accordance with points 6.2.2.3.1 and 6.2.2.3.2.

6.2.2.3.1. Test track conditions

The tests shall be performed on a reference track as defined in Section 6.2 of EN ISO 3095:2013.

However, it is permitted to carry out the test on a track that does not comply with the reference track conditions in terms of acoustic rail roughness level and track decay rates as long as the noise levels measured in accordance with point 6.2.2.3.2 do not exceed the limit values set out in point 4.2.3.

The acoustic rail roughness and the decay rates of the test track shall be determined in any case. If the track on which the tests are performed does meet the reference track conditions, the measured noise levels shall be marked ‘comparable’, otherwise they shall be marked ‘non-comparable’. It shall be recorded in the technical file whether the measured noise levels are ‘comparable’ or ‘non-comparable’.

The measured acoustic rail roughness values of the test track remain valid during a period starting 3 months before and ending 3 months after this measurement, provided that during this period no track maintenance has been performed which influences the rail acoustic roughness.

The measured track decay rate values of the test track shall remain valid during a period starting 1 year before and ending 1 year after this measurement, provided that during this period no track maintenance has been performed which influences the track decay rates.

Confirmation shall be provided in the technical file that the track data related to the type's pass-by noise measurement were valid during the day(s) of testing, e.g. by providing the date of last maintenance having an impact on noise.

Furthermore, it is permitted to carry out tests at speeds equal to or higher than 250 km/h on slab tracks. In this case the limit values shall be 2 dB higher than those set out in point 4.2.3.

6.2.2.3.2. Procedure

The tests shall be carried out in accordance with the provision in Sections 6.1, 6.3, 6.4, 6.5, 6.6 and 6.7 (without 6.7.2) of EN ISO 3095:2013. Any comparison against limit values shall be carried out with results rounded to the nearest integer decibel. Any normalisation shall be performed before rounding. The detailed assessment procedure is set out in points 6.2.2.3.2.1, 6.2.2.3.2.2 and 6.2.2.3.2.3.

6.2.2.3.2.1. EMU, DMUs, locomotives and coaches

For EMU, DMUs, locomotives and coaches three classes of maximum operational speed are distinguished:

(1) If the maximum operational speed of the unit is lower than or equal to 80 km/h, the pass-by noise shall be measured at its maximum speed v_{max}. This value shall not exceed the limit value $L_{pAeq,Tp(80\ km/h)}$ as set out in point 4.2.3.

(2) If the maximum operational speed v_{max} of the unit is higher than 80 km/h and lower than 250 km/h, the pass-by noise shall be measured at 80 km/h and at its maximum speed. Both measured pass-by noise values $L_{pAeq,Tp(vtest)}$ shall be normalised to the reference speed of 80 km/h $L_{pAeq,Tp(80\ km/h)}$ using formula (1). The normalised value shall not exceed the limit value $L_{pAeq,Tp(80\ km/h)}$ as set out in point 4.2.3.

Formula (1):

$$L_{pAeq,Tp(80\ km/h)} = L_{pAeq,Tp(vtest)} - 30 * \log (v_{test}/80\ km/h)$$

$\rightarrow_1 v_{test} \leftarrow$	=	Actual speed during the measurement

(3) If the maximum operational speed v_{max} of the unit is equal to or higher than 250 km/h, the pass-by noise shall be measured at 80 km/h and at its maximum speed with an upper test speed limit of 320 km/h. The measured pass-by noise value $L_{pAeq,Tp(vtest)}$ at 80 km/h shall be normalised to the reference speed of 80 km/h $L_{pAeq,Tp(80\ km/h)}$ using formula (1). The normalised value shall not exceed the limit value $L_{pAeq,Tp(80\ km/h)}$ as set out in point 4.2.3. The measured pass-by noise value at maximum speed $L_{pAeq,Tp(vtest)}$ shall be normalised to the reference speed of 250 km/h $L_{pAeq,Tp(250\ km/h)}$ using formula (2). The normalised value shall not exceed the limit value $L_{pAeq,Tp(250\ km/h)}$ as set out in point 4.2.3.

Formula (2):

$$L_{pAeq,Tp(250\ km/h)} = L_{pAeq,Tp(vtest)} - 50 * \log(v_{test}/250\ km/h)$$

$\rightarrow_1 v_{test} \leftarrow$	=	Actual speed during the measurement

6.2.2.3.2.2. Wagons

For wagons two classes of maximum operational speed are distinguished:

(1) If the maximum operational speed v_{max} of the unit is lower than or equal to 80 km/h, the pass-by noise shall be measured at its maximum speed. The measured pass-by noise value $L_{pAeq,Tp(vtest)}$ shall be normalised to a reference APL of 0,225 m^{-1} $L_{pAeq,Tp\ (APLref)}$ using formula (3). This value shall not exceed the limit value $L_{pAeq,Tp(80\ km/h)}$ as set out in point 4.2.3.

Formula (3):

$$L_{pAeq,Tp\ (APLref)} = L_{pAeq,Tp(vtest)} - 10 * \log(APL_{wag}/0{,}225\ m^{-1})$$

APL_{wag}	=	Number of axles divided by the length over the buffers [m^{-1}]
➔1 v_{test} ←	=	Actual speed during the measurement

(2) If the maximum operational speed v_{max} of the unit is higher than 80 km/h, the pass-by noise shall be measured at 80 km/h and at its maximum speed. Both measured pass-by noise values $L_{pAeq,Tp(vtest)}$ shall be normalised to the reference speed of 80 km/h and to a reference APL of 0,225 m^{-1} $L_{pAeq,Tp(APL\ ref,\ 80\ km/h)}$ using formula (4). The normalised value shall not exceed the limit value $L_{pAeq,Tp(80\ km/h)}$ as set out in point 4.2.3.

Formula (4):

$$L_{pAeq,Tp\ (APLref,\ 80\ km/h)} = L_{pAeq,Tp(vtest)} - 10 * \log(APL_{wag}/0{,}225\ m^{-1}) — 30 * \log(v_{test}/80\ km/h)$$

APL_{wag}	=	Number of axles divided by the length over the buffers [m^{-1}]
➔1 v_{test} ←	=	Actual speed during the measurement

6.2.2.3.2.3. OTMs

For OTMs the same assessment procedure as set out in 6.2.2.3.2.1 applies. The measuring procedure shall be performed without additional trailer loads.

OTMs are deemed to comply with the pass-by noise level requirements in point 4.2.3 without measuring when they are:

– solely braked by either composite brake blocks or disc brakes, and

– equipped with composite scrubbers, if scrubber blocks are fitted.

6.2.2.4. Driver's cab interior noise

The demonstration of conformity with the limit values on the driver's cab interior noise as set out in point 4.2.4 shall be carried out in accordance with EN 15892:2011. For OTMs the measuring procedure shall be performed without additional trailer loads.

6.2.3. Simplified evaluation

Instead of the test procedures as set out in point 6.2.2, it is permitted to substitute some or all of the tests by a simplified evaluation. The simplified evaluation consists of acoustically comparing the unit under assessment to an existing type (further referred to as the reference type) with documented noise characteristics.

The simplified evaluation may be used for each of the applicable basic parameters ‘stationary noise’, ‘starting noise’, ‘pass-by noise’ and ‘driver's cab interior noise’ autonomously and shall consist of providing evidence that the effects of the differences of the unit under assessment do not result in exceeding the limit values set out in Section 4.2.

For the units under simplified evaluation, the proof of conformity shall include a detailed description of the noise relevant changes compared to the reference type. From this description, a simplified evaluation shall be performed. The estimated noise values shall include the uncertainties of the applied evaluation method. The simplified evaluation can either be a calculation and/or simplified measurement.

A unit certified on the basis of the simplified evaluation method shall not be used as a reference unit for a further evaluation.

If the simplified evaluation is applied for pass-by noise, the reference-type shall comply with at least one of the following:

– Chapter 4 and for which the pass-by noise results are marked ‘comparable’

– Chapter 4 of Decision 2011/229/EU and for which the pass-by noise results are marked ‘comparable’

– Chapter 4 of Decision 2006/66/EC

– Chapter 4 of Decision 2008/232/EC.

In case of a wagon whose parameters remain, compared to the reference type, within the permitted range of Table 7 it is deemed without further verification that the unit complies with the limit values on pass-by noise as set out in point 4.2.3.

Table 7	
Permitted variation of wagons for the exemption from verification	
Parameter	Permitted variation (compared to the reference unit)

Max. unit speed	Any speed up to 160 km/h
Type of wheel	Only if equally or less noisy (acoustic characterisation i. a. w. Annex E of EN 13979-1:2011)
Tare weight	Only within the range of +20 %/- 5 %
Brake block	Only if the reference unit is fitted with brake blocks and the brake block of the unit under assessment is covered either by an EC Declaration of Conformity in accordance with this TSI or it is listed in Appendix G of this TSI.~~variation does not result in higher noise emission.~~

7. IMPLEMENTATION

7.1. Application of this TSI to new subsystems

~~See Article 8 of this Regulation.~~

(1) This TSI is applicable to all units of rolling stock in its scope which are placed on the market after the date of application of this TSI, except where the point 7.1.1.2 'Application to ongoing projects' of the LOC&PAS TSI or the point 7.1.1 'Application to ongoing projects' of the WAG TSI applies.

(2) Compliance with the NOI TSI 1304/2014 is deemed equivalent to compliance with this TSI, except for the TSI changes listed in appendix H.

(3) The rules related to the EC type or design examination certificates for the rolling stock subsystem and the associated interoperability constituents shall be as specified in the LOC&PAS TSI clause 7.1.3. and in the WAG TSI clause 7.2.3.

🡻 774/2019 Art. 1.4 and Annex .7(a)

7.2. Application of this TSI to existing subsystems

The principles to be applied by the applicants and authorising entities in case of change(s) to a~~n existing~~ rolling stock in operation or to an existing rolling stock type are defined in ~~point~~ clause 7.1.2 of the Annex to Regulation (EU) No 1302/2014 and ~~section~~ clause 7.2.2 of the Annex to Regulation (EU) No 321/2013.

7.2.1. Provisions in case of changes to ~~existing~~ rolling stock in operation or to an existing rolling stock type

The applicant shall ensure that the noise levels of rolling stock subject to change(s) remain below the limits set out in the TSI, which was applicable when the rolling stock in question was first authorised. If no TSI existed at the time of the first authorisation, the applicant shall ensure that the noise levels of the rolling stock subject to change(s) are either not increased or remain below the limits set out in Decision 2006/66/EC or Decision 2002/735/EC.

If an assessment is required, it shall be limited to the basic parameters affected by the change(s).

If the simplified evaluation is applied, the original unit may represent the reference unit in accordance with the provisions of point 6.2.3.

The replacement of a whole unit or (a) vehicle(s) within a unit (e.g. a replacement after a severe damage) does not require a conformity assessment against this TSI, as long as the unit or the vehicle(s) are identical to the ones they replace.

7.2.2. Additional provisions for the application of this TSI to existing wagons

The restriction of the operation set out in Article 5a of this Regulation shall not apply to wagons mostly operated on lines with a gradient of more than 40 ‰, wagons with a maximum operating speed higher than 120 km/h, wagons with a maximum axle load higher than 22,5 t, wagons exclusively operated for infrastructure works and wagons used in rescue trains.

If a wagon is being equipped with ~~quieter brake blocks as defined in point 7.2.2.1~~ either friction elements for wheel tread brakes covered by an EC Declaration of Conformity in accordance with this TSI or with friction elements for wheel tread brakes listed in appendix G and no noise sources are added to the wagon, then it shall be assumed that the requirements of point 4.2.3 are met without further testing.

7.2.2.1. ~~Quieter brake blocks~~Not used

~~A quieter brake block is a brake block belonging to one of the following categories:~~

~~– Brake block listed in Appendix G of Regulation (EU) No 321/2013;~~

~~– Brake block assessed in accordance with the procedure set out in Appendix F of this TSI.~~

7.2.2.2. Wagons operated on quieter routes

Wagons belonging to one of the categories below can be operated on the quieter routes within their area of use:

– Wagons holding an EC declaration of verification against Commission Decision 2006/66/EC concerning the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ of the trans-European conventional rail system;

– Wagons holding an EC declaration of verification against Commission Decision 2011/229/EU concerning the technical specifications of interoperability relating to the subsystem 'rolling stock – noise' of the trans-European conventional rail system;

– Wagons holding an EC declaration of verification against this TSI;

– Wagons fitted with ~~quieter brake blocks as defined in point 7.2.2.1~~ either:

  – friction elements for wheel tread brakes covered by an EC Declaration of Conformity in accordance with this TSI, or

  – friction elements for wheel tread brakes listed in appendix G, or

  – ~~-~~brake discs for the service brake function;

– Wagons fitted with composite brake blocks listed in Appendix E for the service brake function. The operation of these wagons on the quieter routes shall be limited in accordance with the conditions described in this appendix.

7.2.2.3. Interoperability constituents

This point concerns interoperability constituents which are subject to type examination or design examination ~~or to suitability for use~~.

The type or design examination or suitability for use remains valid even if a revision of this TSI comes into force, unless explicitly otherwise specified in the revision of these TSIs.

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

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↓ 1304/2014

7.3. Specific cases

7.3.1. Introduction

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

(a)	'P' cases	:	'permanent' cases;
(b)	'T' cases	:	'temporary' cases.

7.3.2. List of specific cases

🡻 774/2019 Art. 1.4 and Annex .7(b)

7.3.2.1. Specific cases

(a) Specific case Estonia, Finland, Latvia, Lithuania, Poland and Slovakia

('P') For units, which are in shared use with third countries, the track gauge of which is different from that of the main rail network within the Union, the application of national technical rules instead of the requirements in this TSI shall be permitted.

(b) Specific case Finland

('T') Decision 2011/229/EU may continue to apply for freight wagons to be used only on the territory of Finland and until the relevant technical solution in relation to severe winter conditions is found, but in any case not later than until 31 December 2032. This shall not prevent freight wagons from other Member States to operate on the Finnish network.

🡻 1304/2014

7.3.2.2. Limits for stationary noise (point 4.2.1)

(a) Specific case Finland

('T') For coaches and wagons equipped with a diesel generator for electrical power supply higher than 100 kW and intended to operate solely on the railway network of Finland the limit value for stationary noise $L_{pAeq,T\ [unit]}$ in Table 2 may be raised up to 72 dB.

🡻 774/2019 Art. 1.4 and Annex .7(c)

🡻 1304/2014

(b) Specific case UK for Great Britain

('P') For DMUs intended to operate solely on the railway network of Great Britain the limit value for stationary noise $L_{pAeq,T\ [unit]}$ in Table 2 may be raised up to 77 dB.

This specific case does not apply to DMUs intended to operate solely on the High Speed 1 railway network.

(c) Specific case UK for Great Britain

('T') For units intended to operate solely on the railway network of Great Britain the limit values $L^{i}_{pAeq,T}$ in Table 2 considering the main air compressor do not apply. The measured values shall be submitted to the NSA UK.

This specific case does not apply to units intended to operate solely on the High Speed 1 railway network.

7.3.2.3. Limits for starting noise (point 4.2.2)

(a) Specific case Sweden

('T') For locomotives with total tractive power of more than 6000 kW and a maximum axle load of more than 25 t the limit values for starting noise $L_{pAF,max}$ in Table 3 may be raised up to 89 dB.

(b) Specific case UK for Great Britain

('P') For units specified in Table 8 intended to operate solely on the railway network of Great Britain the limit value for starting noise $L_{pAF,max}$ in Table 3 may be raised up to the values set out in Table 8.

Table 8	
Limit values for starting noise regarding a specific case UK for Great Britain	
Category of the rolling stock subsystem	$L_{pAF,max}$ [dB]
Electric locomotives with total tractive power P < 4500 kW	83
Diesel locomotives P < 2000 kW at the engine output shaft	89
DMUs	85

This specific case does not apply to units intended to operate solely on the High Speed 1 railway network.

↓ 774/2019 Art. 1.4 and Annex .7(d)

7.3.2.4. Limits for pass-by noise (point 4.2.3)

(a) Specific case Channel Tunnel

('P') For the Channel Tunnel, the limits for pass-by noise shall not apply to wagons dedicated to the transport of heavy goods vehicles between Coquelles (France) and Folkestone (United Kingdom).

(b) Specific case Sweden

('T') For locomotives with total tractive power of more than 6000 kW and a maximum axle load of more than 25 t the limit values for pass-by noise $L_{pAeq,Tp\ (80\ km/h)}$ in Table 4 may be raised up to 85 dB.

↓ 774/2019 Art. 1.4 and Annex .7(e)

7.4. Particular implementation rules

7.4.1. Particular implementation rules for the application of this TSI to existing wagons (point 7.2.2)

(a) Particular implementation rules for the application of this TSI to existing wagons in the Channel Tunnel

('P') For the calculation of the annual average daily operated freight trains during night-time the freight trains composed of wagons dedicated to the transport of heavy goods vehicles confined in the Coquelles (France) - Folkestone (United Kingdom) line shall not be taken into account.

(b) Particular implementation rules for the application of this TSI to existing wagons in Finland and Sweden

('T') The concept of quieter routes shall not apply on the Finnish and Swedish networks due to uncertainties related to the operation in severe winter conditions with composite brake blocks until 31 December 2032. This shall not prevent freight wagons from other Member States to operate on the Finnish and Swedish network.

7.4.2. Particular implementation rules for wagons operated on quieter routes (point 7.2.2.2)

(a) Particular implementation rules for wagons operated on quieter routes of Belgium

('T') On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of Belgium:

– Wagons with tyred wheels until 31 December 2026

– Wagons which require the fitting of a kink valve in order to replace the cast iron block with composite brake blocks until 31 December 2026

– Wagons fitted with cast iron blocks which require the replacement of wheels with wheels compliant with the requirements set out in EN 13979-

1:2003+A2:2011 in order to be retrofitted with composite brake blocks until 31 December 2026

(b) Particular implementation rules for wagons operated on quieter routes of Channel Tunnel

('P') On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the Channel Tunnel concession:

Wagons dedicated to the transport of heavy goods vehicles between Coquelles (France) and Folkestone (United Kingdom)

(c) Particular implementation rules for wagons operated on quieter routes of Czechia

('T') On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of Czechia:

– Wagons with tyred wheels, until 31 December 2026

– Wagons with 59V type bearings until 31 December 2034

– Wagons which require the fitting of a kink valve in order to replace the cast iron block with composite brake blocks, until 31 December 2034

– Wagons with 1Bg or 1Bgu brake configuration fitted with cast iron brake blocks until 31 December 2036

– Wagons fitted with cast iron blocks which require the replacement of wheels with wheels compliant with the requirements set out in EN 13979-1:2003+A2:2011 in order to be retrofitted with composite brake blocks until 31 December 2029

Furthermore, it shall not be mandatory to use composite brake blocks on quieter routes for existing wagons not covered by the five dashes above and for which there exists no one-to-one-solution for replacement of cast iron brake blocks until 31 December 2030.

(d) Particular implementation rules for wagons operated on quieter routes of France

('T') On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of France:

– Wagons with 1Bg or 1Bgu brake configuration fitted with cast iron brake blocks until 31 December 2030

– Wagons fitted with small wheels (diameter under 920 mm) until 31 December 2030

(e) Particular implementation rules for wagons operated on quieter routes of Italy

(‘T’) On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of Italy:

– Wagons with tyred wheels until 31 December 2026

– Wagons which require the fitting of a kink valve in order to replace the cast iron block with composite brake blocks until 31 December 2026

– Wagons fitted with cast iron blocks which require the replacement of wheels with wheels compliant with the requirements set out in EN 13979-1:2003+A2:2011 in order to be retrofitted with composite brake blocks until 31 December 2026

Furthermore, it shall not be mandatory to use composite brake blocks on quieter routes for existing wagons not covered by the three dashes above and for which there exists no one-to-one-solution for replacement of cast iron brake blocks until 31 December 2030.

(f) Particular implementation rules for wagons operated on quieter routes of Poland

(‘T’) On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of Poland until 31 December 2036:

– Wagons with tyred wheels

– Wagons with 1Bg or 1Bgu brake configuration fitted with cast iron blocks

– Wagons designed for ‘S’ traffic equipped with ‘SS’ brake fitted with cast iron blocks

– Wagons fitted with cast iron blocks and designed for ‘SS’ traffic for which retrofitting with LL brake blocks would require fitting with wheels complying with EN 13979-1:2003+A2:2011 and a kink valve

(g) Particular implementation rules for wagons operated on quieter routes of Slovakia

(‘T’) On top of the wagons listed in point 7.2.2.2, the following existing wagons can be operated on quieter routes in the territory of Slovakia:

– Wagons with tyred wheels until 31 December 2026

– Wagons with bogies of type 26-2.8 fitted with cast iron blocks P10 until 31 December 2036

– Wagons, which require the fitting of a kink valve in order to replace the cast iron block with composite brake blocks until 31 December 2036.

(‘P’) Wagons with bogies 2TS intended for circulation between Slovakia and third countries by means of exchange of bogies in the border station

(h) Particular implementation rules for wagons operated on quieter routes of UK for Great Britain

('P') For units intended to operate solely on the GB Network, where existing wagons are equipped with composite brake blocks published in GMGN 2688 it shall be permitted to operate on quieter routes

('T') The following types of existing wagons equipped with cast iron brake blocks intended to operate on the GB Network shall be permitted to operate on quieter routes:

– Wagons equipped with a non-UIC braking system for which there are no compatible silent brake blocks available for retrofitting until 31 December 2030.

– Wagons with a designed braking distance of 810m or less from 60 mph in brake mode G (goods timing)/75 mph in brake mode P (passenger timing), where those wagons are operated in trains with other wagons which have stopping distances in accordance with the relevant UK(GB) national technical rules, until 31 December 2030

– Wagons used exclusively for the transport of nuclear products until 31 December 2050.

↓ 1304/2014

Appendix A

~~**Open points**~~

~~↓ 774/2019 Art. 1.4 and Annex .8~~

~~Element of the rolling stock subsystem~~	~~Clause of this TSI~~	~~Technical aspect not covered by this TSI~~	~~Comments~~
~~Quieter brake block~~	~~7.2.2.1 and Appendix F~~	~~Assessment of the acoustic properties of the brake blocks~~	~~Alternative technical solutions available (see point 7.2.2)~~

Not used

↓ 1304/2014

Appendix B

Standards referred to in this TSI

TSI		Standard	
Characteristics to be assessed		References to mandatory standards	Chapter
Stationary noise	4.2.1	—	—
	6.2.2.1	EN ISO 3095:2013	5
Starting noise	4.2.2	—	—
	6.2.2.2	EN ISO 3095:2013	7
Pass-by noise	4.2.3	EN ISO 3095:2013	6
	6.2.2.3	EN ISO 3095:2013	6
Driver's cab interior noise	4.2.4	—	—
	6.2.2.4	EN 15892:2011	all
Simplified evaluation	6.2.3	EN 13979-1:2011	Annex E

Appendix C

Assessment of the rolling stock subsystem

Characteristics to be assessed, as specified in Section 4.2						Particular assessment procedure
Element of the rolling stock sub-system	Point	Element of the rolling stock sub-system	Design review	Type Test	Routine Test	Point
Stationary noise	4.2.1	X[3]	X	n.a.	6.2.2.1	
Starting noise	4.2.2	X[4]	X	n.a.	6.2.2.2	
Pass-by noise	4.2.3	X[5]	X	n.a.	6.2.2.3	
Driver's cab interior noise	4.2.4	X[6]	X	n.a.	6.2.2.4	

[3] Only if the simplified evaluation in accordance with point 6.2.3 is applied.
[4] Only if the simplified evaluation in accordance with point 6.2.3 is applied.
[5] Only if the simplified evaluation in accordance with point 6.2.3 is applied.
[6] Only if the simplified evaluation in accordance with point 6.2.3 is applied.

↓ 774/2019 Art. 1.4 and Annex .9

Appendix D

Quieter routes

D.1 Identification of quieter routes

In accordance with Article 5c(1) of this Regulation the Member States shall provide the European Union Agency for Railways ('the Agency') with a list of quieter routes in a format allowing further processing by the users with IT-tools. The list shall contain at least the following information:

– Start and end points of the quieter routes and their corresponding sections, using geographical code location as defined in the register set out in Commission Implementing Decision 2014/880/EU[7] (RINF). If one of these points is at the border of the Member State, it shall be reflected.

– Identification of the sections making up the quieter route

The list shall be provided using the template below:

Quieter route	Sections in the route	Unique section ID	Quieter route starts/finishes at the border of the Member State
Point A — Point E	Point A — Point B	201	Yes POINT E (Country Y)
	Point B — Point C	202	
	Point C — Point D	203	
	Point D — Point E	204	
Point F — Point I	Point F — Point G	501	No
	Point G — Point H	502	

[7] Commission Implementing Decision 2014/880/EU of 26 November 2014 on the common specifications of the register of railway infrastructure and repealing Implementing Decision 2011/633/EU (OJ L 356, 12.12.2014, p. 489).

	Point H — Point I	503	

In addition, the Member States may provide maps illustrating the quieter routes on a voluntary basis. All lists and maps shall be published on the Agency website (http://www.era.europa.eu) no later than 9 months after 27.5.2019.

By the same date the Agency shall inform the Commission of the lists and maps of quieter routes. The Commission shall inform the Member States accordingly through the committee referred to in Article 51 of Directive (EU) 2016/797.

D.2 Update of quieter routes

The freight traffic data used for the update of quieter routes in accordance with Article 5c(2) of this Regulation shall refer to the last three years preceding the update for which the data is available. In case the freight traffic due to exceptional circumstances diverges in a given year from that average number by more than 25 %, the Member State concerned can calculate the average number on the basis of the remaining two years. Member States shall provide the Agency with the updated quieter routes.

The routes designated as quieter routes shall remain as such following the update unless during the period concerned the volume of traffic has decreased by more than 50 % and the average number of daily operated freight trains during the night-time is lower than 12.

In case of new and upgraded lines, the expected volume of traffic shall be used for the designation of those lines as quieter routes.

The Agency shall publish the updated quieter routes on its website (http://www.era.europa.eu) no later than 3 months after their reception and they shall apply from the next December timetable change following one year after their publication.

The Agency shall inform the Commission of any changes to the quieter routes. The Commission shall inform the Member States of these changes through the committee referred to in Article 51 of Directive (EU) 2016/797.

Appendix E

Historic composite brake blocks

E.1 Historic composite brake blocks for international use

Existing wagons equipped with the brake blocks listed below are allowed to be used on the quieter routes within their area of use, until the relevant date set out in Appendix N of UIC 541-4.

Manufacturer/name of product	Designation/type of block	Type of friction coefficient
Valeo/Hersot Wabco/Cobra	693 W554	K
Ferodo	I/B 436	K
Abex	229	K (Fe — sintered)
Jurid	738	K (Fe — sintered)

Wagons equipped with historic composite brake blocks not listed in the table above but already authorised for international traffic in conformity with the provisions of Decision 2004/446/EC or Decision 2006/861/EC can still be used without any deadline within the area of use covered by their authorisation.

E.2 Historic composite brake blocks for national use

Existing wagons equipped with the brake blocks listed below are only allowed to be used on the railway networks, including quieter routes, of the corresponding Member States within their area of use.

Manufacturer/name of the product	Designation/type of block	Member State	Remarks
Cobra/Wabco	V133	Italy	
Cofren	S153	Sweden	
Cofren	128	Sweden	
Cofren	229	Italy	

ICER	904	Spain, Portugal	
ICER	905	Spain, Portugal	
Jurid	838	Spain, Portugal	

Appendix F

Assessment of acoustic performance of a brake block

The purpose of this procedure is to demonstrate the acoustic performance of a composite brake block at interoperability constituent level.

~~This procedure shall be an open point in accordance with Article 4(6) of Directive (EU) 2016/797.~~

The procedure consists of the following steps:

1. Measure the acoustic roughness of a wheel representative of the brake block under assessment.

Wheel acoustic roughness development on bench test

New brake blocks shall be used. Only new or reprofiled wheels shall be used. The wheels shall be free of any damage (cracks, flats, etc).

The brake performance test program:

- A2_a for LL-Blocks and A1_a for K-blocks of UIC 541-4:2020 or
- D.1 for LL-Blocks and C.1 for K-blocks of EN 16452:2015+A1:2019 or
- J.2 of EN 16452:2015+A1:2019 for other blocks

shall be applied to at least one wheel of 920 mm nominal diameter.

The selected program shall be completed and the results of the measurement series after completion shall be used to determine the wheel roughness index.

It is optional to continue with a second run of the selected program. If this option is chosen, the results of the measurement series after completion of the second run shall be used to determine the wheel roughness index. The results from both runs shall be documented.

The second run shall be performed with the same wheel, but the brake block can be renewed and replaced with another block of the same type. In this option the bedding-in of the new brake block shall be completely executed at the beginning of the second run.

Wheel acoustic roughness measurement procedure

The measurement will be performed as set out in EN 15610:2019 except clause 6.2.2.2. In order to ensure the representativeness of the acoustic roughness of the rolling surface of the wheel, 8 measurement lines spaced 5 mm are deemed sufficient instead of the positions defined in point 6.2.2.2 of EN 15610:2019.

The measurement shall be performed during the wheel acoustic roughness development on bench test defined above in accordance with one of the tables below:

If the selected program is A2_a of UIC 541-4:2020:

Acoustic roughness measurement series / Label		Programme section	Brake application No.
1st run	2nd run		
A		At start	Initial condition
B	I	After bedding-in	after Br 6
C	J	After conditioning the block for empty load	after Br. 26
D	K	Dry and empty conditions	after Br. 51
E	L	Wet and empty conditions	after Br. 87
F	M	Laden conditions	after Br. 128
G	N	Drag braking (steep gradient downhill simulation)	after Br. 130
H	O	End of programme	after Br. 164

If the selected program is A1_a of UIC 541-4:2020:

Acoustic roughness measurement series / Label		Programme section	Brake application No.
1st run	2nd run		
A		At start	Initial condition
B	I	After bedding-in	after Br 6
C	J	After conditioning the block for empty load	after Br. 26
D	K	Dry and empty conditions	after Br. 51
E	L	Wet and empty conditions	after Br. 87

F	M	Laden conditions	after Br. 128
G	N	Drag braking (steep gradient downhill simulation)	after Br. 130
H	O	End of programme	after Br. 164

If the selected program is D.1 of EN 16452:2015+A1:2019

Acoustic roughness measurement series / Label		Programme section	Brake application No.
1st run	2nd run		
A		At start	Initial condition
B	I	After bedding-in	after Br 6
C	J	After conditioning the block for empty load	after Br. 26
D	K	Dry and empty conditions	after Br. 51
E	L	Wet and empty conditions	after Br. 87
F	M	Laden conditions	after Br. 128
G	N	Drag braking (steep gradient downhill simulation)	after Br. 130
H	O	End of programme	after Br. 149

If the selected program is C.1 of EN 16452:2015+A1:2019

Acoustic roughness measurement series / Label	Programme section	Brake application No.

1st run	2nd run		
A		At start	Initial condition
B	I	After bedding-in	after Br 6
C	J	After conditioning the block for empty load	after Br. 26
D	K	Dry and empty conditions	after Br. 51
E	L	Wet and empty conditions	after Br. 87
F	M	Laden conditions	after Br. 128
G	N	Drag braking (steep gradient downhill simulation)	after Br. 130
H	O	End of programme	after Br. 149

If the selected program is J.2 of EN 16452:2015+A1:2019

Acoustic roughness measurement series / Label		Programme section	Brake application No.
1st run	2nd run		
A		At start	Initial condition
B	I	After bedding-in	after Br 6
C	J	After conditioning the block for empty load	after Br. 26
D	K	Dry and empty conditions	after Br. 51
E	L	Wet and empty conditions	after Br. 87
F	M	Laden conditions	after Br. 128
G	N	Drag braking (steep gradient downhill simulation)	after Br. 130

H	O	End of programme	after Br. 149

- Sampling: The acoustic roughness of 1 wheel shall be measured.
- Averaging: the RMS average of the acoustic roughness shall be used.

The result is a representative one-third octave wavelength wheel roughness spectrum in the wavelength domain L_r

2. Derive a scalar indicator from the measured wheel roughness L_r in step 1

$$C(i) = B(i) + 10\ \log_{10}[10^{0,1L_R(i)} + 10^{0,1A(i)}]$$

$$Indicator = \ 10\log_{10}(\Sigma_{i=1}^{19}\ 10^{0,1\ C(i)})$$

Where A(i) and B(i) are tabulated as follows[8]:

i	Wavelength λ	A	B	L_r
	[m]	dB re 1 micrometer	dB re 1 micrometer	dB re 1 micrometer
1	0,00315	-17,9	-19,2	
2	0,004	-16,2	-16,5	
3	0,005	-15,5	-13,1	
4	0,0063	-14,4	-9,5	
5	0,008	-13,3	-8,0	
6	0,01	-13,1	-6,8	
7	0,0125	-12,8	-5,1	Obtained from
8	0,016	-12,4	-4,5	Wheel roughness
9	0,02	-10,9	-4,4	measurements
10	0,025	-11,1	-6,5	
11	0,0315	-10,5	-9,0	

[8] Coefficients A(i) and B(i) are tailored to the current limit values for pass-by noise and reference track conditions

12	0,04	-9,8	-11,1	
13	0,05	-4,8	-15,5	
14	0,063	-5,9	-17,5	
15	0,08	-5,6	-22,3	
16	0,1	-0,5	-30,3	
17	0,125	2,4	-31,4	
18	0,16	4,8	-32,9	
19	0,2	2,4	-32,2	

3. Pass-fail criterion

The indicator measured in step 2 shall be lower than or equal to 1.

The indicator measured in step 2 as well as the representative one-third octave wavelength wheel roughness spectrum in the wavelength domain L_r shall be recorded in the IC certificate.

Appendix G

The blocks listed below are exempted from an EC Declaration of conformity for a period of 10 years after the entry into force of this TSI.

Manufacturer	**Type description and abbreviated designation (if different)**
Becorit	K40
CoFren	C333
CoFren	C810
Knorr-Bremse	Cosid 704
Knorr-Bremse	PROBLOCK J816M
Frenoplast	FR513
Federal Mogul	Jurid 816 M abbreviated: J816M
Federal Mogul	Jurid 822
Knorr-Bremse	PROBLOCK J822
CoFren	C952-1
Federal Mogul	J847
Knorr-Bremse	PROBLOCK J847
Icer Rail / Becorit	IB 116*
Alstom/Flertex	W30-1

Appendix H

Changes of requirements and transition regimes

Changes with a generic transition regime:

For TSI clauses listed in table 1, conformity with the previous TSI does not lead systematically to conformity with this TSI. However, for projects already in design phase when this TSI enters into force, the requirement from the previous TSI can still apply for a duration of 7 years from the entry in to force of this TSI. Projects in production phase and rolling stock in operation are not affected by the TSI requirements listed in table 1

Table 1 – transition regime of 7 years

TSI clause(s)	TSI clause(s) in previous TSI	Explanation of the TSI change
Not applicable		

Changes with a specific transition regime:

For TSI clauses listed in table 2, conformity with the previous TSI does not lead systematically to conformity with this TSI. However, for projects already in design phase when this TSI enters into force, the requirement from the previous TSI can still apply according to the specific transition regime described in the table. Projects in production phase and rolling stock in operation are affected by the TSI requirements listed in table 2 according to the specific transition regime described in the table.

Table 2 – Specific transition regime

TSI clause(s)	TSI clauses(s) in previous version	Explanation on TSI change	Transition regime			
			Design phase not started	Design phase started	Production phase	RST in operation
Not applicable						

↑

ANNEX