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**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**

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1. INTRODUCTION

Technical Specifications for Interoperability (TSI) lay down the optimal level of harmonised specifications for each subsystem (or part of it), to ensure the safety and interoperability of the rail system, to facilitate, improve and develop rail transport services within the Union and with third countries, and to contribute to the completion of the single European railway area and the progressive achievement of the internal market. The specifications of the TSIs must meet the essential requirements as set out in Annex III to Directive (EU) 2016/797.

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

1.1. Technical scope

1.1.1. *Scope related to rolling stock*

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

1.1.2. *Scope related to operational aspects*

Alongside with the Annex to Commission Implementing Regulation (EU) 2019/773¹ (OPE TSI), this TSI applies to the operation of freight wagons, which are used on railway infrastructure designated as ‘quieter routes’.

1.2. Geographical scope

The geographical scope of this TSI corresponds to the scopes defined in point 1.2 of LOC&PAS TSI and in point 1.2 of WAG TSI, each for their rolling stock (RST) concerned.

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 of LOC&PAS TSI and Chapter 2 of WAG TSI 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 of Annex I to Directive (EU) 2016/797:

- (a) locomotives and passenger rolling stock including thermal or electric traction units, self-propelling thermal or electric passenger trains, and passenger coaches. This category is further defined in Chapter 2 of LOC&PAS TSI 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 of WAG TSI and shall be referred to in this TSI as wagons;

¹ Commission Implementing Regulation (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU (OJ L 139I, 27.5.2019, p. 5).

- (c) special vehicles, such as on-track machines. This category is further defined in Chapter 2 of LOC&PAS TSI.

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 to Directive (EU) 2016/797. Table 1 indicates the allocation.

| <i>Table 1</i> | | | | | | | |
|--|--|------------------------|------------------------------|--------|--------------------------|-------------------------|---------------|
| <i>Basic parameters and their link to the essential requirements</i> | | | | | | | |
| 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 | | |

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 point. 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 those operation modes plans the use of both thermal and electric power at the same time, the less restrictive limit value applies. In accordance with Article 4(5) and Article 2(13) of Directive (EU) 2016/797, provision may be made for specific cases. Such provisions are indicated in point 7.3.

The assessment procedures for the requirements in this point are defined in the indicated 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 ($L_{pAeq,T}^i$);
- (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_{pAFmax}^i).

The limit values are set 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] | $L_{pAeq,T}^i$ [dB] | L_{pAFmax}^i [dB] |
| Electric locomotives and special vehicles with electric traction | 70 | 75 | 85 |
| Diesel locomotives and special vehicles 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 set at a distance of 7,5 m from the centre of the track and 1,2 m above top of rail.

| <i>Table 3</i> | |
|--|--------------------|
| <i>Limit values for starting noise</i> | |
| 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 $P \geq 4500$ kW Special vehicles with electric traction | 84 |
| Diesel locomotives $P < 2000$ kW at the engine output shaft | 85 |
| Diesel locomotives $P \geq 2000$ kW at the engine output shaft Special vehicles with diesel traction | 87 |
| EMUs with a maximum speed $v_{max} < 250$ km/h | 80 |
| EMUs with a maximum speed $v_{max} \geq 250$ km/h | 83 |
| DMUs $P < 560$ kW/engine at the engine output shaft | 82 |
| DMUs $P \geq 560$ 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 ($L_{pAeq,Tp,(80 \text{ km/h})}$) and, if applicable, at 250 km/h ($L_{pAeq,Tp,(250 \text{ km/h})}$) concerning the pass-by noise allocated to the categories of the rolling stock subsystem are set out in Table 4. The limit values are set 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 the specification referenced in Appendix B, Index [1] and assessed against the applicable limit values of Table 4.

| <i>Table 4</i> | | |
|---|------------------------------|-------------------------------|
| <i>Limit values for pass-by noise</i> | | |
| Category of the rolling stock subsystem | $L_{pAeq,Tp}$ (80 km/h) [dB] | $L_{pAeq,Tp}$ (250 km/h) [dB] |
| Electric locomotives and special vehicles with electric traction | 84 | 99 |
| Diesel locomotives and special vehicles with diesel traction | 85 | n.a. |
| EMUs | 80 | 95 |
| DMUs | 81 | 96 |
| Coaches | 79 | n.a. |
| Wagons (normalised to $APL = 0,225$) ⁽¹⁾ | 83 | n.a. |
| ⁽¹⁾ APL: the number of axles divided by the length over the buffers (m^{-1}) | | |

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.

The demonstration of conformity of brake blocks for freight wagons is described in point 6.1.2.1 of this TSI. Conformity of its brake blocks to that point does not exempt the unit under assessment from the requirements set out in point 4.2.3 and the demonstration of conformity set out in point 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, EMUs, DMUs and coaches fitted with a cab are set out in Table 5. The limit values are set in the vicinity of the driver's ear.

These limit values are not mandatory for special vehicles. However, the demonstration of conformity referred to in point 6.2.2.4 shall be performed and the resulting values shall be recorded in the technical file.

| <i>Table 5</i> | |
|--|-------------------|
| <i>Limit values for driver's cab interior noise</i> | |
| 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 $250 \text{ km/h} \leq v_{max} < 350 \text{ km/h}$ | 80 |

The demonstration of conformity is described in point 6.2.2.4.

4.3. Functional and technical specifications of the interfaces

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

Interface with subsystems referred to in Chapter 2, points (a) and (c), of this Annex (dealt with in LOC&PAS TSI) 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 referred to in Chapter 2, point (b), of this Annex (dealt with in WAG TSI) with regard to:

- pass-by noise,
- stationary noise.

This TSI has the following interface with OPE TSI with regard to:

- pass-by noise.

4.4. Operating rules

Requirements concerning the operating rules for the subsystem rolling stock are set out in point 4.4 of LOC&PAS TSI and in point 4.4 of WAG TSI.

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

The contingency arrangements as set out in point 4.2.3.6.3 of OPE TSI include the operation of wagons not compliant with point 7.2.2.2 of this Annex 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.

4.5. Maintenance rules

Requirements concerning the maintenance rules for the subsystem rolling stock are set out in point 4.5 of LOC&PAS TSI and in point 4.5 of WAG TSI.

4.6. Professional qualifications

Not applicable.

4.7. Health and safety conditions

See Article 6.

5. INTEROPERABILITY CONSTITUENTS

5.1. General

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

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 set out in point 4.2.3.a. Those requirements shall be assessed at IC level.

6. CONFORMITY ASSESSMENT AND EC VERIFICATION

6.1. Interoperability constituents

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 |
|------------|--|

Those 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 set out in point 4.2. If necessary, additional requirements concerning the assessment of particular interoperability constituents are defined in the following points.

6.1.2.1. Friction element for wheel tread brakes of freight wagons

A friction element for wheel tread brakes of freight wagons shall comply with the requirements set out 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 set out in Appendix F 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.

| <i>Table 6</i> | |
|--|---|
| <i>Modules for EC verification of subsystems</i> | |
| 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 |

Those 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 set out in point 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 the specification referenced in Appendix B, Index [1].

For the assessment of the main air compressor noise at the nearest measuring position i , the $L_{pAeq,T}^i$ indicator shall be used with T representative of one operating cycle as defined in the specification referenced in Appendix B, Index [1]. Only the train systems that are required for the air compressor to run under normal operating conditions shall be used for that purpose. 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_{pAFmax}^i 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 the specification referenced in Appendix B, Index [1]. The maximum level method shall apply. Deviating from the test procedure of the specification, the train shall accelerate from standstill up to 30 km/h and then maintain the speed.

In addition the noise shall be measured at the same distance from the centre of the track and the same height above top of rail as set out in point 4.2.2. The ‘averaged level method’ and the ‘maximum level method’ in accordance with the specification referenced in Appendix B, Index [1] 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 special vehicles 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 the specification referenced in Appendix B, Index [1].

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 that measurement, provided that during that 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 that measurement, provided that during that 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 that 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 specification referenced in Appendix B, Index [1]. 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} . That value shall not exceed the limit value $L_{pAeq,Tp(80 \text{ km/h})}$ 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 $L_{pAeq,Tp(V_{\text{test}})}$ shall be normalised to the reference speed of 80 km/h $L_{pAeq,Tp(80 \text{ km/h})}$ using Formula (1). The normalised value shall not exceed the limit value $L_{pAeq,Tp(80 \text{ km/h})}$ as set out in point 4.2.3.

Formula (1):

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

| | | |
|-------------------|---|-------------------------------------|
| V_{test} | = | 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 $L_{pAeq,Tp}(V_{test})$ at 80 km/h shall be normalised to the reference speed of 80 km/h $L_{pAeq,Tp}(80 \text{ km/h})$ using Formula (1). The normalised value shall not exceed the limit value $L_{pAeq,Tp}(80 \text{ km/h})$ as set out in point 4.2.3. The measured pass-by noise value at maximum speed $L_{pAeq,Tp}(V_{test})$ shall be normalised to the reference speed of 250 km/h $L_{pAeq,Tp}(250 \text{ km/h})$ using Formula (2). The normalised value shall not exceed the limit value $L_{pAeq,Tp}(250 \text{ km/h})$ as set out in point 4.2.3.

Formula (2):

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

| | | |
|------------|---|-------------------------------------|
| V_{test} | = | 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 $L_{pAeq,Tp}(V_{test})$ shall be normalised to a reference APL of $0,225 \text{ m}^{-1}$ $L_{pAeq,Tp}(APL_{ref})$ using Formula (3). That value shall not exceed the limit value $L_{pAeq,Tp}(80 \text{ km/h})$ as set out in point 4.2.3.

Formula (3):

$$L_{pAeq,Tp}(APL_{ref}) = L_{pAeq,Tp}(V_{test}) - 10 * \log(APL_{wag}/0,225 \text{ m}^{-1})$$

| | | |
|-------------|---|--|
| APL_{wag} | = | Number of axles divided by the length over the buffers [m^{-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 $L_{pAeq,Tp}(V_{test})$ shall be normalised to the reference speed of 80 km/h and to a reference APL of $0,225 \text{ m}^{-1}$ $L_{pAeq,Tp}(APL_{ref}, 80 \text{ km/h})$ using Formula (4). The normalised value shall not exceed the limit value $L_{pAeq,Tp}(80 \text{ km/h})$ as set out in point 4.2.3.

Formula (4):

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

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

6.2.2.3.2.3. Special vehicles

For special vehicles 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.

Special vehicles 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 the specification referenced in Appendix B, Index [2]. For special vehicles 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 point 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. On the basis of that 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 of this Annex and for which the pass-by noise results are marked 'comparable',
- Chapter 4 of the Annex to Decision 2011/229/EU and for which the pass-by noise results are marked 'comparable',
- Chapter 4 of the Annex to Decision 2006/66/EC,
- Chapter 4 of the Annex to 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.

| <i>Table 7</i> | |
|--|--|
| <i>Permitted variation of wagons for the exemption from verification</i> | |
| 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. the specification referenced in Appendix B, Index [3]) |
| 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 to this TSI. |

7. IMPLEMENTATION

7.1. Application of this TSI to new subsystems

- (1) This TSI is applicable to all units of rolling stock in its scope which are placed on the market after **[Publications Office: please insert the date of entry into force of this amending act]**, except where point 7.1.1.2 ‘Application to ongoing projects’ or point 7.1.1.3 ‘Application to special vehicles’ of LOC&PAS TSI or point 7.1.1 ‘Application to ongoing projects’ of WAG TSI applies.
- (2) 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 the TSI changes listed in Appendix H.
- (3) For the rolling stock subsystem and the associated interoperability constituents, the rules related to the EC type or design examination certificates shall be as specified in point 7.1.3 of LOC&PAS TSI. and point 7.2.3 of WAG TSI.

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 rolling stock in operation or to an existing rolling stock type are defined in point 7.1.2 of LOC&PAS TSI and point 7.2.2 of WAG TSI.

7.2.1. *Provisions in case of changes to 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 version of 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 Commission Decision 2002/735/EC².

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.

² Commission Decision 2002/735/EC of 30 May 2002 concerning the technical specification for interoperability relating to the rolling stock subsystem of the trans-European high-speed rail system referred to in Article 6(1) of Directive 96/48/EC (OJ L 245, 12.9.2002, p. 402).

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 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 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. Not used

7.2.2.2. Wagons operated on quieter routes

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

- wagons holding an EC declaration of verification against Decision 2006/66/EC,
- wagons holding an EC declaration of verification against Decision 2011/229/EU,
- wagons holding an EC declaration of verification against this TSI,
- wagons fitted with either of the following:
 - friction elements for wheel tread brakes covered by an EC Declaration of Conformity in accordance with this TSI,
 - friction elements for wheel tread brakes listed in Appendix G,
 - 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 those 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.
- 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.

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

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. That shall not prevent freight wagons from other Member States to operate on the Finnish network.

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.

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.

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.

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. That 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 may 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 the specification referenced in Appendix B, Index [3] 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 may 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 may 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 the specification referenced in Appendix B, Index [3] 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 first paragraph 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 may 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 may be operated on quieter routes in the territory of Italy:

- wagons with tired 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 the specification referenced in Appendix B, Index [3] 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 first paragraph 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 may be operated on quieter routes in the territory of Poland until 31 December 2036:

- wagons with tired 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 the specification referenced in Appendix B, Index [3] 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 may 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.

–

Appendix A - Not used

Appendix B
STANDARDS REFERRED TO IN THIS TSI

| <i>Table B.1</i> | | | |
|-------------------------------------|--|------------------|---|
| <i>List of referenced standards</i> | | | |
| <i>Index</i> | <i>Parameter</i> | <i>TSI Point</i> | <i>Standard Point</i> |
| [1] | EN ISO 3095 :2013 Acoustics — Railway applications — Measurement of noise emitted by railbound vehicles | | |
| [1.1] | Pass-by noise - measurements at speeds higher than or equal to 250 km/h | 4.2.3 | 6 |
| [1.2] | Stationary noise – demonstration of conformity | 6.2.2.1 | 5.1, 5.2, 5.3, 5.4, 5.5 (without 5.5.2), 5.7 and clause 5.8.1 |
| [1.3] | Stationary noise – operating cycle of the main air compressor | 6.2.2.1 | 5.7 |
| [1.4] | Starting noise | 6.2.2.2 | 7 (without 7.5.1.2) Deviation to 7.5.3 |
| [1.5] | Pass-by noise – test track conditions | 6.2.2.3.1 | 6.2 |
| [1.6] | Pass-by noise - procedure | 6.2.2.3.2 | 6.1, 6.3, 6.4, 6.5, 6.6 and 6.7 (without 6.7.2) |
| [2] | EN ISO 3381:2021 Railway applications - Acoustics - Noise measurement inside railbound vehicles | | |
| [2.1] | Driver's cab interior noise | 6.2.2.4 | 7, 8 except 8.4.5 and 8.7.2 |
| [3] | EN 13979-1:2020 Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Part 1: Forged and rolled wheels Note: EN 13979-1:2003+A2:2011 is also acceptable | | |
| [3.1] | Simplified evaluation | 6.2.3 – table 7 | Annex E |

| | | | |
|-------|--|------------|-----------------------------|
| [3.2] | Particular implementation rules for wagons operated on quieter routes | 7.4.2 | All |
| [4] | UIC 541-4 :2020 Composite brake blocks - General conditions for certification and use | | |
| [4.1] | Brake performance test program | Appendix F | Test programs A1_a and A2_a |
| [5] | EN 16452:2015+A1:2019 Railway applications - Braking - Brake blocks | | |
| [5.1] | Brake performance test program – LL-blocks and K-blocks | Appendix F | Test programs D.1 and C.1 |
| [5.2] | Brake performance test program – other blocks | Appendix F | Test program J.2 |
| [6] | EN 15610:2019 Railway applications - Acoustics - Rail and wheel roughness measurement related to noise generation | | |
| [6.1] | Wheel acoustic roughness measurement procedure | Appendix F | All except clause 6.2.2.2 |

Appendix C

ASSESSMENT OF THE ROLLING STOCK SUBSYSTEM

| Characteristics to be assessed, as specified in point 4.2 | | Design review | Type Test | Routine Test | Particular assessment procedure |
|--|-------|------------------|-----------|--------------|---------------------------------|
| Element of the rolling stock sub-system | point | | | | point |
| Stationary noise | 4.2.1 | X ⁽¹⁾ | X | n.a. | 6.2.2.1 |
| Starting noise | 4.2.2 | X ⁽¹⁾ | X | n.a. | 6.2.2.2 |
| Pass-by noise | 4.2.3 | X ⁽¹⁾ | X | n.a. | 6.2.2.3 |
| Driver's cab interior noise | 4.2.4 | X ⁽¹⁾ | X | n.a. | 6.2.2.4 |
| (1) Only if the simplified evaluation in accordance with point 6.2.3 is applied. | | | | | |

Appendix D

QUIETER ROUTES

D.1 Identification of quieter routes

- In accordance with Article 5c(1), the Member States shall provide the Agency with a list of quieter routes through the Commission Implementing Decision (EU) 2019/777³ (RINF). 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 in the register set out in RINF. If one of those 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 | |
| | 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.

³ Commission Implementing Decision (EU) 2019/777 of 16 May 2019 on the common specifications for the register of railway infrastructure and repealing Implementing Decision 2014/880/EU (OJ L 139I, 27.5.2019, p. 312).

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) shall refer to the last three years preceding the update for which the data is available. Where, due to exceptional circumstances, the freight traffic diverges in a given year from that average number by more than 25 %, the Member State concerned may calculate the average number on the basis of the remaining two years. Member States shall ensure that the infrastructure managers update quieter routes in RINF as soon as these updates become available. Updates shall apply from the next timetable change following their publication.

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

Appendix E

Historic composite brake blocks

E.1 Historic composite brake blocks for international use

Existing wagons equipped with the brake blocks listed in the table 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 but already authorised for international traffic in conformity with Commission Decision 2004/446/EC⁴ or Commission Decision 2006/861/EC⁵ may 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 in the table 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 | |

⁴ Commission Decision 2004/446/EC of 29 April 2004 specifying the basic parameters of the ‘Noise’, ‘Freight Wagons’ and ‘Telematic applications for freight’ Technical Specifications for Interoperability referred to in Directive 2001/16/EC (OJ L 155, 30.4.2004, p. 1).

⁵ Commission Decision 2006/861/EC of 28 July 2006 concerning the technical specification of interoperability relating to the subsystem ‘rolling stock — freight wagons’ of the trans-European conventional rail system (OJ L 344, 8.12.2006, p. 1).

| | | | |
|-------|-----|--------------------|--|
| 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.

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.).

One of the following brake performance test programs shall be applied to at least one wheel of 920 mm nominal diameter:

- A2_a for LL-Blocks and A1_a for K-blocks of the specification referenced in Appendix B, Index [4];
- D.1 for LL-Blocks and C.1 for K-blocks of the specification referenced in Appendix B, Index [5];
- J.2 of the specification referenced in Appendix B, Index [5] for other blocks.

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 that 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 may be renewed and replaced with another block of the same type. In that 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 the specification referenced in Appendix B, Index [6]. 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 set out in the specification referenced in Appendix B, Index [6].

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

If the selected program is A2_a of the specification referenced in Appendix B, Index [4]:

| 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 the specification referenced in Appendix B, Index [4]:

| 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 the specification referenced in Appendix B, Index [5]

| 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 the specification referenced in Appendix B, Index [5]

| 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 the specification referenced in Appendix B, Index [5]

| 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

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

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

Where A(i) and B(i) are tabulated as follows⁶:

| i | Wavelength λ [m] | A dB re 1 micrometer | B dB re 1/(10 ⁻⁶ m) | L_r dB re 1 micrometer |
|----|-----------------------------|-------------------------|-----------------------------------|--|
| 1 | 0,00315 | -17,9 | -16,6 | Obtained from Wheel roughness measurements |
| 2 | 0,004 | -16,2 | -13,9 | |
| 3 | 0,005 | -15,5 | -10,0 | |
| 4 | 0,0063 | -14,4 | -6,9 | |
| 5 | 0,008 | -13,3 | -6,2 | |
| 6 | 0,01 | -13,1 | -5,4 | |
| 7 | 0,0125 | -12,8 | -3,3 | |
| 8 | 0,016 | -12,4 | -2,2 | |
| 9 | 0,02 | -10,9 | -4,2 | |
| 10 | 0,025 | -11,1 | -8,5 | |
| 11 | 0,0315 | -10,5 | -11,2 | |
| 12 | 0,04 | -9,8 | -14,3 | |
| 13 | 0,05 | -4,8 | -15,6 | |
| 14 | 0,063 | -5,9 | -17,3 | |
| 15 | 0,08 | -5,6 | -23,7 | |
| 16 | 0,1 | -0,5 | -29,0 | |
| 17 | 0,125 | 2,4 | -30,7 | |
| 18 | 0,16 | 4,8 | -31,7 | |
| 19 | 0,2 | 2,4 | -30,7 | |

⁶ Coefficients A(i) and B(i) are tailored to the current limit values for pass-by noise and reference track conditions

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

Exempted brake blocks

The blocks listed below are exempted from an EC Declaration of conformity until [Publications Office: Please insert the date 10 years after the entry into force of this amending act]. Until that date, the manufacturer or its representative may notify to the Commission the need to revise the pass-fail criterion set out in point 3 of Appendix F or the methodology set out in that Appendix.

| 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

For other TSI points than these listed in Table H.1 and Table H.2, compliance with the ‘previous TSI’ (i.e. this Regulation as amended by Commission Implementing Regulation (EU) 2019/774⁷) imply compliance with this TSI applicable from *[Publications Office: please insert the date of entry into force of this amending act]*.

Changes with a generic transition regime of 7 years:

For TSI points listed in Table H.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 rolling stock in operation are not affected by the TSI requirements listed in Table H.1.

Table H.1 – transition regime of 7 years

| TSI point(s) | TSI point(s) in the previous TSI | Explanation of the TSI change |
|----------------|----------------------------------|-------------------------------|
| Not applicable | | |

Changes with a specific transition regime:

For TSI points listed in Table H.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 rolling stock in operation shall comply with the requirement of this TSI in accordance with the respective transition regime set out in Table H.2 starting from *[Publications Office: please insert the date of entry into force of this amending act]*.

⁷

Commission Implementing Regulation (EU) 2019/774 of 16 May 2019 amending Regulation (EU) No 1304/2014 as regards application of the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ to the existing freight wagons (OJ L 139I, 27.5.2019, p. 89).

Table H.2 – Specific transition regime

| TSI point(s) | TSI points(s) in the previous TSI | Explanation on TSI change | Transition regime | | | |
|----------------|-----------------------------------|---------------------------|--------------------------|----------------------|------------------|----------------------------|
| | | | Design phase not started | Design phase started | Production phase | rolling stock in operation |
| Not applicable | | | | | | |

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