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Economic Commission for Europe**Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Noise****Sixty-eighth session**

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Item 2 of the provisional agenda

UN Regulation No. 9 (Noise of three-wheeled vehicles)**Proposal for a Supplement to UN Regulation No. 9 (Noise of three-wheeled vehicles)****Submitted by the expert from the European Commission***

The text reproduced below was prepared by the expert from the European Commission in accordance with a view of the Working Party on Noise (GRB) at its sixty-seventh session (ECE/TRANS/WP.29/GRB/65, para. 28) to consider including in UN Regulation No. 9 additional sound emission provisions (ASEP) for L₄ and L₅ category vehicles with the power-to-mass ratio (PMR) of more than 50 W/kg. It is based on ECE/TRANS/WP.29/2017/2 and GRB-67-04 and proposes the introduction of definitions (paragraph 2), specifications (paragraph 6), transitional provisions (paragraph 11) and of two new Annexes 6 and 7 on technical and administrative requirements. The modifications are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21/Add.1, Cluster 3), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



I. Proposal

Add new subparagraphs 2.12. and 2.13. to read:

"2.12. "Power-to-mass ratio index" means the ratio of the rated maximum net power of the vehicle in W to the test mass in kg.

The symbol PMR denotes the power-to-mass ratio index.

2.13. "Idling speed" is the speed of the engine running in warm condition, the gear lever placed in neutral, and the clutch engaged.

The symbol n_{idle} denotes the idling speed expressed in min^{-1} ."

Add a new paragraph 6.3.4. and its subparagraphs to read:

"6.3.4. Additional sound emission provisions

6.3.4.1. The vehicle type to be approved shall meet the requirements of Annex 6 to this Regulation. If the vehicle has user selectable software programs or modes which affect the sound emission of the vehicle, all these modes shall be in compliance with the requirements in Annex 6. Testing shall be based on the worst case scenario.

6.3.4.2. In the application for type approval or for modification or extension of a type approval the manufacturer shall provide a statement in accordance with Annex 7 that the vehicle type to be approved complies with the requirements of paragraphs 6.3.4. of this Regulation.

6.3.4.3. The Type Approval Authority may carry out any test prescribed in this Regulation."

Paragraph 11.3., amend to read:

~~"11.3. Contracting Parties applying this Regulation shall not refuse to grant extensions of type approvals for existing types which have been granted according to the preceding series of amendments to this Regulation.~~

11.3. Contracting Parties applying this UN Regulation shall not refuse to grant type approvals according to any preceding series of amendments to this UN Regulation or extensions thereof."

Paragraph 11.6., amend to read:

~~11.6. Notwithstanding the transitional provisions above, Contracting Parties whose application of this Regulation comes into force after the date of entry into force of the most recent series of amendments are not obliged to accept type approvals which were granted in accordance with any of the preceding series of amendments to this Regulation are only obliged to accept type approval granted in accordance with the 07 series amendments.~~

"11.6. Notwithstanding the transitional provisions above, Contracting Parties who start to apply this UN Regulation after the date of entry into force of the most recent series of amendments are not obliged to accept UN type-approvals which were granted in accordance with any of the preceding series of amendments to this UN Regulation."

Add new subparagraphs 11.9. - 11.13. to read:

"11.9. As from the official date of entry into force of the XX series of amendments [this series of amendments with the current supplement],

no Contracting Party applying this UN Regulation shall refuse to grant or refuse to accept type approvals under this UN Regulation as amended by the XX series of amendments [this series of amendments with the current supplement].

- 11.10. As from 1 September following the entry into force of the XX series of amendments or 1 September following the entry into force of the XX series of amendments + 12 months, whichever results at least in 12 months ("Date (b)"), Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals to the preceding series of amendments, first issued after "Date (b)".
- 11.11. Until 1 September of [year of "Date (c) = year of "Date (b)" + 36 months] ("Date (c)"), Contracting Parties applying this UN Regulation shall accept UN type-approvals to the preceding series of amendments, first issued before "Date (b)".
- 11.12. As from 1 September of [year of "Date (c) = year of "Date (b)" + 36 months] ("Date (c)"), Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals issued to the preceding series of amendments to this Regulation.
- 11.13. Notwithstanding paragraph 11.12., Contracting Parties applying this UN Regulation shall continue to accept UN type-approvals issued according to the preceding series of amendments to this UN Regulation, for the vehicles/vehicle systems which are not affected by the changes introduced by the XX series of amendments [this series of amendments with the current supplement]."

Annex 5,

Footnote 2, amend to read::

"² ISO 10844:~~1994~~**2014**"

Paragraph 4.3., amend to read:

"4.3. Volumetric macrotexture measurement

For the purpose of this standard, texture depth measurements shall be made on at least 10 positions evenly spaced along the wheel tracks of the test strip and the average value taken to compare with the specified minimum texture depth. For the description of the procedure see standard ISO 10844:~~1994~~**2014**."

Add *new annexes 6 and 7* to read:

"Annex 6

Additional Sound Emission Provisions (ASEP)

1. **Scope**
 - 1.1. **This Annex applies to vehicles of category L₄ and L₅ with PMR >50.**
 - 1.2. **Vehicles with variable gear ratios or automatic transmission with non-lockable gear ratios are exempted from the requirements of this Annex,**

if the vehicle manufacturer provides technical documents to the Type Approval Authority showing, that the vehicle's engine speed at BB' does neither exceed $n_{BB'} + 0.05 * (n_{rated} - n_{idle})$ nor fall below $n_{BB'} - 0.05 * (n_{rated} - n_{idle})$ for any test condition inside the ASEP control range defined in paragraph 2.5. below, where $n_{BB'}$ is the average engine speed at BB' from the two valid acceleration tests according to paragraphs 2. and 3. of Annex 3.

n_{idle} shall be measured by the Technical Service in accordance with the requirements laid down in Annex 2 of GTR No. 15 (ECE/TRANS/180/Add.15/Amend.1) during the ASEP test, performed in accordance with paragraph 2 of this Annex, unless the manufacturer presents a test report or a Communication which mentions the value of n_{idle} , measured in accordance with the above mentioned requirements of GTR No. 15.

2. Additional sound emission requirements

2.1. Measuring instruments

The requirements for the measurement equipment are identical to those defined in paragraph 1.1. of Annex 3 for the tests of the vehicle in motion.

2.2. Acoustical environment, meteorological conditions and background noise

The requirements concerning the acoustical environment, the meteorological conditions and the background noise are identical to those defined in paragraph 2.1. of Annex 3 for the tests of the vehicle in motion.

2.3. Microphone positions and conditions of the vehicle

The requirements concerning the conditions of the vehicle and the microphone positions are identical to those defined in paragraphs 2.2. and 3.1., respectively, of Annex 3 for the tests of the vehicle in motion.

2.4. General operating conditions

The path of the centreline of the vehicle shall follow the line CC' as closely as possible throughout the entire test, from the approach to line AA' until the rear of the vehicle passes line BB' (see Annex 5 – Figure 1).

In addition, the conditions of paragraph 3.1.2.1. of Annex 3 shall apply.

2.5. ASEP control range

The requirements of this Annex apply to any vehicle operation with the following restrictions:

- (a) $v_{AA'}$ shall be at least 20 km/h
- (b) $v_{BB'}$ shall not exceed 80 km/h
- (c) $n_{AA'}$ shall be at least $0.1 * (n_{rated} - n_{idle}) + n_{idle}$,

- (d) $n_{BB'}$ shall not exceed $n_{BB'_{max}}$,
 $n_{BB'_{max}}$ shall be determined by
- (i) $0.85 * (n_{rated} - n_{idle}) + n_{idle}$ for $PMR \leq 66$ and
 $3.4 * PMR^{-0.33} * (n_{rated} - n_{idle}) + n_{idle}$ for $PMR > 66$, or
- (ii) $1.3 * n_{BB'_{ref}}$,
 whichever is higher, but shall not exceed n_{rated} .
- $n_{BB'_{ref}}$ is calculated in accordance to paragraph 3.3.1. of this Annex.

3. Testing compliance by measurements

3.1. General

The Type Approval Authority as well as the Technical Service may request tests to check the compliance of the vehicle with the requirements of paragraph 2 above. To avoid undue work load testing is restricted to the reference points defined in paragraph 3.2. below and up to two additional operating conditions other than the reference points but inside the ASEP control range.

3.2. Test procedure

The same test procedure as described in paragraph 3.1.2.1. of Annex 3 shall be applied.

3.3. ASEP test conditions

3.3.1. ASEP reference test

3.3.1.1. Test speed and gear selection

The vehicle shall be tested at the operating conditions as described in paragraph 3.1.2.2. of Annex 3.

3.3.1.2. The sound level determination shall be performed as described in paragraph 3.1.3. of Annex 3. At least two measurements shall be made on each side of the vehicle.

The final sound level result shall be calculated according to paragraph 3.1.4. of Annex 3.

This value constitutes the reference level L_{ref} . The gear chosen for the test constitutes the reference gear g_{ref} .

3.3.1.3. The $n_{BB'}$ values of the measurements shall be averaged and rounded to the nearest integer.

This value constitutes the reference engine speed $n_{BB'_{ref}}$.

3.3.2. ASEP test 1

3.3.2.1. Test speed and gear selection

The selected gear shall be

- (a) g_{ref} or $g_{ref} + 1$, if $g_{ref} = 2$,
 (b) $g_{ref} - 1$, g_{ref} or $g_{ref} + 1$, if $g_{ref} > 2$

The gear and $v_{AA'}$ shall be chosen in that way, so that the test condition complies with the control range specifications and that

$$n_{BB'} \leq 0,85 * n_{BB'_{ref}}$$

Pretests may be carried out in order to determine an appropriate measurement condition.

- 3.3.2.2. The sound level determination shall be performed as described in paragraph 3.1.3. of Annex 3. At least two measurements shall be made on each side of the vehicle.

The final sound level result shall be calculated according to paragraph 3.1.4. of Annex 3.

- 3.3.2.3. Data processing and reporting

The engine speed measurements at AA' and BB' shall be averaged arithmetically. The results in units of min^{-1} shall be mathematically rounded to the nearest integer. The $n_{BB'}$ value shall be used for the calculations specified in paragraph 4 of this Annex.

The final sound pressure level for the full throttle acceleration shall not exceed the limits specified in paragraph 4 of this Annex.

- 3.3.3. ASEP test 2

- 3.3.3.1. Test speed and gear selection

The selected gear shall be

- (a) g_{ref} or $g_{ref} + 1$, if $g_{ref} = 2$,
- (b) $g_{ref} - 1$, g_{ref} or $g_{ref} + 1$, if $g_{ref} > 2$

The gear and $v_{AA'}$ shall be chosen in that way, so as the test condition complies with the control range specifications and that

$$n_{BB'} \geq 1,15 * n_{BB'_{ref}}$$

Pretests may be carried out in order to determine an appropriate measurement condition.

- 3.3.3.2. The sound level determination shall be performed as described in paragraph 3.1.3. of Annex 3. At least two measurements shall be made on each side of the vehicle.

The final sound level result shall be calculated according to paragraph 3.1.4. of Annex 3.

- 3.3.3.3. Data processing and reporting

The engine speed measurements at AA' and BB' shall be averaged arithmetically. The results in units of min^{-1} shall be mathematically rounded to the nearest integer. The $n_{BB'}$ value shall be used for the calculations specified in paragraph 4 of this Annex.

The final sound pressure level for the full throttle acceleration shall not exceed the limits specified in paragraph 4 of this Annex.

4. ASEP limits

The maximum noise level recorded during the passage of the vehicle through the test track shall not exceed:

$L_{ref} + (1 * (n_{BB'} - n_{BB'_{ref}}) / 1,000) + 3$ for $n_{BB'} < n_{BB'_{ref}}$ and

$L_{ref} + (5 * (n_{BB'} - n_{BB'_{ref}}) / 1,000) + 3$ for $n_{BB'} \geq n_{BB'_{ref}}$

with L_{ref} and $n_{BB'_{ref}}$ as specified in paragraph 3.3.1. and $n_{BB'}$ as specified in paragraphs 3.3.2. and 3.3.3.

Annex 7

Statement of compliance with the Additional Sound Emission Provisions (ASEP)

(Maximum format: A4 (210 x 297 mm))

..... (Name of manufacturer) attests that vehicles of this type (type with regard to its noise emission pursuant to UN Regulation No. 9) comply with the requirements of paragraph 6.3.4. of UN Regulation No. 9.

..... (Name of manufacturer) makes this statement in good faith, after having performed an appropriate evaluation of the sound emission performance of the vehicles.

Date:

Name of authorized representative:

Signature of authorized representative:"

II. Justification

General

1. ASEP for high powered L_4 and L_5 vehicles, used for passenger transport, are proposed in line with ASEP in the 04 series of amendments to UN Regulation No 41, due to comparable sound emissions levels of L_4 and L_5 vehicles with the ones of L_3 vehicles and the possibility of applying similar measurement methods for sound emissions for those vehicle categories. This is also supported by the European Commission study on enhanced sound requirements for mopeds, quads and replacement silencers of L-category vehicles, which led to appropriate amendments to UN Regulation Nos. 9, 63 and 92.

Paragraph 2.

2. The “power-to-mass ratio index” and “idling speed” definitions are added, because they are necessary for the new requirements added in Annexes 6 and 7.

Paragraph 6.

3. A new subparagraph is added, in order to refer to the correct Annexes on ASEP.

Paragraph 11.

4. The appropriate transitional provisions are also added or the existing ones are amended, in accordance with the provisions of ECE/TRANS/WP.29/2017/107.

Annex 5

5. The reference to standard ISO 10844, in footnote 2 and paragraph 4.3., is updated to the same version used in the rest of UN Regulation No. 9.

Annex 6

6. The text is in line with the corresponding requirements in the 04 series of amendments to UN Regulation No. 41 and is modified in order to meet the requirements of Annex 3 of this Regulation, as well as to make the ASEP requirements more robust.

Annex 6, paragraph 1.1.

7. ASEP is required for L₄ and L₅ vehicles with PMR > 50 W/kg. For hybrids the system power would be required in order to calculate PMR.

Annex 6, paragraph 2.5 (d) (ii)

8. Depending on the design of the vehicle it could happen, that $n_{BB',ref}$ is rather close to $n_{BB',max}$, but both are far below n_{rated} . In this case the sound emission for more aggressive driving behaviour would not be controlled by ASEP. Therefore, it is required that the control range for the engine speed $n_{BB'}$ should cover engine speeds up to 130% of $n_{BB',ref}$, without exceeding n_{rated} .

Annex 6, paragraph 3.3.

9. The ASEP reference test is a copy of the Annex 3 test and its results provide the data for the reference point. The reference point is determined by the sound level L_{ref} , the chosen gear g_{ref} and the engine speed $v_{BB'}$ at the end of the test track BB'. In the 04 series of amendments to UN Regulation No. 41 the target speed and the reference engine speed is $v_{PP'}$ and $n_{PP'}$. Since these values are not required in this UN Regulation, the reference was moved to BB'. Validation should be possible through measurements.

10. The approach for the two ASEP tests, described in subparagraphs 3.3.2. and 3.3.3., is as follows: The engine speed $n_{BB'}$ for the first test shall be sufficiently below and the engine speed for the second test shall be sufficiently above $n_{BB',ref}$ in order to cover the operation conditions in practical vehicle use as much as possible.

Annex 7

11. Annex 7 is in line with the 04 series of amendments to UN Regulation No. 41 and amended in order to comply with this UN Regulation. Ideally, this Annex should be replaced by the suitable entries in Annex 1 (Communication).
