Transmitted by the experts of OICA

Informal document **GRBP-78-10**
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agenda item 3.

Proposal for a supplement to the 03 series of amendments to UN Regulation No. 51

This proposal concerns to amendments to Annex 7 of UN Regulation No. 51. The proposed changes regarding sound enhancement systems are based on the 03 series of amendment to UN Regulation No. 51 up to Supplement 09. In addition, some clarifications concerning power definition and temperature correction have been included based on experiences with the last changes of this regulation.

The modifications are marked in **bold** for new or ~~strikethrough~~ for deleted characters. For easier reading, the topics (sound enhancement systems, temperature correction and power definition) are highlighted with different colors.

I. Proposal

Paragraph 6.2.3., amend to read:

"6.2.3. Additional sound emission provisions

The Additional Sound Emission Provisions (ASEP) apply only to vehicles of categories M_1 and N_1 equipped with:

- an internal combustion engine **(ICE) for propulsion of the vehicle, or**
- **any other propulsion technology, if fitted with an exterior sound enhancement system other than specified under item (d) in this paragraph.**

Vehicles are deemed to fulfil the requirements of Annex 7, if the vehicle manufacturer provides technical documents to the type approval authority showing, that the difference between maximum and minimum engine speed of the vehicles at BB' for any test condition inside the ASEP control range defined in paragraph 2.3. of Annex 7 to this Regulation (including Annex 3 conditions) does not exceed 0.15 x S. This article is intended especially for non-lockable transmissions with variable gear ratios (CVT).

Vehicles are exempted from ASEP if one of the following conditions is fulfilled:

(a) For vehicles of category N_1, if the engine capacity does not exceed 660 cc and the power-to-mass ratio PMR calculated by using the technically permissible maximum laden mass does not exceed 35.

(b) For vehicles of category N_1, if the payload is at least 850 kg and the power-to-mass ratio calculated by using the technically permissible maximum laden mass does not exceed 40.

(c) For vehicles of category N_1 or M_1 derived from N_1, if the technically permissible maximum laden mass is greater than 2.5 tons and the R-point height is greater than 850 mm from the ground and the power- to-mass ratio calculated by using the technically permissible maximum laden mass does not exceed 40.

(d) For vehicles of category M_1 and N_1 equipped with an exterior sound enhancement system, operating as an Acoustic Vehicle Alerting System (AVAS) defined in UN Regulation No. 138 solely in the speed range specified in paragraph 6.2. of UN Regulation No. 138.

The sound emission of the vehicle under typical on-road driving conditions, which are different from those under which the type-approval test set out in Annex 3 and

Annex 7 was carried out, shall not deviate from the test result in a significant manner.[1]

Any electric sound enhancement system for the purpose of the exterior sound emission shall be operational during the type-approval test."

Add new paragraph 11.14., to read:

"11.14. Supplement 10 does not apply to existing type approvals and its extensions, granted prior to the date of entry into force of Supplement 10."

Annex 1 – Appendix 2
Paragraph 3.3. and its subparagraphs, amend to read:

"3.3. Electric motor **(describe each type of electric motor separately)**

3.3.1. **Make: .....**

3.3.2. Type ~~(winding, excitation)~~: .....

3.3.**3.**~~1.1.~~ ~~Maximum hourly output~~ **Rated maximum net power**: …. kW

3.3.**4.**~~1.2.~~ Operating voltage: …. V"

Annex 1 - Appendix 2,
Add new Paragraph 7.2., to read:

"7.2. Sound enhancement systems

7.2.1. solely for the purpose of UN Regulation 138..... yes/no

7.2.2. for other purposes aside UN Regulation No. 138 .....yes/no"

Annex 3 - Appendix 2,
Paragraph 3.2.4., amend to read:

"3.2.4. For each gear, run and vehicle side under constant speed extract the power train component $L_{PT,crs,j}$ from the test result $L_{crs,j}$, by calculation.

$L_{PT,crs,j} = 10 \times \lg(10^{0.1 \times Lcrs,j} - 10^{0.1 \times LTR,crs,j,9crs})$

In case that $L_{TR,crs,9crs}$ is greater **than 99%** of $L_{crs,j}$ the power train component $L_{PT,crs,j}$ is determined by

$L_{PT,crs,j} = 10 \times \lg(0.01 \times 10^{0.1 \times Lcrs,j})$,

with $L_{TR,crs,j,9crs}$ redefined as

$L_{TR,crs,j,9crs} = 10 \times \lg(0.99 \times 10^{0.1 \times Lcrs,j})$"

Annex 3 - Appendix 2,
Paragraph 3.2.4., amend to read:

"3.3.4. For each gear, run and vehicle side under constant speed extract the power train component $L_{PT,wot,j}$ from the test result $L_{wot,j}$, by calculation.

$L_{PT,wot,j} = 10 \times \lg(10^{0.1 \times Lwot,j} - 10^{0.1 \times LTR,wot,j,9crs})$

[1] See document GRB-68-03 as guidance for technical interpretation. The document can be found in https://unece.org/documents-reference-only-0

In case that $L_{TR,wot,9wot}$ is greater **than 99%** of $L_{wot,j}$ the power train component $L_{PT,crs,j}$ is determined by

$L_{PT,wot,j} = 10 \times \lg(0.01 \times 10^{0.1 \times Lwot,j})$,

with $L_{TR,wot,j,9crs}$ redefined as

$L_{TR,wot,j,9wot} = 10 \times \lg(0.99 \times 10^{0.1 \times Lwot,j})$"

Annex 7,
various paragraphs, amend to read:

amendments to be defined *on the base of investigations and measurements, due to*

- the drivetrain (number of gears).
- the measures to limit acceleration.
- the (engine) speeds.

II. Justification

1. General Intention

As an outcome of the new TF QRTV the need for additional regulatory action for BEVs with sound enhancement systems other than AVAS regarding their noise emission has been identified.

For noise emission of electric vehicles, this document is an essential part of an approach, presented by OICA as TF-QRTV-07-06, intending:

- to use the appropriate regulation for safety (e.g., UN Regulation No. 138) and environment (e.g., UN Regulation No.51).
- to keep the regulatory requirements technology neutral.
- to define the minimum safety standards for AVAS sound in UN Regulation No. 138, while enabling measures for further safety developments.
- to include BEVs with sound enhancement systems other than AVAS in the scope of Annex 7 of UN Regulation No. 51.
- to update GRB-68-03 according to the expected sound behavior of BEVs with sound enhancement systems other than AVAS.

In addition, an accompanying revision of the GRBP document for reference GRB-68-03 must be worked out to meet the changed sound behaviour of BEVs with sound enhancement systems other than AVAS. The combination of this updated documents enables the TF QRTV to focus only on AVAS sound and its safety requirements in UN Regulation No. 138.

2. Paragraph 6.2.3. and Annex 7, several paragraphs

The abolition of the exemption for electric vehicles causes some clarifications regarding gears, acceleration and engine speeds.

To amend Annex 7 in UN Regulation No. 51 is expected to be entered into force much faster than a new series of amendments of UN Regulation No. 138 with some transitional provisions. This can limit those vehicles with a nowadays legal but unexpected sound emission (as discussed in TF QRTV) to be established in the market.

3. Annex 1, Appendix 2 paragraph 3.3.:

The “technical information document” has been aligned to the power definitions of UN Regulation No. 85, this regulation is referring to in paragraph 2.8.

4. Annex 3, Appendix 2 paragraphs 3.2.4. and 3.3.4.

Regarding the temperature correction according to Annex 3 – Appendix 2, a conflict will occur in case that the determined tyre rolling sound by tests according to Annex 3 - Appendix 3 is greater than the Annex 3 test result (either constant speed or accelerated). If only the power train sound $L_{PT,crs,j}$ or $L_{PT,wot,j}$ is buffered, this will lead to an increase of the original measurement result, independent from any temperature correction. This effect can occur by measurement uncertainty of the tyre rolling sound measurement inself. It is proposed to split in this case the test run result by 1% powertrain energy (as is already implemented in the regulation) and 99% tyre rolling sound.