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UN Regulation No. 51 (Noise of M and N Categories of Vehicles)

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

Submitted by the experts from the International Organization of Motor Vehicle Manufacturers*

The text reproduced below was prepared by the experts from the International Organization of Motor Vehicle Manufacturers (OICA) with the aim to bring clarifications to UN Regulation No. 51. The proposed changes are based on the 03 series of amendment to UN Regulation No. 51, up to Supplement 10. 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 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), 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

Paragraphs 2.8. to 2.8.3., amend to read:

"2.8. "Maximum net power, P_n" means the declared engine power available for propulsion expressed in kW and measured dependent on the drive train concepts pursuant to UN Regulation No. 85 or UN ~~GTR No. 21~~ **Regulation No. 177.**

Applicable power sources are those which provide drive power for forward motion to the vehicle.

2.8.1. For vehicles with combustion engine(s) only (ICE)

The maximum engine power is the net power P_n of the combustion engine(s) measured at full engine load pursuant to UN Regulation No.85 paragraph 5.2.

2.8.2. For battery electric vehicles (BEV) or fuel cell electric vehicle (FCEV) that have only one propulsion energy converter

The net power P_n of the electric motor of the electric drive train is determined pursuant to UN Regulation No.85 paragraph 5.3.

2.8.3. For hybrid electric vehicles (HEV), or pure electric vehicles that have more than one propulsion energy converter

The maximum engine power is the "vehicle system power rating" according to the arithmetic sum of parallel propulsive engines on the vehicle or **the** ~~GTR 21, paragraph 6.9.1.(b)~~ "sustained vehicle system power" **according to UN Regulation No. 177, paragraph 8.9.1.(b)**."

Add new paragraphs 11.17. and 11.18., to read:

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

11.18. Supplement [11] does not apply to existing type approvals and their extensions, granted prior to the date of entry into force of Supplement [11]."

Annex 3, paragraph 1.2., amend to read:

"1.2. ~~Calibration~~ **Daily Verification and Adjustment** of the ~~e~~**E**ntire Acoustic Measurement System for ~~a~~ **every** Measurement Session

At the beginning ~~and at the end~~ of every measurement session, the entire acoustic measurement system shall be checked by means of a sound calibrator of at least precision Class 1 according to IEC 60942:2003**, and - if necessary – adjusted to the reference values given by the calibrator**.

At the end of the measurement session, the entire acoustic measurement system shall be re-checked by the same calibrator which was used for the check in the beginning. Without any further adjustment the difference between the readings ~~of two consecutive checks~~ **at the beginning and at the end** shall be less than or equal to 0.5 dB~~(A)~~.

If ~~this value~~ **the difference** is ~~exceeded~~ **greater than 0.5 dB**, the results of the **whole** measurements **session** ~~obtained after the previous satisfactory check~~ shall be discarded.

For indoor testing, the entire measurement system shall be checked at the beginning and at the end of a series of sessions, **according to ISO 362-3:2021**.

A qualified calibration method (i.e. electrical calibration) is recommended to be provided by the hardware supplier and, in that case, shall be implemented in the measurement software used. Simulation algorithms using sound source localization detection should deactivate that feature for these tests."

Annex 3, paragraph 2.2.2.3.4., amend to read:

"2.2.2.3.4. Calculation of the test mass of a virtual vehicle with two axles:

When a vehicle family is not represented by a two-axle vehicle because it is physically not available, the vehicle family can be represented by a vehicle with more than two axles (vrf). In that case the test mass of a virtual two-axle vehicle ($m_{t\ (2\ axles\ virtual)}$) can be calculated in the following way:

For the calculation of the unladen vehicle mass of the virtual two-axle vehicle ($m_{unladen\ (2\ axles\ virtual)}$), take from the vehicle with more than two axles (vrf) the measured unladen front axle load ($m_{fa\ (vrf)\ load\ unladen}$) and the measured unladen rear axle load of that driven rear axle ($m_{ra\ (vrf)\ load\ unladen}$) which has the highest unladen load.

If the vehicle (vrf) has more than one front axle, take the one with the highest unladen front axle load.

~~→ $m_{unladen\ (2\ axles\ virtual)} = m_{fa\ (vrf)\ load\ unladen} + m_{ra\ (vrf)\ load\ unladen}$~~

~~→ $m_{xload\ (2\ axles\ virtual)} = m_{target} - (m_d + m_{unladen\ (2\ axles\ virtual)})$~~

$m_{unladen\ (2\ axles\ virtual)} = m_{fa\ (vrf)\ load\ unladen} + m_{ra\ (vrf)\ load\ unladen}$

$m_{xload\ (2\ axles\ virtual)} = m_{target} - (m_d + m_{unladen\ (2\ axles\ virtual)})$

Due to the requirement that the sum of the extra loading ($m_{xload\ (2\ axles\ virtual)}$) and the unladen rear axle load, $m_{ra\ (vrf)\ load\ unladen}$, is limited to 75 per cent of the technically permissible maximum laden mass allowed for the rear axle, $m_{ac\ ra\ max\ (2\ axles\ virtual)}$, this value, $m_{ac\ ra\ max\ (2\ axles\ virtual)}$, has to be chosen in such a way that it represents the rear axle of the forecasted highest production-volume in the manufacturer's variation with a technically permissible maximum laden mass allowed for the rear axle ($m_{ac\ ra\ max\ (chosen)}$) for the vehicle family as declared by the manufacturer.

~~→ $m_{ac\ ra\ max\ (4x2\ virtual)} = m_{ac\ ra\ max\ (chosen)}$~~

$m_{ac\ ra\ max\ (4x2\ virtual)} = m_{ac\ ra\ max\ (chosen)}$

If $m_{xload\ (2\ axles\ virtual)} \leq 0.75\ m_{ac\ ra\ max\ (chosen)} - m_{ra\ (vrf)\ load\ unladen}$

then

$m_{t\ (2\ axles\ virtual)} = m_{xload\ (2\ axles\ virtual)} + m_d + m_{fa\ (vrf)\ load\ unladen} + m_{ra\ (vrf)\ load\ unladen}$

and

$m_{t\ (2\ axles\ virtual)} = m_{target}$

If $m_{xload\ (2\ axles\ virtual)} > 0.75\ m_{ac\ ra\ max\ (chosen)} - m_{ra\ (vrf)\ load\ unladen}$

then

$m_{t\ (2\ axles\ virtual)} = 0.75\ m_{ac\ ra\ max\ (chosen)} + m_d + m_{fa\ (vrf)\ load\ unladen}$

and

$m_{t\ (2\ axles\ virtual)} < m_{target}$

The test mass of the vehicle with more than two axles representing the vehicle family is defined as followed:

$m_{t\ (vrf)} = m_{t\ (2\ axles\ virtual)}$

and the extra loading is calculated as

$m_{xload\ (vrf)} = m_{t\ (2\ axles\ virtual)} - m_d - m_{unladen\ (vrf)}$"

Annex 3, Appendix 2, paragraph 3.3.4., amend to read:

"3.3.4. For each gear, run**,** and vehicle side**,** extract the power train component $L_{PT,wot,j}$ from the reported acceleration test $L_{wot,j}$, by calculation.

$$L_{PT,wot,j} = 10 \times \lg\left(10^{0.1 \times L_{wot,j}} - 10^{0.1 \times L_{TR,wot,j,\vartheta_{wot}}}\right)$$

In case that

$$10^{0.1 \times L_{TR,wot,j,\vartheta_{wot}}} \geq 0.99 \times 10^{0.1 \times L_{wot,j}}$$

the power train component $L_{PT,wot,j}$ is determined by

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

with $L_{TR,wot,j,\vartheta wot}$ redefined as

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

The redefined $L_{TR,wot,j,\vartheta wot}$ shall then be subjected to temperature correction in ~~3.2.3.~~ **paragraph 3.3.3.** to obtain the corresponding $L_{TR,wot,j,\vartheta ref.}$.

Calculate per gear the acceleration test result $L_{wot,j,\vartheta_{ref}}$

$$L_{wot,j,\vartheta_{ref}} = 10 \times \lg\left(10^{0.1 \times L_{PT,wot,j}} + 10^{0.1 \times L_{TR,wot,j,\vartheta_{ref}}}\right)$$"

Annex 7, paragraph 5.2., amend to read:

"5.2. The determination of gear α is as follows:

- α = 3 for manual transmission and for automatic transmission tested in locked position with up to 5 gears;
- α = 4 for manual transmission and for automatic transmission tested in locked position with 6 or more gears. If the acceleration calculated from AA to BB + vehicle length in gear 4 exceeds 1.9 m/s², the first higher gear α > 4 with an acceleration lower than or equal to 1.9 m/s² shall be chosen. If there is no gear with an acceleration less than or equal to 1.9 m/s² available, the highest available gear shall be chosen.

~~For vehicles tested under locked condition, the gear ratio for further calculation shall be determined from the acceleration test result in Annex 3.~~

For vehicles tested under non-locked condition, the gear ratio for further calculation shall be determined from the acceleration test result in Annex 3 using the reported engine speed and vehicle speed at line BB'. "

II. Justification

Paragraph 2.8., definition of maximum net power

1. UN Regulation No. 177 is based on UN GTR No. 21 and was adopted at the 195th session of the WP.29. It will be available for the determination of system power. It is proposed to replace the reference to UN GTR No. 21 by the reference to the same paragraph in UN Regulation No. 177 to avoid future possible divergence between those two texts.

Paragraph 11.17. and 11.18., transitional provisions for Supplements 10 and [11]

2. Supplement 10 introduced changes in the calculation of temperature and track corrections introduced in Supplement 7. Therefore, transitional provisions are needed, to avoid unnecessary measurements for type approval extensions.

3. Supplement [11] itself mainly adds the editorial amendments, however, because it is considered to include the content of previous Supplements up to Supplement 10 as well, transitional provisions are needed.

Annex 3, paragraph 1.2., calibration

4. Ambiguity did raise on the way of calibration, as the calibration is specified as a check of the system. It is proposed to describe the check procedure the way it is written in ISO 362-1.

5. Before a measurement session, a validation of the measuring system is always necessary, including an eventual adjustment to the reference values given by the calibrator. After a measurement session, a potential drift of the microphone calibration is re-checked. Here, without any further adjustment the system shall be within the 0,5 dB range, to validate the measurements which have been performed.

6. The procedure can be compared to the necessary tare function for scales, e.g. in supermarkets. Before the weight of goods is determined, customers expect that the scale is balanced to zero.

Annex 3, paragraph 2.2.2.3.4., editorial correction

7. It is proposed to remove the arrows "➔" and replace them by an indent. There is no change in the formulas.

Annex 3, Appendix 2, paragraph 3.3.4., editorial correction

8. The referenced paragraph is wrongly referring to formulas regarding constant speed tests (crs). The correct number is referring to the formulas regarding accelerated tests (WOT). It is obviously an editorial error, since section 3.3. is only dealing with accelerated tests.

Annex 7, paragraph 5.2., gear ratios for $ASEP_{Lref}$

9. This sentence has been wrongly introduced in the text of Supplement 10 (GRBP-79-33-Rev.1). It was not the object of the amendment to this paragraph. The previous amendment to this paragraph was in Supplement 5 (E/ECE/324/Rev.1/Add.50/Rev.3/Amend.5), where this sentence was not present.

10. It is obviously an editorial error, as this sentence does not make sense, since the choice of gear ratio for the measurement or calculation of L_{ref} in the case of locked gear ratios is already clearly addressed in the same paragraph. It is then proposed to remove this sentence.