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**Economic Commission for Europe**

Inland Transport Committee

**World Forum for Harmonization of Vehicle Regulations**

**Working Party on Noise and Tyres**

**Seventy-seventh session**

Geneva, 7–10 February 2023

Item 3 of the provisional agenda

**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 Informal Working Group on Measurement Uncertainties, the Informal Working Group on Additional Sound Emission Provisions and from the International Organization for Standardization[[1]](#footnote-2)\***

The text reproduced below includes editorial corrections and clarifications that has been prepared by the experts from the Informal Working Group on Measurement Uncertainties (IWG MU), the Informal Working on Additional Sound Emission Provisions (ASEP) and from the International Organization for Standardization (ISO). The proposed changes are based on the 03 series of amendment to UN Regulation No. 51 up to Supplement 7. The modifications are marked in bold for new or strikethrough for deleted characters.

**I. Proposal**

*Paragraph 2.24.,* amend to read:

"2.24. Table of symbols

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| … | … | … | … | … |
| Lcrs **(**i**)** | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | vehicle sound pressure level at constant speed test for gear i; value to be reported and used for calculations to the first decimal place |
| Lcrs (i + 1) | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | vehicle sound pressure level at constant speed test for gear (i + 1); value to be reported and used for calculations to the first decimal place |
| Lcrs rep | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | reported vehicle sound pressure level at constant speed test; value to be reported and used for calculations to the first decimal place |
| Lwot **(**i**)** | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | vehicle sound pressure level at wide-open-throttle test for gear i; value to be reported and used for calculations to the first decimal place |
| Lwot (i + 1) | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | vehicle sound pressure level at wide-open-throttle test for gear (i + 1); value to be reported and used for calculations to the first decimal place |
| Lwot rep | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | reported vehicle sound pressure level at wide-open-throttle; value to be reported and used for calculations to the first decimal place |
| Lurban | dB(A) | Annex 3 | 3.1.3.**4.**1.**2.** | reported vehicle sound pressure level representing urban operation; value to be reported mathematically rounded to the nearest integer |
| … | … | … | … | … |

"

*Annex 3,*

*Paragraph 3.1.2.1.3.,* amend to read:

"3.1.2.1.3. Partial power factor *kP*

 The partial power factor *kP* (see paragraph 3.1.3.**4.**1.**2.**) is used for the weighted combination of the test results of the acceleration test and the constant speed test for vehicles of category M1 and N1 and M2 < 3,500 kg technically permissible maximum laden mass

 In cases other than a single gear test, awot ref shall be used instead of awot test (see paragraph 3.1.3.**4.**1.**2.**)."

 *Annex 3, Appendix 1,*

 *Figure 4a,* amend to read:

"Figure 4a

**Flowchart for vehicles tested according to paragraph 3.1.2.1. of Annex 3 to this Regulation – Lurban computation**

Determine PMR for test vehicle 3.1.2.1.1.

Determine target acceleration aurban (3.1.2.1.2.3.) and reference acceleration awot ref (3.1.2.1.2.4.)

Select test method (3.1.2.1.4.)

locked gears (3.1.2.1.4.1.) See Figures 4b, 4c and 4d

non-locked gears (3.1.2.1.4.2.) See Figure 4e

Acceleration test (3.1.2.1.5.)

Constant speed test (3.1.2.1.6.)

Calculation of gear weighting factor k if 2-gear test (3.1.2.1.4.1.)

Calculate *L* wot rep and *L* crs rep (3.1.3.**4.**1.**2.**)

Calculate *kP* (3.1.3.**4.**1.**2.**)

Calculate *L*urban (3.1.3.**4.**1.**2.**)

"

*Figure 4b,* amend to read:

"Figure 4b

**Flowchart for vehicles tested according to paragraph 3.1.2.1. of Annex 3 to this Regulation -
Gear selection using locked gear PART 1**

Select Gear

Is acceleration stable according to 2.26.2.?

Calculate test acceleration according to 3.1.2.1.2.1.

Select Pre-acceleration and entry speed

Yess

No

Is acceleration within *awot\_ref* tolerance band?

Yess

No

Is acceleration less than or equal 2,0 m/s2? and engine speed less than *nMAX* prior to BB'?

Use gear and compute *k*P according to (3.1.3.**4.**1.**2.**)

Compute *Lwot\_rep*using results of valid runs

No

Select gears to obtain gear *i* with stable acceleration above

*awot\_ref* and gear *i*+1 with stable acceleration below *awot\_ref*

See Case 2 in Figure 4c

See Case 1 in Figure 4c

Yess

Testing locked gears according to 3.1.2.1.4.1.

"

*Figure 4c*, amend to read:

"Figure 4c

**Flowchart for vehicles tested according to paragraph 3.1.2.1. of Annex 3 to this Regulation –
Gear selection using locked gear PART 2**

Yess

No

Is acceleration of gear *i* less than or equal 2.0 m/s2? and engine speed less than *nMAX* prior to BB’?

Use both gears *i* and *i*+1, (*i*+2, *i*+3, or*…*) and compute *kP* according to 3.1.3.**4.**1.**2.** and *k* by 3.1.2.1.4.1.

Compute *Lwot\_rep*using results of valid runs

Case 1:

 Two gears, gear *i* with stable acceleration above *awot\_ref* and gear *i*+1 with stable acceleration below *awot\_ref*

Case 2:

 One gear with stable acceleration above 2.0 m/**s**2 or engine speed greater than *nMAX* prior to BB'

Determine first gear *i* + n (n=1, 2…) with stable acceleration less than or equal to 2.0 m/s2 and engine speed less than *nMAX* prior to BB'

Is acceleration of gear *i* +n more than *aurban*?

Yess

Use gear **i+n (n=1, 2, …)** and compute *kP* according to 3.1.3.**4.**1.**2.**

No

Use both gears *i* with acceleration higher than 2.0 m/s2 and *i*+1, (*i*+2, *i*+3, or*…*) with acceleration less than *aurban*

Is engine speed of gear *i* more than *nMAX* prior to BB’?

See Case 3 in Figure 4d

No

Yess

"

*Figure 4d*, amend to read:

"Figure 4d

**Flowchart for vehicles tested according to paragraph 3.1.2.1. of Annex 3 to this Regulation –
Gear selection using locked gear PART 3**

"

Yess

No

Yes

~~Determine first gear~~ *~~i~~* ~~+ n (n=1, 2, …) with stable acceleration less than or equal to 2.0 m/s² and engine speed less than~~ *~~S~~* ~~prior to BB’. Test with this gear at a speed,~~ *~~v~~~~test~~*~~, of 50 km/h~~

**Use gear i+n (n=1, 2, ...) with test speed 50km/h and compute *kP* according to 3.1.3.4.1.2.**

Reduce test speed *vtest* by 2.5 km/h with gear *i*

~~Test locked gears according to 3.1.2.1.4.1. with new test speed~~

**Use both gears i and i+n (n=1, 2, ...) with new test speed for gear i and 50km/h for gear i+n and compute *kP* according to 3.1.3.4.1.2.**

Is engine speed of gear *i* less than *nMAX* prior to BB’?

No

Case 3:

 No gear with acceleration more than *aurban* and engine speed less than *nMAX* prior to BB’

Is test speed *vtest* **=** 40 km/h?

*Figure 4e*, amend to read:

"Figure 4e

**Flowchart for vehicles tested according to paragraph 3.1.2.1. of Annex 3 to this Regulation Gear Selection using non-locked gears**

Yess

No

Compute *Lwot\_rep*using results of valid runs

Calculate test acceleration according to 3.1.2.1.2.2. Pre-acceleration is not allowed

Compute *kP*according to 3.1.3.**4.**1.**2.**

Can measures be taken to control downshifts?

Is acceleration stable? i.e. there is no delay.

Calculate test acceleration according to 3.1.2.1.2.2.

Select Pre-acceleration and entry speed

No

Yess

If possible, control downshift to obtain acceleration less than or equal to 2.0 m/s2 or *awot\_ref*, whichever is lower. If not possible, run higher than 2.0 m/s2 is valid.

Testing unlocked gears according to 3.1.2.1.4.2.

Select entry speed

No

See flowchart 4f.

engine speed greater than *nMAX* prior to BB'

Yes

**"**

*Figure 4f*, amend to read:

“Figure 4f

**Flowchart for vehicles tested according to paragraph 3.1.2.1.4.2. of Annex 3 to this Regulation – Gear Selection using non-locked gears**

**Possibility 2**

Test according to 3.1.2.1.4.2. with specified engine load

**Possibility 1**

Yess

No

Yes

Not valid test condition.

Reduce test speed *vtest* by 2.5 km/h

Test according to 3.1.2.1.4.2. with new test speed

Is engine speed less than *nMAX* prior to BB’?

No

Engine speed exceed *nMAX* prior to BB’

Is test speed *vtest* **=** 40 km/h?

Reduce engine load (by using partial load) such that *nBB’* is between 95 % *nMAX* and *nMAX*

Yess

**"**

*Appendix 2, paragraph 2.,* amend to read:

"2. General (see the flowcharts in this Appendix 2, Figure 7a to Figure ~~7d~~ **7c**)

This Appendix provides correction for temperature and test track dependent on the tyre category and purpose.

For the correction, tyre rolling sound reference values are needed. Tyre rolling sound measurements shall be carried out according to the test procedure of Appendix 3 to Annex 3 of this regulation."

*Annex 9, Appendix 4,*

*Formula 3.2.4.4.2. No.2,* amend to read:

"

*Formula 3.4. No.2,* amend to read:

~~"~~

"

 **II. Justification**

*Paragraph 2.24.*

1. The content of paragraph 3.1.3.1. was moved to paragraph 3.1.3.4.1.2. without any change when the measurement uncertainties and the real driving additional sound emission provisions (RD-ASEP) were introduced in Supplement 7. In the table of symbols, the references to this paragraph 3.1.3.1. need to be renumbered to 3.1.3.4.1.2., accordingly.

*Annex 3, paragraph 3.1.2.1.3.*

2. The content of paragraph 3.1.3.1. was moved to paragraph 3.1.3.4.1.2. without any change when RD-ASEP was introduced in Supplement 7. In paragraph 3.1.2.1.3., the reference to this paragraph 3.1.3.1. needs to be renumbered to 3.1.3.4.1.2., accordingly.

*Annex 3, Appendix 1, Figures 4a to 4f*

3. The content of paragraph 3.1.3.1. was moved to paragraph 3.1.3.4.1.2. without any change when RD-ASEP was introduced in Supplement 7. In the figures, references to this paragraph 3.1.3.1. need to be renumbered to 3.1.3.4.1.2., accordingly.

*Additional clarifications*

4. In Figure 4c, from the current wording in Annex 3, paragraph 3.1.2.1.4.1.(c), the addition of “i+n (n=1, 2, …)” in the box “Use gear and compute *kP* according to 3.1.3.4.1.2.” was made for better understanding and clarification.

5. In Figure 4d, to avoid misinterpretation, the following modifications were made from the current wording in Annex 3, paragraph 3.1.2.1.4.1.(d) for clarification and better understanding:

* + - * Adding “=” in the box “Is test speed vtest 40km/h”.
			* Replacing “*Determine first gear i + n (n=1, 2, …) with stable acceleration less than or equal to 2.0 m/s² and engine speed less than S prior to BB’. Test with this gear at a speed, vtest, of 50 km/h*” by “*Use gear i+n (n=1, 2, ...) with test speed 50km/h and compute kP according to 3.1.3.4.1.2*”.
			* Replacing “*Test locked gears according to 3.1.2.1.4.1. with new test speed*” by “*Use both gears i and i+n (n=1, 2, ...) with new test speed for gear i and 50km/h for gear i+n and compute kP according to 3.1.3.4.1*.2.”

6. In Figure 4f, from the current wording in Annex 3, paragraph 3.1.2.1.4.2., the addition of “=” in the box “Is test speed vtest 40km/h” was made for better understanding and clarification.

*Annex 3, Appendix 2, paragraph 2*

7. The reference numbers for the figures have to be corrected: ‘Figure 7a to Figure 7c’ instead of ‘Figure 7a to Figure 7d’.

*Annex 9, Appendix 4, formula 3.2.4.4.2. No.2*

8. Because of the wrong copy/paste of the formula, it has to be adjusted to the existing wording in Annex 9, Appendix 1 as approved through the adoption of Supplement 7.

*Annex 9, Appendix 4, Formula 3.4. No.2*

9. The subscript characters have to be corrected and put at the ‘right’ level, i.e. all at the same level.

1. \* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2023 (A/77/6 (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. [↑](#footnote-ref-2)