Proposal for Supplement 3 to the 07 series of amendments to Regulation No. 83 (Emissions of M\textsubscript{1} and N\textsubscript{1} vehicles)

Submitted by the Working Party on Pollution and Energy*

The text reproduced below was adopted by the Working Party on Pollution and Energy (GRPE) at its seventy-second session (ECE/TRANS/WP.29/GRPE/72, paras. 12 and 13). It is based on ECE/TRANS/WP.29/GRPE/2016/4 as amended by para. 12 of the report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee AC.1 for consideration at their June 2016 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.
Supplement 3 to the 07 series of amendments to Regulation No. 83 (Emissions of M₁ and N₁ vehicles)

Annex 4a – Appendix 7,

Paragraphs 5.1.1.1. to 5.1.1.2.7., amend to read:

"5.1.1.1. Test equipment and error

Time shall be measured to an error lower than ±0.1 s.

Speed shall be measured to an error lower than ±2 per cent.

During the test, elapsed time and vehicle speed shall be measured and recorded at a minimum frequency of 1 Hz.

5.1.1.2. Test procedure

5.1.1.2.1. Accelerate the vehicle to a speed 10 km/h higher than the chosen test speed v.

5.1.1.2.2. Place the gearbox in "neutral" position.

5.1.1.2.3. For each reference speed point vᵢ, measure the time taken (ΔTᵢ) for the vehicle to decelerate from speed v₂ = vᵢ + Δv km/h to v₁ = vᵢ - Δv km/h

where:

Δv is equal to 5 km/h

vᵢ is each of the reference speed [km/h] points as indicated in the following table:

| 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |

5.1.1.2.4. Perform the same test in the opposite direction: ΔTᵢᵢ

5.1.1.2.5. These measurements shall be carried out in opposite directions until, for each reference speed vᵢ, a minimum of three consecutive pairs of measurements have been obtained which satisfy the statistical accuracy pᵢ, in per cent, as defined below.

\[ pᵢ = \frac{vᵢ}{\sqrt{n} \cdot \Delta Tᵢ} \leq 3 \text{ per cent} \]

where:

pᵢ is the statistical accuracy of the measurements performed at reference speed vᵢ;

n is the number of pairs of measurements;

ΔTᵢ is the mean coast down time at reference speed vᵢ in seconds, given by the equation:

\[ ΔTᵢ = \frac{1}{n} \sum_{i=1}^{n} ΔTᵢᵢ \]

where ΔTᵢᵢ is the harmonic mean coast down time of the iᵗʰ pair of measurements at velocity vᵢ, seconds [s], given by the equation:
\[ \Delta T_{ji} = \left( \frac{1}{\Delta T_{aji}} \right)^2 \left( \frac{1}{\Delta T_{bji}} \right)^2 \]

where \( \Delta T_{aji} \) and \( \Delta T_{bji} \) are the coast down times of the \( i \)th measurement at reference speed \( v_j \), in seconds [s], in opposite directions a and b, respectively;

\( s_j \) is the standard deviation, in seconds [s], defined by:

\[ s_j = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (\Delta T_{ji} - \Delta T_j)^2} \]

\( t \) is a coefficient given in the following table:

<table>
<thead>
<tr>
<th>Coefficient t as function of n</th>
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<tr>
<td>( n )</td>
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<tr>
<td>-----</td>
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<td>3</td>
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<td>9</td>
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5.1.1.2.6. If during a measurement in one direction any external factor or driver action occurs which influences the road load test, that measurement and the corresponding measurement in the opposite direction shall be rejected.

5.1.1.2.7. The total resistances, \( F_{aj} \) and \( F_{bj} \), at reference speed \( v_j \) in directions a and b, are determined by the equations:

\[ F_{aj} = \frac{1}{3.6} \cdot M \cdot \frac{2 \cdot \Delta v}{\Delta T_{aj}} \]

and

\[ F_{bj} = \frac{1}{3.6} \cdot M \cdot \frac{2 \cdot \Delta v}{\Delta T_{bj}} \]

where:

\( F_{aj} \) is the total resistance at reference speed, \( j \), in direction a, [N];

\( F_{bj} \) is the total resistance at reference speed, \( j \), in direction b, [N];

\( M \) is the reference mass, [kg];

\( \Delta v \) is the delta speed around \( v_j \), taken according to 5.1.1.2.3.

\( \Delta T_{aj} \) and \( \Delta T_{bj} \) are the mean coast down times in directions a and b, respectively, corresponding to reference speed \( v_j \), in seconds [s], given by the following equations:

\[ \Delta T_{aj} = \frac{1}{n} \sum_{i=1}^{n} \Delta T_{aji} \]

and

\[ \Delta T_{bj} = \frac{1}{n} \sum_{i=1}^{n} \Delta T_{bji} \]
5.1.1.2.8. The following equation shall be used to compute the average total resistance:

\[ F_j = \frac{(F_{aj} + F_{bj})}{2} \]

5.1.1.2.9. For each reference speed \( v_j \) calculate the power \( P_j \), [kW], by the formula:

\[ P_j = \frac{(F_j \cdot v_j)}{1,000} \]

where:

- \( F_j \) is the average resistance at reference speed, \( j \), [N];
- \( v_j \) is the reference speed, \( j \), [m/s], defined in 5.1.1.2.3.

5.1.1.2.10. The complete power curve \( P \), [kW], as a function of speed, [km/h], shall be calculated with a least squares regression analysis."

**Paragraph 5.1.1.2.8. (former),** renumber as paragraph 5.1.1.2.11.

Paragaph 5.1.2.2.5. to 5.1.2.2.7., amend to read:

"5.1.2.2.5. Carry out the operations specified in paragraph 5.1.1.2. of this appendix (with the exception of paragraph 5.1.1.2.4. of this appendix), replacing \( M \) by \( I \) in the formula set out in paragraph 5.1.1.2.7. of this appendix.

5.1.2.2.6. Adjust the brake to reproduce the corrected power (paragraph 5.1.1.2.11. of this appendix) and to take into account the difference between the vehicle mass \( (M) \) on the track and the equivalent inertia test mass \( (I) \) to be used. This may be done by calculating the mean corrected road coast down time from \( V_2 \) to \( V_1 \) and reproducing the same time on the dynamometer by the following relationship:

\[ T_{corrected} = \frac{T_{measured} \cdot I}{K \cdot M} \]

\( K \) = value specified in paragraph 5.1.1.2.11. above.

5.1.2.2.7. The power \( P_a \) to be absorbed by the dynamometer shall be determined in order to enable the same power (paragraph 5.1.1.2.11. of this appendix) to be reproduced for the same vehicle on different days."

**Paragraph 5.2.1.2.7.,** amend to read:

"5.2.1.2.7. The average torque \( C_T \) determined on the track shall be corrected to the reference ambient conditions as follows:

\[ C_{Tcorrected} = K \cdot C_{Tmeasured} \]

Where \( K \) has the value specified in paragraph 5.1.1.2.11. of this appendix."