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Item 4.7.3 of the provisional agenda

1958 Agreement:

Consideration of draft amendments to existing

UN Regulations submitted by GRPE

Proposal for Supplement 9 to the 01 series of amendments to UN Regulation No. 101 (CO₂ emission/fuel consumption)

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 eightieth session (ECE/TRANS/WP.29/GRPE/80) and is based on ECE/TRANS/WP.29/GRPE/2020/6 as amended by Annex VIII of the session report. It is a proposal for Supplement 9 to the 01 series of amendments to UN Regulation No. 101 (CO₂ emission/fuel consumption). It allows for WLTP road load determination as an alternative to the procedure used for NEDC test protocol. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and Administrative Committee 1 (A.C.1) for consideration at its June 2020 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), 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.

*Annex 6**Paragraph 1.1., amend to read:*

- "1.1. Emissions of carbon dioxide (CO₂) and fuel consumption of vehicles powered by an internal combustion engine only shall be determined according to the procedure for the Type I test as defined in Annex 4a to UN Regulation No. 83 according to the series of amendments to which the vehicle is approved or in the case that the vehicle is not approved according to UN Regulation No. 83, the series of amendments in force at the time of the approval of the vehicle.

In case vehicle's emissions are approved according to WLTP procedures as defined in UN GTR No. 15, the methodology for Road Load determination and dyno setting, defined in Annex 7 - Appendix 2 may be used instead of the methodology of Annex 4a – Appendix 7 to UN Regulation No.83."

*Annex 7**Appendix, amend to read:***"Annex 7 - Appendix 1****Determination of the total road load power of a vehicle powered by an electric power train only, and calibration of the dynamometer"***Insert a new Annex 7 - Appendix 2, to read:***"Annex 7 - Appendix 2****Alternative procedure for determination of the total road load power of a vehicle**

1. Introduction

The purpose of this appendix is to provide the road load power calculation method that may be used, at the choice of manufacturer, when vehicle's emissions are approved using UN GTR No. 15 procedure
2. Method
 - 2.1. WLTP Road Load calculation of the vehicle

The WLTP Road Load of the vehicle shall be determined according to UN GTR No. 15 Annex 4 or in case the vehicle is part of an interpolation family, according to Annex 7 point 3.2.3.2.2. "Road Load calculation for an individual vehicle" considering as input parameters of the individual vehicle:

 - (a) The Test Mass of the vehicle ¹, fitted with its standard equipment ¹
 - (b) The RRC value of the applicable tyre energy class according to Table A4/2 of UN GTR No. 15 Annex 4 or, if the tyres on the front and rear axles belong to different energy efficiency classes, the weighted mean using the equation in paragraph 3.2.3.2.2.3. of UN GTR No. 15 Annex 4.
 - (c) The aerodynamic drag of the vehicle fitted with its standard equipment¹
 - 2.2. Calculation of the applicable (NEDC) road load of the vehicle

¹ As defined in UN GTR No. 15

2.2.1. Effect of different tyre pressure prescriptions

The tyre pressure to be taken into account for the purpose of calculating the NEDC road load shall be the average between the two axles of the average between the minimum and maximum tyre pressure permitted for the selected tyres on each axle for the NEDC reference mass of the vehicle. The calculation shall be carried out with the following formula:

$$P_{avg} = \left(\frac{P_{max} + P_{min}}{2} \right)$$

Where,

P_{max} , is the average of the maximum tyre pressures of the selected tyres for the two axles;

P_{min} , is the average of the minimum tyre pressures of the selected tyres for the two axles.

The corresponding effect in terms of resistance applied to the vehicle shall be calculated using the following formula:

$$TP = \left(\frac{P_{avg}}{P_{min}} \right)^{-0.4}$$

2.2.2. Effect of tyre tread depth

The effect in terms of the resistance applied to the vehicle shall be determined in accordance with the following formula:

$$TTD = \left(2 \cdot \frac{0.1 \cdot RM_n \cdot 9.81}{1000} \right)$$

Where, RM_n is the reference mass of the vehicle according to this Regulation

2.2.3. Effect of different consideration of rotating parts

During the WLTP coastdown setting, coastdown times are to be transferred to forces and vice versa by taking into account the applicable test mass plus the effect of rotational mass (3 % of the sum of the MRO and 25 kg). For the NEDC coastdown setting, coastdown times are to be transferred to forces and vice versa by neglecting the effect of rotational mass.

2.2.4. Determination of the NEDC road load coefficients

(a) The road load coefficient $F_{0,n}$ expressed in Newton (N) for vehicle shall be determined as follows:

(i) Effect of different inertia:

$$F_{0n}^1 = F_{0w} \cdot \left(\frac{RM_n}{TM_w} \right)$$

Where:

RM_n is the Reference Mass of the vehicle according to this Regulation

F_{0w} is the road load coefficient F_0 determined for the WLTP test of the vehicle;

TM_w is the WLTP test mass of the vehicle fitted with its standard equipment.

(ii) Effect of different tyre pressure:

$$F_{0n}^2 = F_{0n}^1 \cdot TP$$

Where the factors TP in the formula are as defined in point 2.2.1.

(iii) Effect of the inertia of rotating parts:

$$F_{0n}^3 = F_{0n}^2 \cdot \left(\frac{1}{1.03} \right)$$

(iv) Effect of different tyre tread depth:

$$F_{0n} = F_{0n}^3 \cdot TTD$$

Where the factors *TTD* in the formula are as defined in point 2.2.2

- (b) The road load coefficient F_{1n} for the vehicle shall be determined as follows:

$$F_{1n} = F_{1w} \cdot \left(\frac{1}{1.03} \right)$$

- (c) The road load coefficient F_{2n} for the vehicle shall be determined as follows:

$$F_{2n} = F_{2w} \cdot \left(\frac{1}{1.03} \right)$$

Where the factor F_{2w} is the WLTP road load coefficient F_2 determined of the vehicle fitted with its standard equipment."
