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World Forum for Harmonization of Vehicle Regulations**Working Party on Pollution and Energy****Seventy-seventh session**

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Item 5 of the provisional agenda

UN Regulations Nos. 24 (Visible pollutants, measurement of power of C.I. engines (Diesel smoke)), 85 (Measurement of the net power), 115 (LPG and CNG retrofit systems), 133 (Recyclability of motor vehicles) and 143 (Heavy Duty Dual-Fuel Engine Retrofit Systems (HDDF-ERS))**Proposal for amendments to UN Regulation No. 24 (Visible pollutants, measurement of power of Compression Ignition engine (Diesel smoke))****Submitted by the expert from the International Organization of Motor Vehicle Manufacturers***

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) to further align the provisions of the 03 series of amendments to UN Regulation No. 24 with UN Regulation No. 85. Other amendments are proposed in order to bring the format of UN Regulation No. 24 up to date. The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21 and Add.1, Cluster 3), 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.

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I. Proposal

Paragraph 2.2., amend to read:

"2.2. "Net power" means the power of a C.I. engine as defined in annex 10 to this Regulation **or in paragraph 2.3 of UN Regulation No. 85**; "

Paragraph 2.7.1., amend to read:

"2.7.1. either the highest of the following three engine speeds:

- (a) 45 per cent of maximum net power speed,
- (b) 1000 rpm,
- (c) minimum speed permitted by the idling control,"

Paragraph 2.8.2., amend to read:

"2.8.2. "Hybrid electric vehicle (HEV)" means a vehicle that, for the purpose of mechanical propulsion, draws energy from both of the following on-vehicle sources of stored energy/power:

- (a) a consumable fuel
- (b) an electrical energy/power storage device (e.g.: battery, capacitor, flywheel/generator ...)"

Paragraph 4.1.5., amend to read:

"4.1.5. When determining the emission of visible pollutants the power and fuel consumption of the same engine submitted for approval shall be measured according to annex 10 to this Regulation **or annex 5 to UN Regulation No. 85**."

Paragraph 4.2.1.2., amend to read:

"4.2.1.2. An engine corresponding in all aspects to the description report in that annex 1 shall be submitted to the technical service for tests described in annex 10 to this Regulation **or annex 5 to UN Regulation No. 85**. Such tests shall only be carried out on the test bench,"

Paragraph 7.3., amend to read:

"7.3. Irrespective of these classifications in paragraph 7.2. a new approval, with tests, i.e. Classification (1), will automatically be required unless the engine also respects the following conditions:

- (a) Maximum rated speed not greater than 100 per cent nor less than 75 per cent of that of the engine in the approval test,
- (b) Minimum rated speed not less than that of the engine in the approval test,
- (c) Torque rating not greater than 100 per cent, nor less than 70 per cent of that of the engine at that speed in the approval test,

- (d) Steady state absorption values are not greater than 1.1 times the values obtained in the approval test and do not exceed the prescribed limits in annex 7,
- (e) Exhaust back pressure not greater than that of the engine in the type approval test,
- (f) Exhaust system volume does not differ by more than 40 per cent,
- (g) Intake depression not greater than that of the engine in the type approval test,
- (h) Moment of inertia of a new combined flywheel and transmission is within 15 per cent of the engine flywheel and transmission system approved.

Note: In all cases the engine in the approval test means "an engine representative of the type to be approved" as defined in paragraph 3. 3."

Paragraph 15.3.1., amend to read:

- "15.3.1. The installation of the engine shall respect in particular the following limitations with respect to the type approval of the engine:
- (a) Intake depression shall not exceed that of the type approved engine
 - (b) Exhaust back pressure shall not exceed that of the type approved engine
 - (c) Exhaust system volume is within ± 40 per cent of the type approved engine
 - (d) Moment of inertia of the combined flywheel and transmission is within ± 15 per cent of the type approved engine."

Annex 1, Paragraph 8.5.1., amend to read:

"8.5.1. Test on bench

Declared powers at the points of measurement referred to in annex 4, paragraph 2.2. shall be stated in table 1.

Table 1

Declared speeds and powers of the engine/vehicle² submitted for approval (Speeds to be agreed with the test authority)

Measurement points ⁵	Engine speed: n [rpm]	Power: P* [kW]
...
...
...
...
...

Annex 2, Paragraph 11.1.1., amend to read:

"11.1.1. Tests at steady speeds: Vehicle on roller dynamometer/engine on test bench²

Measurement points	Engine speed n [rpm]	Power P [kW]	Nominal flow G [litres/sec]	Measured absorption values [m ⁻¹]
1				
2				
3				
4				
5				
6				

⁵ See annex 5, paragraph 2.2.

* Net power according to annex 10 to this Regulation or annex 5 to UN Regulation No. 85."

Paragraph 11.1.2.1., amend to read:

"11.1.2.1. Engine test in accordance with annex 5 ³

Percentage of maximum [rpm] ⁴	Percentage of maximum torque at rpm stated [m ⁻¹]	Measured absorption value [m ⁻¹]	Corrected absorption value [m ⁻¹]
100	100		
90	100		
100	90		
90	90		
100	80		
90	80		

Annex 4, add new paragraph 3.1.6., to read:

"3.1.6. Alternatively and regardless of the requirements set out in paragraphs 3.1.4. and 3.1.5., at the request of manufacturer, the power of the engine can be measured in accordance with annex 5 to UN Regulation No. 85."

Renumber paragraphs 3.1.6., to 3.1.7. and 3.1.7. to 3.1.8., to read:

3.1.67. The exhaust device shall not have any orifice through which the gases emitted by the engine might be diluted. In cases where an engine has several exhaust outlets, these shall be connected to a single outlet in which the opacity measurement shall be made.

3.1.78. The engine shall be in the normal working condition prescribed by the manufacturer. In particular, the cooling water and the oil shall each be at the normal temperature prescribed by the manufacturer."

Add new paragraph 3.3.3., to read:

"3.3.3. Alternatively and regardless of the requirements set out in paragraphs 3.3.1. and 3.3.2., at the request of manufacturer, the provisions of annex 5 to UN Regulation No. 85 can be used."

Amend paragraph 4.1., to read:

⁴ The lower limit may be that stated by the manufacturer in accordance with this Regulation, part I, paragraph 6.3.4.

"4.1. For each of the engine speeds at which the absorption coefficient is measured pursuant to paragraph 2.2. above, the nominal gas flow shall be calculated by means of the following formulae:

(a) for two-stroke engines $G = V.n/60$

(b) for four-stroke engines $G = V.n/120$

in which:

G = nominal gas flow, in litres per second (l/s)

V = cylinder capacity of the engine, in litres (l)

n = engine speed, in revolutions per minute (min^{-1})"

Annex 7, amend to read:

"Annex 7

Limit values applicable for the test at steady speeds

Nominal flow G [litres/second]	Absorption coefficient k [m^{-1}] [m^{-2}]
42	2.26
45	2.19
50	2.08
55	1.985
60	1.90
65	1.84
70	1.775
75	1.72
80	1.665
85	1.62
90	1.575
95	1.535
100	1.495
105	1.465
110	1.425
115	1.395
120	1.37

125	1.345
130	1.32
135	1.30
140	1.27
145	1.25
150	1.225
155	1.205
160	1.19
165	1.17
170	1.155
175	1.14
180	1.125
185	1.11
190	1.095
195	1.08
200	1.065

Note: Although the above values are rounded to the nearest 0.01 or 0.005, this does not mean that the measurements need to be made to this degree of accuracy."

Annex 10, paragraph 5.1.2., amend the text to read (the table remains unamended):

"5.1.2. Auxiliaries to be removed

Certain vehicle accessories necessary only for the operation of the vehicle and which may be mounted on the engine shall be removed for the test. The following non-exhaustive list is given as a sample.

- (a) Air compressor for brakes;
- (b) Power steering compressor;
- (c) Suspension compressor;
- (d) Air-conditioning system.

Where accessories cannot be removed, the power they absorb in the unloaded condition may be determined and added to the measured engine power.

....."

II. Justification

1. The test to establish the engine power curve, which is necessary for the diesel smoke test should be identical between UN Regulations No. 24 and No. 85. In order to reduce the burden of always reproducing updates to UN Regulations No. 85 in UN Regulations No. 24, it is proposed to insert references to UN Regulations No. 85 as an alternative. This ensures that any existing approvals which were conducted respecting the differences in text are not threatened.
2. It is recommended that a paragraph with sub points (bullets) is labelled (a), (b) etc. Several paragraphs are updated to reflect this.
3. It is recommended that units are shown in square brackets, several tables are updated to reflect this.

III. Appendix

Consolidated version of UN Regulation No. 24 available as informal document during the 78th session of GRPE.
