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1958 Agreement – Consideration of draft amendments to existing Regulations submitted by GRPE

Proposal for Supplement 4 to the 01 series of amendments to Regulation No. 101 (CO_2 emissions/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 sixty-eighth session (ECE/TRANS/WP.29/GRPE/68, para. 27). It is based on ECE/TRANS/WP.29/GRPE/2014/5, not amended. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee AC.1 for consideration.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), 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.

Paragraphs 5.1.3., amend Table A to read:

"5.1.3. Table A illustrates the application of the test requirements for type approval of a vehicle.

Table A

Application of the test requirements: CO_2 emissions, fuel consumption, electric energy consumption and electric range

Vehicles with positive ignition engines including hybrids			*Test?*
Mono fuel	Petrol (E5/E10)[3]		Yes
	LPG		Yes
	NG/Biomethane		Yes
	Hydrogen		Yes
Bi-fuel[1]	Petrol (E5/E10)[3]	LPG	Yes (both fuels)
	Petrol (E5/E10)[3]	NG/Biomethane	Yes (both fuels)
	Petrol (E5/E10)[3]	Hydrogen	Yes (both fuels)
Flex-fuel[1]	Petrol (E5/E10)[3]	Ethanol (E85)	Yes (both fuels)
	NG/Biomethane	H2NG	Yes (both fuels)
Vehicles with compression ignition engines including hybrids			*Test?*
Flex fuel	Diesel (B5/B7)[3]	Biodiesel	Yes (B5/B7 only)[2,3]
Mono fuel	Diesel (B5/B7)[3]		Yes
Other vehicles			*Test?*
Pure electric vehicles			Yes
Hydrogen Fuel cell vehicles			Yes

Notes:

[1] When a bi-fuel vehicle is combined with a flex fuel vehicle, both test requirements are applicable.

[2] This provision is temporary, further requirements for biodiesel shall be proposed later on.

[3] Upon the choice of the manufacturer vehicles with positive and compression ignition engines may be tested with either E5 or E10 and either B5 or B7 fuels, respectively. However:

- not later than sixteen months after the dates set out in point 12.2.1 of Regulation No. 83, new type approvals shall only be performed with E10 and B7 fuels;
- not later than as from dates set out in point 12.2.4 of Regulation No. 83, all new vehicles shall be approved with E10 and B7 fuels.

"

Paragraphs 5.2.3. and 5.2.4., amend to read (leaving footnote 3 unchanged):

"5.2.3. Fuel consumption values must be expressed in litres per 100 km (in the case of petrol (E5/E10), LPG, ethanol (E85) and diesel (B5/B7)), in m^3 per 100 km (in the case of NG/biomethane and H2NG) or in kg per 100 km (in the case of hydrogen) and are calculated according to paragraph 1.4.3. of Annex 6. The results will be rounded to the first decimal place.

5.2.4. For the purpose of the calculation mentioned in paragraph 5.2.3., the fuel consumption shall be expressed in appropriate units and the following fuel characteristics shall be used:

(a) Density: measured on the test fuel according to ISO 3675 or an equivalent method. For petrol (E5/E10), diesel (B5/B7), biodiesel and ethanol (E85 and E75) the density measured at 15 ºC will be used; for LPG and natural gas/biomethane a reference density will be used, as follows:

0.538 kg/litre for LPG

0.654 kg/m^3 for NG [3];

(b) Hydrogen-carbon ratio: fixed values will be used which are:

$C_1H_{1.89}O_{0.016}$ for petrol (E5);

$C_1H_{1.93}O_{0.033}$ for petrol (E10);

$C_1H_{1.86}O_{0.005}$ for diesel (B5);

$C_1H_{1.86}O_{0.007}$ for diesel (B7);

$C_1H_{2.525}$ for LPG (liquefied petroleum gas);

CH_4 for NG (natural gas) and biomethane;

$C_1H_{2.74}O_{0.385}$ for ethanol (E85);

$C_1H_{2.61}O_{0.329}$ for ethanol (E75)."

Annex 6, paragraphs 1.4.2. and 1.4.3., amend to read:

"1.4.2. The fuel consumption values shall be calculated from the emissions of hydrocarbons, carbon monoxide, and carbon dioxide determined from the measurement results using the provisions defined in paragraph 6.6. of Annex 4a to Regulation No. 83 in force at the time of the approval of the vehicle.

1.4.3. The fuel consumption, expressed in litres per 100 km (in the case of petrol (E5/E10), LPG, ethanol (E85) and diesel (B5/B7)), in m^3 per 100 km (in the case of NG/biomethane and H2NG) or in kg per 100 km (in the case of hydrogen) is calculated by means of the following formulae:

(a) For vehicles with a positive ignition engine fuelled with petrol (E5):$FC = (0.118/D) \cdot [(0.848 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO_2)]$;

(b) For vehicles with a positive ignition engine fuelled with petrol (E10):

$FC = (0,120/D) \cdot [(0,830 \cdot HC) + (0,429 \cdot CO) + (0,273 \cdot CO2)]$;

(c) For vehicles with a positive ignition engine fuelled with LPG:

…

(d) For vehicles with a positive ignition engine fuelled with NG/biomethane:

$FC_{norm} = (0.1336 / 0.654) \cdot [(0.749 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO_2)]$;

(e) For vehicles with a compression ignition engine fuelled with diesel (B5):

$FC = (0.116/D) \cdot [(0.861 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO_2)]$;

(f) For vehicles with a compression ignition engine fuelled with diesel (B7):

$FC = (0,116/D) \cdot [(0,859 \cdot HC) + (0,429 \cdot CO) + (0,273 \cdot CO2)]$

(g) For vehicles with a positive ignition engine fuelled with ethanol (E85):

$FC = (0.1742/D) \cdot [(0.574 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO_2)]$.

(h) For vehicles with a positive ignition engine fuelled by H2NG:

$$FC = \left(\frac{910.4 \cdot A + 13600}{44.655 \cdot A^2 + 667.08 \cdot A}\right) \cdot \left(\left(\frac{7.848 \cdot A}{9.104 \cdot A + 136}\right) \cdot HC + 0.429 \cdot CO + 0.273 \cdot CO_2\right)$$

(i) For vehicles fuelled by gaseous hydrogen:

$$FC = 0.024 \frac{V}{d}\left[\frac{1}{Z_1}\frac{p_1}{T_1} - \frac{1}{Z_2}\frac{p_2}{T_2}\right]$$

Under previous agreement with the type-approval authority, and for vehicles fuelled either by gaseous or liquid hydrogen, the manufacturer may choose as alternative to the method above, either the formula

$FC = 0.1 \cdot (0.1119 \cdot H_2O + H_2)$

for vehicles powered by internal combustion engine only, or a method according to standard protocols such as SAE J2572 or ISO 23828.

In these formulae:

FC = the fuel consumption in litre per 100 km (in the case of petrol (E5/E10), ethanol, LPG, diesel (B5/B7) or biodiesel) in m^3 per 100 km (in the case of natural gas and H2NG) or in kg per 100 km in the case of hydrogen.

HC = the measured emission of hydrocarbons in g/km

…"