United Nations ECE/TRANS/WP.29/GRPE/2015/6

Economic and Social Council

Distr.: General
4 November 2014

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on Pollution and Energy

Seventieth session
Geneva, 13- 16 January 2015
Item 3(a) of the provisional agenda
Light vehicles – Regulations Nos. 68 (Measurement of maximum speed, including electric vehicles), 83 (Emissions of M_1 and N_1 vehicles), 101 (CO_2 emission/fuel consumption) and 103 (Replacement pollution control devices)

Proposal for a Supplement to the 06 series of amendments to Regulation No. 83 (Emissions of M_1 and N_1 vehicles)

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) in order to update the reference fuels, in order to reflect those introduced in the 07 series of amendments of the same Regulation. The modifications to the original English text are marked using bold text for additions and amendments and strikethrough for deletions.

* 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.

I. Proposal

Paragraph 2.4, amend to read:

"2.4. "*Gaseous pollutants*" means the exhaust gas emissions of carbon monoxide, oxides of nitrogen expressed in nitrogen dioxide (NO_2) equivalent and hydrocarbons assuming ratio of:

(a) $C_1H_{2.525}$ for liquefied petroleum gas (LPG)
(b) C_1H_4 for natural gas (NG) and biomethane
(c) $C_1H_{1.89}O_{0.016}$ for petrol (E5)
(d) $C_1H_{1.93}O_{0.033}$ for petrol (E10)
(e) $C_1H_{1.86}O_{0.005}$ for diesel (B5)
(f) $C_1H_{1.86}O_{0.007}$ for diesel (B7)
(g) $C_1H_{2.74}O_{0.385}$ for ethanol (E85)
(h) $C_1H_{2,61}O_{0,329}$ for ethanol (E75)."

Paragraph 5.2.3., Table A, amend to read:

"Table A. Requirements

Application of test requirements for type approval and extensions

	Vehicles with positive ignition engines including hybrids								*Vehicles with C.I. engines including hybrids*	
	Mono fuel				*Bi-fuel*[1]			*Flex-fuel*[1]	*Flex fuel*	*Mono fuel*
Reference fuel	Petrol (E5/**E10**)[4]	LPG	NG/ Bio-methane	Hydrogen	Petrol (E5/**E10**)[4] LPG	Petrol (E5/**E10**)[4] NG/ Biome-thane	Petrol (E5/**E10**)[4] Hydrogen	Petrol (E5/**E10**)[4] Ethanol (E85)	Diesel (B5/**B7**)[4] Biodiesel	Diesel (B5/**B7**)[4]
Gaseous pollutants (Type 1 test)	Yes	Yes	Yes		Yes (both fuels)	Yes (both fuels)	Yes (petrol only)[2]	Yes (both fuels)	Yes (B5/**B7** only)[2,4]	Yes
Particulate mass (Type I test)	Yes (direct injection only)	—	—		Yes (direct injection only) (petrol only)	Yes (direct injection only) (petrol only)	Yes (direct injection only) (petrol only)[2]	Yes (direct injection only) (both fuels)	Yes (B5/**B7** only)[2,4]	Yes
Particle number (Type 1 test)					—	—	—	—	Yes (B5/**B7** only)[2,4]	Yes
Idle emissions (Type II test)	Yes	Yes	Yes		Yes (both fuels)	Yes (both fuels)	Yes (petrol only)[2]	Yes (both fuels)	—	—
Crankcase emissions (Type III test)	Yes	Yes	Yes		Yes (petrol only)	Yes (petrol only)	Yes (petrol only)[2]	Yes (petrol)	—	—
Evaporative emissions (Type IV test)	Yes	—	—		Yes (petrol only)	Yes (petrol only)	Yes (petrol only)[2]	Yes (petrol)	—	—
Durability (Type V test)	Yes	Yes	Yes		Yes (petrol only)	Yes (petrol only)	Yes (petrol only)[2]	Yes (petrol)	Yes (B5/**B7** only)[2,4]	Yes
Low temperature emissions (Type VI test)	Yes	—	—		Yes (petrol only)	Yes (petrol only)	Yes (petrol only)[2]	Yes (both fuels)[3]	—	—
In-service conformity	Yes	Yes	Yes		Yes (both fuels)	Yes (both fuels)	Yes (petrol only)[2]	Yes (both fuels)	Yes (B5/**B7** only)[2,4]	Yes
On-board diagnostics	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes

[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 and hydrogen shall be proposed later on.

[3] The E75 test reference fuel specified in Annex 10 shall be used.

[4] 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. "

Paragraph 5.3.7.3., amend to read:

"……

Where:

[ ] = concentration in per cent volume,

K1 = conversion factor for NDIR measurement to FID measurement (provided by manufacturer of measuring equipment),

H_{cv} = Atomic ratio of hydrogen to carbon,

(a) for petrol (E5) 1.89
(b) for petrol (E10) 1.93
(c) for LPG 2.53
(d) for NG/biomethane 4.0
(e) for ethanol (E85) 2.74
(f) for ethanol (E75) 2.61

O_{cv} = Atomic ratio of oxygen to carbon,

(a) for petrol (E5) 0.016
(b) for petrol (E10) 0.033
(c) for LPG 0.0
(d) for NG/biomethane 0.0
(e) for ethanol (E85) 0.39
(f) for ethanol (E75) 0.329"

Annex 4A, paragraph 6.6.2., amend to read:

"6.6.2. Total mass of gaseous and particulate pollutants emitted

The mass M of each pollutant emitted by the vehicle during the test shall be determined by obtaining the product of the volumetric concentration and the volume of the gas in question, with due regard for the following densities under above-mentioned reference conditions:

In the case of carbon monoxide (CO):	d = 1.25 g/l
In the case of hydrocarbons:	
For petrol (E5) ($C_1H_{1.89}O_{0.016}$)	d = 0.631 g/1
For petrol (E10) ($C_1H_{1.93}O_{0.033}$)	**d = 0.645 g/1**
For diesel (B5) ($C_1H_{l.86}O_{0.005}$)	d = 0.622 g/1
For diesel (B7) ($C_1H_{1.86}O_{0.007}$)	**d = 0.623 g/1**
For LPG ($CH_{2.525}$)	d = 0.649 g/l
For NG/biomethane (C_1H_4)	d = 0.714 g/l
For ethanol (E85) ($C_1H_{2,74}O_{0.385}$)	d = 0.932 g/l
For ethanol (E75) ($C_1H_{2,61}O_{0,329}$)	d = 0.886 g/l
In the case of nitrogen oxides (NO_x):	d = 2.05 g/1″

Annex 4A, paragraph 6.6.4., amend to read:

"6.6.4. ……..

The dilution factors for the reference fuels covered by this Regulation are provided below:

$$DF = \frac{13.4}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for petrol (E5) (5a)

$$DF = \frac{13.4}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ **for petrol (E10)** **(5b)**

$$DF = \frac{13.5}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for diesel (B5) (5**c**)

$$DF = \frac{13.5}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ **for diesel (B7)** **(5d)**

$$DF = \frac{11.9}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for LPG (5**e**)

$$DF = \frac{9.5}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for NG/biomethane (5**f**)

$$DF = \frac{12.5}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for ethanol (E85) (5**g**)

$$DF = \frac{12.5}{C_{CO2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$ for ethanol (E75) (5**h**)".

Annex 10, paragraph 1.1., insert the following table between the tables "Type: Petrol (E5)" and "Type: Ethanol (E85)":

Type: Petrol (E10)

Parameter	*Unit*	*Limits* [1]		*Test method*
		Minimum	*Maximum*	
Research octane number, RON [2]		**95.0**	**98.0**	**EN ISO 5164**
Motor octane number, MON [2]		**85.0**	**89.0**	**EN ISO 5163**
Density at 15°C	**kg/m^3**	**743.0**	**756.0**	**EN ISO 12185**
Vapour pressure (DVPE)	**kPa**	**56.0**	**60.0**	**EN 13016-1**
Water content	**% m/m**	**max 0.05** **Appearance at -7°C: Clear & Bright**		**EN 12937**
Distillation:				
– evaporated at 70°C	**% v/v**	**34.0**	**46.0**	**EN ISO 3405**
– evaporated at 100°C	**% v/v**	**54.0**	**62.0**	**EN ISO 3405**
– evaporated at 150°C	**% v/v**	**86.0**	**94.0**	**EN ISO 3405**
– final boiling point	**°C**	**170**	**195**	**EN ISO 3405**
Residue	**% v/v**	**—**	**2.0**	**EN ISO 3405**
Hydrocarbon analysis:				

– olefins	% v/v	6.0	13.0	EN 22854
– aromatics	% v/v	25.0	32.0	EN 22854
– benzene	% v/v	-	1.00	EN 22854 EN 238
– saturates	% v/v	report		EN 22854
Carbon/hydrogen ratio		report		
Carbon/oxygen ratio		report		
Induction Period [3]	minutes	480	—	EN ISO 7536
Oxygen content [4]	% m/m	3.3	3.7	EN 22854
Solvent washed gum (Existent gum content)	mg/100ml	—	4	EN ISO 6246
Sulphur content [5]	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion 3hrs, 50°C		—	class 1	EN ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content [6]	mg/l	—	1.3	ASTM D 3231
Ethanol [4]	% v/v	9.0	10.0	EN 22854

[1] The values quoted in the specifications are 'true values'. In establishment of their limit values the terms of ISO 4259 Petroleum products - Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

[2] Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

[3] A correction factor of 0.2 for MON and RON shall be subtracted for the calculation of the final result in accordance with EN 228:2008.

[4] The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.

[5] Ethanol is the only oxygenate that shall be intentionally added to the reference fuel. The Ethanol used shall conform to EN 15376.

[6] The actual sulphur content of the fuel used for the Type 1 test shall be reported.

[7] There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

Annex 10, paragraph 1.1., insert the following table after the table "Type: Diesel fuel (B5)":

Type*:* Diesel fuel (B7)

Parameter	*Unit*	*Limits* [1]		*Test method*
		Minimum	*Maximum*	
Cetane Index		**46.0**		**EN ISO 4264**
Cetane number [2]		**52.0**	**56.0**	**EN ISO 5165**
Density at 15 °C	**kg/m^3**	**833.0**	**837.0**	**EN ISO 12185**
Distillation:				
- 50% point	**°C**	**245.0**	**—**	**EN ISO 3405**
- 95% point	**°C**	**345.0**	**360.0**	**EN ISO 3405**
- final boiling point	**°C**	**—**	**370.0**	**EN ISO 3405**
Flash point	**°C**	**55**	**—**	**EN ISO 2719**
Cloud point	**°C**	**-**	**-10**	**EN 23015**
Viscosity at 40 °C	**mm^2/s**	**2.30**	**3.30**	**EN ISO 3104**
Polycyclic aromatic hydrocarbons	**% m/m**	**2.0**	**4.0**	**EN 12916**
Sulphur content	**mg/kg**	**—**	**10.0**	**EN ISO 20846** **EN ISO 20884**
Copper corrosion 3hrs, 50°C		**—**	**Class 1**	**EN ISO 2160**
Conradson carbon residue (10 % DR)	**% m/m**	**—**	**0.20**	**EN ISO 10370**
Ash content	**% m/m**	**—**	**0.010**	**EN ISO 6245**
Total contamination	**mg/kg**	**-**	**24**	**EN 12662**
Water content	**mg/kg**	**—**	**200**	**EN ISO 12937**
Acid number	**mg KOH/g**	**—**	**0.10**	**EN ISO 6618**
Lubricity (HFRR wear scan diameter at 60 °C)	**µm**	**—**	**400**	**EN ISO 12156**
Oxidation stability @ 110°C [3]	**h**	**20.0**		**EN 15751**
FAME [4]	**% v/v**	**6.0**	**7.0**	**EN 14078**

[1] The values quoted in the specifications are 'true values'. In establishment of their limit values the terms of ISO 4259 Petroleum products – Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility). Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

[2] The range for cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

[3] Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice shall be sought from the supplier as to storage conditions and life.

[4] FAME content to meet the specification of EN 14214.

Annex 10, paragraph 2., insert the following table between the tables "Type: Petrol (E5)" and "Type: Ethanol (E75)":

Type: Petrol (E10)

Parameter	*Unit*	*Limits* [1]		*Test method*
		Minimum	*Maximum*	
Research octane number, RON [2]		**95.0**	**98.0**	**EN ISO 5164**
Motor octane number, MON [2]		**85.0**	**89.0**	**EN ISO 5163**
Density at 15°C	**kg/m^3**	**743.0**	**756.0**	**EN ISO 12185**
Vapour pressure (DVPE)	**kPa**	**56.0**	**95.0**	**EN 13016-1**
Water content		**max 0.05** **Appearance at -7°C: Clear & Bright**		**EN 12937**
Distillation:				
– evaporated at 70°C	**% v/v**	**34.0**	**46.0**	**EN ISO 3405**
– evaporated at 100°C	**% v/v**	**54.0**	**62.0**	**EN ISO 3405**
– evaporated at 150°C	**% v/v**	**86.0**	**94.0**	**EN ISO 3405**
– final boiling point	**°C**	**170**	**195**	**EN ISO 3405**
Residue	**% v/v**	**—**	**2.0**	**EN ISO 3405**
Hydrocarbon analysis:				
– olefins	**% v/v**	**6.0**	**13.0**	**EN 22854**
– aromatics	**% v/v**	**25.0**	**32.0**	**EN 22854**
– benzene	**% v/v**	**-**	**1.00**	**EN 22854** **EN 238**
– saturates	**% v/v**	**report**		**EN 22854**
Carbon/hydrogen ratio		**report**		
Carbon/oxygen ratio		**report**		
Induction Period [3]	**minutes**	**480**	**—**	**EN ISO 7536**
Oxygen content [4]	**% m/m**	**3.3**	**3.7**	**EN 22854**
Solvent washed gum (Existent gum content)	**mg/100ml**	**—**	**4**	**EN ISO 6246**
Sulphur content [5]	**mg/kg**	**—**	**10**	**EN ISO 20846** **EN ISO 20884**
Copper corrosion 3hrs, 50°C		**—**	**class 1**	**EN ISO 2160**
Lead content	**mg/l**	**—**	**5**	**EN 237**
Phosphorus content [6]	**mg/l**	**—**	**1.3**	**ASTM D 3231**
Ethanol [4]	**% v/v**	**9.0**	**10.0**	**EN 22854**

[1] **The values quoted in the specifications are 'true values'. In establishment of their limit values the terms of ISO 4259 Petroleum products - Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility). Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.**

[2] **A correction factor of 0,2 for MON and RON shall be subtracted for the calculation of the final result in accordance with EN 228:2008.**

[3] **The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.**

[4] **Ethanol is the only oxygenate that shall be intentionally added to the reference fuel. The Ethanol used shall conform to EN 15376.**

[5] **The actual sulphur content of the fuel used for the Type 1 test shall be reported.**

[6] **There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.**

II. Justification

The latest reference fuels E10 and B7 have been introduced into Regulation No. 83 (07 series of amendments) and into Regulation No. 101 (01 series of amendments). This proposal introduces the optional use of the fuels in the 06 series of amendments to Regulation No. 83, allowing manufacturers to perform a single test to cover markets outside of the European Union (EU) and to avoid the need for storage of excessive numbers of fuels.