

5 February 2016

Agreement

Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions*

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 82 – Regulation No. 83

Revision 4 - Amendment 5

Supplement 5 to the 06 series of amendments – Date of entry into force: 29 January 2016

Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2015/56 (as amended by paragraph 64 of the report ECE/TRANS/WP.29/1116).



UNITED NATIONS

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

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 (NO₂) equivalent and hydrocarbons assuming ratio of:

- (a) C₁H_{2.525} for liquefied petroleum gas (LPG);
- (b) C₁H₄ for natural gas (NG) and biomethane;
- (c) C₁H_{1.89}O_{0.016} for petrol (E5);
- (d) C₁H_{1.93}O_{0.033} for petrol (E10);
- (e) C₁H_{1.86}O_{0.005} for diesel (B5);
- (f) C₁H_{1.86}O_{0.007} for diesel (B7);
- (g) C₁H_{2.74}O_{0.385} for ethanol (E85);
- (h) C₁H_{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 I 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 I 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:

"5.3.7.3. ...

$$\frac{[\text{CO}_2] + \frac{[\text{CO}]}{2} + [\text{O}_2] + \left(\frac{H_{\text{CV}}}{4} \cdot \frac{3.5}{3.5 + \frac{\text{CO}}{\text{CO}_2}} - \frac{O_{\text{CV}}}{2} \right) \cdot ([\text{CO}_2] + [\text{CO}])}{\left(1 + \frac{H_{\text{CV}}}{4} - \frac{O_{\text{CV}}}{2} \right) \cdot ([\text{CO}_2] + [\text{CO}] + K1[\text{HC}]}$$

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

"

Paragraph 9.3.5.2., amend to read:

"9.3.5.2. For IUPR, the number of sample lots to be taken is described in Table 4 and is based on the number of vehicles of an OBD family that are approved with IUPR (subject to sampling).

For the first sampling period of an OBD family, all of the vehicle types in the family that are approved with IUPR shall be considered to be subject to sampling. For subsequent sampling periods, only vehicle types which have not been previously tested or are covered by emissions approvals that have been extended since the previous sampling period shall be considered to be subject to sampling.

For families consisting of fewer than 5,000 registrations that are subject to sampling within the sampling period, the minimum number of vehicles in a sample lot is six. For all other families, the minimum number of vehicles in a sample lot to be sampled is fifteen.

Each sample lot shall adequately represent the sales pattern, i.e. at least the high volume vehicle types (≥ 20 per cent of the family total) shall be represented.

Vehicles of small series productions with less than 1,000 vehicles per OBD family are exempted from minimum IUPR requirements as well as the requirement to demonstrate these to the approval authority."

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): $d = 1.25 \text{ g/l}$

In the case of hydrocarbons:

For petrol (E5) ($\text{C}_1\text{H}_{1.89}\text{O}_{0.016}$) $d = 0.631 \text{ g/l}$

For petrol (E10) ($\text{C}_1\text{H}_{1.93}\text{O}_{0.033}$) $d = 0.645 \text{ g/l}$

For diesel (B5) ($\text{C}_1\text{H}_{1.86}\text{O}_{0.005}$) $d = 0.622 \text{ g/l}$

For diesel (B7) ($\text{C}_1\text{H}_{1.86}\text{O}_{0.007}$) $d = 0.623 \text{ g/l}$

For LPG ($\text{CH}_{2.525}$) $d = 0.649 \text{ g/l}$

For NG/biomethane (C_1H_4) $d = 0.714 \text{ g/l}$

For ethanol (E85) ($\text{C}_1\text{H}_{2.74}\text{O}_{0.385}$) $d = 0.932 \text{ g/l}$

For ethanol (E75) ($\text{C}_1\text{H}_{2.61}\text{O}_{0.329}$) $d = 0.886 \text{ g/l}$

In the case of nitrogen oxides (NO_x): $d = 2.05 \text{ g/l}$ "

Paragraph 6.6.4., amend to read:

"6.6.4. ...

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

$$\text{DF} = \frac{13.4}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for petrol (E5)} \quad (5a)$$

$$\text{DF} = \frac{13.4}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for petrol (E10)} \quad (5b)$$

$$\text{DF} = \frac{13.5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for diesel (B5)} \quad (5c)$$

$$\text{DF} = \frac{13.5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for diesel (B7)} \quad (5d)$$

$$\text{DF} = \frac{11.9}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for LPG} \quad (5e)$$

$$\text{DF} = \frac{9.5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for NG/biomethane} \quad (5f)$$

$$\text{DF} = \frac{12.5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for ethanol (E85)} \quad (5g)$$

$$\text{DF} = \frac{12.5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}}) \cdot 10^{-4}} \quad \text{for ethanol (E75)} \quad (5h)"$$

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."

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."

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 and 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."

Paragraph 2., amend to read:

- "2. Definitions
For the purposes of this annex only:"

Paragraph 2.10., amend to read:

- "2.10. A "driving cycle" consists of engine key-on, a driving mode where a malfunction would be detected if present, and engine key-off."

Insert a new paragraph 3.2.3., to read:

- "3.2.3. Identification of deterioration or malfunctions may also be done outside a driving cycle (e.g. after engine shutdown)."

Paragraph 3.8.1., amend to read:

- "3.8.1. The OBD system may erase a fault code and the distance travelled and freeze-frame information if the same fault is not re-registered in at least 40 engine warm-up cycles or 40 driving cycles with vehicle operation in which the criteria specified in paragraphs 7.5.1.(a)–(c) of Annex 11, Appendix 1 are met."

Insert a new paragraph 3.10., to read:

- "3.10. Additional provisions for vehicles employing engine shut - off strategies
3.10.1. Driving cycle
3.10.1.1. Autonomous engine restarts commanded by the engine control system following an engine stall may be considered as a new driving cycle or as a continuation of the existing driving cycle."

Appendix 1,

Paragraph 1., amend to read:

- "1. Introduction
This appendix describes the procedure of the test according to paragraph 3. of this annex. The procedure describes a method for checking the function of the On-Board Diagnostic (OBD) system installed on the vehicle by failure simulation of relevant systems in the engine management or emission control system. It also sets procedures for determining the durability of OBD systems.
The manufacturer shall make available the defective components and/or electrical devices which would be used to simulate failures. When measured over the Type I Test cycle, such defective components or devices shall not cause the vehicle emissions to exceed the limits of paragraph 3.3.2. by more than 20 per cent. For electrical failures (short/open circuit), the emissions may exceed the limits of paragraph 3.3.2. by more than twenty per cent.
When the vehicle is tested with the defective component or device fitted, the OBD system is approved if the MI is activated. The OBD system is also approved if the MI is activated below the OBD threshold limits."

Insert a new paragraph 6.1.1., to read:

- "6.1.1. The Type I Test need not be performed for the demonstration of electrical failures (short/open circuit). The manufacturer may demonstrate these failure modes using driving conditions in which the component is used and the monitoring conditions are encountered. These conditions shall be documented in the type approval documentation."

Insert a new paragraph 6.2.3., to read:

- "6.2.3. The use of additional preconditioning cycles or alternative preconditioning methods shall be documented in the type approval documentation."

Paragraph 6.3.1.5., amend to read:

- "6.3.1.5. Electrical disconnection of the electronic evaporative purge control device (if equipped and if active on the selected fuel type)."

Paragraphs 6.4.1.1., amend to read:

- "6.4.1.1. After vehicle preconditioning according to paragraph 6.2. of this appendix, the test vehicle is driven over a Type I test (Parts One and Two).

The MI shall be activated at the latest before the end of this test under any of the conditions given in paragraphs 6.4.1.2. to 6.4.1.5. of this appendix. The MI may also be activated during preconditioning. The Technical Service may substitute those conditions with others in accordance with paragraph 6.4.1.6. of this appendix

In the case of testing a bi-fuel gas vehicle, both fuel types shall be used within the maximum of four (4) simulated failures at the discretion of the Type Approval Authority."

Paragraphs 6.4.2.1., amend to read:

- "6.4.2.1. After vehicle preconditioning according to paragraph 6.2. of this appendix, the test vehicle is driven over a Type I test (Parts One and Two).

The MI shall be activated at the latest before the end of this test under any of the conditions given in paragraphs 6.4.2.2. to 6.4.2.5 of this appendix. The MI may also be activated during preconditioning. The Technical Service may substitute those conditions by others in accordance with paragraph 6.4.2.5. of this appendix. However, the total number of failures simulated shall not exceed four (4) for the purposes of type approval."

Paragraph 7.6.2., amend to read:

- "7.6.2. For specific components or systems that have multiple monitors, which are required to be reported by this paragraph (e.g. oxygen sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system shall separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator shall be reported for the specific component."

Insert a new paragraph 7.6.2.1., to read:

"7.6.2.1. Numerators and denominators for specific monitors of components or systems that are monitoring continuously for short circuit or open circuit failures are exempted from reporting.

"Continuously," if used in this context means monitoring is always enabled and sampling of the signal used for monitoring occurs at a rate no less than two samples per second and the presence or the absence of the failure relevant to that monitor has to be concluded within 15 seconds.

If for control purposes, a computer input component is sampled less frequently, the signal of the component may instead be evaluated each time sampling occurs.

It is not required to activate an output component/system for the sole purpose of monitoring that output component/system."
