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E/ECE/TRANS/505 } Rev.1/Add.82/Rev.3/Amend.3

4 November 2009

## **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 that entered into force on 16 October 1995)

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#### **Addendum 82: Regulation No. 83**

#### **Revision 3 - Amendment 3**

Supplement 8 to the 05 series of amendments: Date of entry into force: 22 July 2009

### **UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO THE EMISSION OF POLLUTANTS ACCORDING TO ENGINE FUEL REQUIREMENTS**



**UNITED NATIONS**

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\*/ 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.

GE.09-25246

List of contents, annexes, Annex 10, amend to read:

"Annex 10: SPECIFICATIONS OF REFERENCE FUELS

1. SPECIFICATIONS OF REFERENCE FUELS FOR TESTING VEHICLES TO THE EMISSION LIMITS GIVEN IN ROW A OF THE TABLE IN PARAGRAPH 5.3.1.4. – TYPE I TEST
  - 1.1. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES
  - 1.2. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH DIESEL ENGINE
2. SPECIFICATIONS OF REFERENCE FUELS FOR TESTING VEHICLES TO THE EMISSION LIMITS GIVEN IN ROW B OF THE TABLE IN PARAGRAPH 5.3.1.4. - TYPE I TEST
  - 2.1. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES
  - 2.2. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH DIESEL ENGINE
3. SPECIFICATIONS OF REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES AT LOW AMBIENT TEMPERATURE - TYPE VI TEST"

Text of the Regulation,

Paragraph 2.4., amend to read:

- "2.4. "Gaseous pollutants" means the exhaust gas emissions of carbon monoxide, oxides of nitrogen expressed in NO<sub>2</sub> equivalent, and hydrocarbons expressed of:
- (a) C<sub>1</sub>H<sub>1,85</sub> for petrol (E0);
  - (b) C<sub>1</sub>H<sub>1,86</sub> for diesel (B0);
  - (c) C<sub>1</sub>H<sub>2.525</sub> for LPG;
  - (d) C<sub>1</sub>H<sub>4</sub> for NG;
  - (e) C<sub>1</sub>H<sub>1.89</sub>O<sub>0.016</sub> for petrol (E5);
  - (f) C<sub>1</sub>H<sub>1.86</sub>O<sub>0.005</sub> for diesel (B5).

Paragraph 2.18., amend to read:

- "2.18. "Fuel requirement by the engine" means the type of fuel normally used by the engine:
- (a) Petrol (E0 or E5);
  - (b) LPG (liquefied petroleum gas);
  - (c) NG (natural gas);
  - (d) Either petrol or LPG;
  - (e) Either petrol or NG;
  - (f) Diesel fuel (B0 or B5)."

Annex 2, item 16.1., amend to read:

"16.1. Test Type I: .....

Pollutant	CO (g/km)	HC (g/km)	NOx (g/km)	HC + NOx (1) (g/km)	Particulates (1) (g/km)
measured					
calculated with deterioration factor (DF)					

(1) For compression-ignition engines only.

Position of the engine cooling fan during the test:

Height of the lower edge above ground: ..... cm.

Lateral position of fan centre: ..... cm.

Right/left of vehicle centre-line 2/

16.1.1. In the case of vehicles fuelled with ...

....."

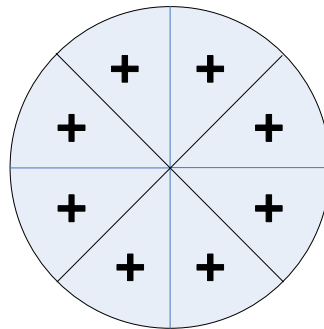
Annex 4

Paragraph 6.1.3., amend to read:

"6.1.3. A current of air of variable speed shall be blown over the vehicle. The blower speed shall be within the operating range of 10 km/h to at least 50 km/h, or as an alternative, at the request of the manufacturer, within the operating range of 10 km/h to at least the maximum speed of the test cycle being used. The linear velocity of the air at the blower outlet shall be within  $\pm 5$  km/h of the corresponding roller speed within the range of 10 km/h to 50 km/h. At the range over 50 km/h, the linear velocity of the air shall be within  $\pm 10$  km/h of the corresponding roller speed. At roller speeds of less than 10 km/h, air velocity may be zero.

The above mentioned air velocity shall be determined as an averaged value of a number of measuring points which:

- (a) For blowers with rectangular outlets are located at the centre of each rectangle dividing the whole of the blower outlet into 9 areas (dividing both horizontal and vertical sides of the blower outlet into 3 equal parts);
- (b) For circular blower outlets, the outlet shall be divided into 8 equal arcs by vertical, horizontal and 45° lines. The measurement points lie on the radial centre line of each arc (22.5°) at a radius of two thirds of the total (as shown in the diagram below).



Each value at those points shall be within 10 per cent of the averaged value of themselves.

The device used to measure the linear velocity of the air shall be located at between 0 and 20 cm from the air outlet.

The final selection of the blower shall have the following characteristics:

- (i) Area: at least 0.2 m<sup>2</sup>;
- (ii) Height of the lower edge above ground: approximately 20 cm;
- (iii) Distance from the front of the vehicle: approximately 30 cm.

As an alternative, at the request of the manufacturer the blower speed shall be fixed at an air speed of at least 6 m/s (21.6 km/h).

The height and lateral position of the cooling fan can also be modified at the request of the manufacturer."

Paragraph 8.2., amend to read:

"8.2. 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:

- (a) For E0 petrol (CH1.85)  $d = 0.619 \text{ g/l}$
- (b) For B0 diesel (CH1.86)  $d = 0.619 \text{ g/l}$
- (c) For LPG (CH2.525)  $d = 0.649 \text{ g/l}$
- (d) For NG (CH4)  $d = 0.714 \text{ g/l}$
- (e) For E5 petrol (C<sub>1</sub>H<sub>1.89</sub>O<sub>0.016</sub>)  $d = 0.631 \text{ g/l}$
- (f) For B5 diesel (C<sub>1</sub>H<sub>1.86</sub>O<sub>0.005</sub>)  $d = 0.622 \text{ g/l}$  "

Annex 4, Appendix 8

Paragraph 1.3., amend to read:

"1.3. CALCULATION OF THE ...

.....

The dilution factor is calculated as follows:

For each reference fuel:

$$DF = \frac{X}{C_{CO_2} + (C_{HC} + C_{CO}) \cdot 10^{-4}}$$

For a fuel of composition C<sub>x</sub>H<sub>y</sub>O<sub>z</sub> the general formula is:

$$X = 100 \frac{x}{x + \frac{y}{2} + 3.76 \left( x + \frac{y}{4} - \frac{z}{2} \right)}$$

For the reference fuels contained in Annex IX, the values of "X" are as follows.

Fuel	X
Petrol (E0)	13.4
Diesel (B0)	13.4
LPG	11.9
NG	9.5
Petrol (E5)	13.4
Diesel (B5)	13.5

"

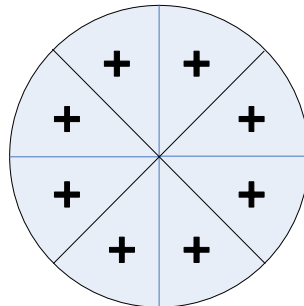
Annex 4a

Paragraph 3.4.2., amend to read:

"3.4.2. A current of air of variable speed shall be blown over the vehicle. The blower speed shall be, within the operating range of 10 km/h to at least 50 km/h, or as an alternative, at the request of the manufacturer within the operating range of 10 km/h to at least the maximum speed of the test cycle being used. The linear velocity of the air at the blower outlet shall be within  $\pm 5$  km/h of the corresponding roller speed within the range of 10 km/h to 50 km/h. At the range over 50 km/h, the linear velocity of the air shall be within  $\pm 10$  km/h of the corresponding roller speed. At roller speeds of less than 10 km/h, air velocity may be zero.

The above mentioned air velocity shall be determined as an averaged value of a number of measuring points which:

- (a) For blowers with rectangular outlets are located at the centre of each rectangle dividing the whole of the blower outlet into 9 areas (dividing both horizontal and vertical sides of the blower outlet into 3 equal parts).
- (b) For circular blower outlets, the outlet shall be divided into 8 equal arcs by vertical, horizontal and  $45^\circ$  lines. The measurement points lie on the radial centre line of each arc ( $22.5^\circ$ ) at a radius of two thirds of the total (as shown in the diagram below).



Each value at those points shall be within 10 per cent of the averaged value of themselves.

The device used to measure the linear velocity of the air shall be located at between 0 and 20 cm from the air outlet.

The final selection of the blower shall have the following characteristics:

- (i) Area: at least  $0.2 \text{ m}^2$ ;
- (ii) Height of the lower edge above ground: approximately 0.2 m;
- (iii) Distance from the front of the vehicle: approximately 0.3 m.

As an alternative, at the request of the manufacturer the blower speed shall be fixed at an air speed of at least 6 m/s (21.6 km/h).

The height and lateral position of the cooling fan can also be modified at the request of the manufacturer."

Annex 10, paragraphs 2. and 3., amend to read:

"2. SPECIFICATIONS OF REFERENCE FUELS FOR TESTING VEHICLES TO THE EMISSION LIMITS GIVEN IN ROW B OF THE TABLE IN PARAGRAPH 5.3.1.4. - TYPE I TEST

2.1. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES

Type: Unleaded petrol (E0)

Parameter	Unit	Limits <u>1/</u>		Test Method
		minimum	maximum	
Research octane number, RON		95.0	-	EN 25164
Motor octane number, MON		85.0	-	EN 25163
Density at 15 °C	kg/m <sup>3</sup>	740	754	ISO 3675
Reid vapour pressure	kPa	56.0	60.0	PrEN ISO 13016-1 (DVPE)
Distillation:				
- Evaporated at 70 °C	per cent v/v	24.0	40.0	EN-ISO 3405
- Evaporated at 100 °C	per cent v/v	50.0	58.0	EN-ISO 3405
- Evaporated at 150 °C	per cent v/v	83.0	89.0	EN-ISO 3405
- Final boiling point	°C	190	210	EN-ISO 3405
Residue	per cent v/v	-	2.0	EN-ISO 3405
Hydrocarbon analysis:				
Olefins	per cent v/v	-	10.0	ASTM D 1319
Aromatics	per cent v/v	29.0	35.0	ASTM D 1319
Saturates	per cent v/v	Report		ASTM D 1319
Benzene	per cent v/v	-	1.0	pr. EN 12177
Carbon/hydrogen ratio		Report		
Induction period <u>2/</u>	minutes	480	-	EN-ISO 7536
Oxygen content	per cent m/m	-	1.0	EN 1601
Existent gum	mg/ml	-	0.04	EN-ISO 6246
Sulphur content <u>3/</u>	mg/kg	-	10	ASTM D 5453
Copper corrosion		-	class 1	EN-ISO 2160
Lead content	mg/l	-	5	EN 237
Phosphorus content	mg/l	-	1.3	ASTM D 3231

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 should 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 the questions as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

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

3/ The actual sulphur content of the fuel used for the Type I test shall be reported.

ALTERNATIVELY

Type: Petrol (E5)

Parameter	Unit	Limits 1/		Test method
		Minimum	Maximum	
Research octane number, RON		95.0	—	EN 25164 prEN ISO 5164
Motor octane number, MON		85.0	—	EN 25163 prEN ISO 5163
Density at 15 °C	kg/m <sup>3</sup>	743	756	EN ISO 3675 EN ISO 12185
Vapour pressure	kPa	56.0	60.0	EN ISO 13016-1 (DVPE)
Water content	% v/v		0.015	ASTM E 1064
Distillation:				
– Evaporated at 70 °C	% v/v	24.0	44.0	EN-ISO 3405
– Evaporated at 100 °C	% v/v	48.0	60.0	EN-ISO 3405
– Evaporated at 150 °C	% v/v	82.0	90.0	EN-ISO 3405
– Final boiling point	°C	190	210	EN-ISO 3405
Residue	% v/v	—	2.0	EN-ISO 3405
Hydrocarbon analysis:				
– Olefins	% v/v	3.0	13.0	ASTM D 1319
– Aromatics	% v/v	29.0	35.0	ASTM D 1319
– Benzene	% v/v	—	1.0	EN 12177
– Saturates	% v/v	Report		ASTM 1319
Carbon/hydrogen ratio		Report		
Carbon/oxygen ratio		Report		
Induction period 2/	minutes	480	—	EN-ISO 7536
Oxygen content 4/	% m/m	Report		EN 1601
Existent gum	mg/ml	—	0.04	EN-ISO 6246
Sulphur content 3/	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content	mg/l	—	1.3	ASTM D 3231
Ethanol 5/	% v/v	4.7	5.3	EN 1601/EN 13132

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 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.

3/ The actual sulphur content of the fuel used for the Type 1 test shall be reported.

4/ Ethanol meeting the specification of prEN 15376 is the only oxygenate that shall be intentionally added to the reference fuel.

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



## 2.2. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH DIESEL ENGINE

Type: Diesel fuel (B0)

Parameter	Unit	Limits <u>1/</u>		Test Method
		minimum	maximum	
Cetane number <u>2/</u>		52.0	54.0	EN-ISO 5165
Density at 15°C	kg/m <sup>3</sup>	833	837	EN-ISO 3675
Distillation:				
50 per cent point	°C	245	-	EN-ISO 3405
95 per cent point	°C	345	350	EN-ISO 3405
- Final boiling point	°C	-	370	EN-ISO 3405
Flash point	°C	55	-	EN 22719
CFPP	°C	-	-5	EN 116
Viscosity at 40 °C	mm <sup>2</sup> /s	2.3	3.3	EN-ISO 3104
Polycyclic aromatic hydrocarbons	per cent m/m	3.0	6,0	IP 391
Sulphur content <u>3/</u>	mg/kg	-	10	ASTM D 5453
Copper corrosion		-	Class 1	EN-ISO 2160
Conradson carbon residue (10 per cent DR)	per cent m/m	-	0.2	EN-ISO 10370
Ash content	per cent m/m	-	0.01	EN-ISO 6245
Water content	per cent m/m	-	0.02	EN-ISO 12937
Neutralisation (strong acid) number	mg KOH/g	-	0.02	ASTM D 974
Oxidation stability <u>4/</u>	mg/ml	-	0.025	EN-ISO 12205
Lubricity (HFRR wear scan diameter at 60 °C)	µm	-	400	CEC F-06-A-96
FAME	Prohibited			

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 should 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 the questions as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should 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/ The actual sulphur content of the fuel used for the Type I test shall be reported.

4/ Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice should be sought from the supplier as to storage conditions and life

ALTERNATIVELY

Type: Diesel fuel (B5)

Parameter	Unit	Limits <u>1/</u>		Test method
		Minimum	Maximum	
Cetane number <u>2/</u>		52.0	54.0	EN-ISO 5165
Density at 15 °C	kg/m <sup>3</sup>	833	837	EN-ISO 3675
Distillation:				
- 50 % point	°C	245	—	EN-ISO 3405
- 95 % point	°C	345	350	EN-ISO 3405
- Final boiling point	°C	—	370	EN-ISO 3405
Flash point	°C	55	—	EN 22719
CFPP	°C	—	- 5	EN 116
Viscosity at 40 °C	mm <sup>2</sup> /s	2.3	3.3	EN-ISO 3104
Polycyclic aromatic hydrocarbons	% m/m	2.0	6.0	EN 12916
Sulphur content <u>3/</u>	mg/kg	—	10	EN ISO 20846 / EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Conradson carbon residue (10 % DR)	% m/m	—	0.2	EN-ISO 10370
Ash content	% m/m	—	0.01	EN-ISO 6245
Water content	% m/m	—	0.02	EN-ISO 12937
Neutralisation (strong acid) number	mg KOH/g	—	0.02	ASTM D 974
Oxidation stability <u>4/</u>	mg/ml	—	0.025	EN-ISO 12205
Lubricity (HFRR wear scan diameter at 60 °C)	µm	—	400	EN ISO 12156
Oxidation stability at 110 °C <u>4/ 6/</u>	h	20.0		EN 14112
FAME <u>5/</u>	% v/v	4.5	5.5	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/ The actual sulphur content of the fuel used for the Type 1 test shall be reported.

4/ 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.

5/ FAME content to meet the specification of EN 14214.

6/ Oxidation stability can be demonstrated by EN-ISO 12205 or by EN 14112. This requirement shall be reviewed based on CEN/TC19 evaluations of oxidative stability performance and test limits

3. SPECIFICATIONS OF REFERENCE FUEL TO BE USED FOR TESTING  
VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES AT LOW  
AMBIENT TEMPERATURE - TYPE VI TEST

Type: Unleaded petrol (E0)

Parameter	Unit	Limits <sup>1/</sup>		Test Method
		minimum	maximum	
Research octane number, RON		95.0	-	EN 25164
Motor octane number, MON		85.0	-	EN 25163
Density at 15 °C	kg/m <sup>3</sup>	740	754	ISO 3675
Reid vapour pressure	kPa	56.0	95.0	prEN ISO 13016-1 (DVPE)
Distillation:				
- Evaporated at 70 °C	per cent v/v	24.0	40.0	EN-ISO 3405
- Evaporated at 100 °C	per cent v/v	50.0	58.0	EN-ISO 3405
- Evaporated at 150 °C	per cent v/v	83.0	89.0	EN-ISO 3405
- Final boiling point	°C	190	210	EN-ISO 3405
Residue	per cent v/v	-	2.0	EN-ISO 3405
Hydrocarbon analysis:				
Olefins	per cent v/v	-	10.0	ASTM D 1319
Aromatics	per cent v/v	29.0	35.0	ASTM D 1319
Saturates	per cent v/v	Report		ASTM D 1319
Benzene	per cent v/v	-	1.0	pr. EN 12177
Carbon/hydrogen ratio		Report		
Induction period <sup>2/</sup>	minutes	480	-	EN-ISO 7536
Oxygen content	per cent m/m	-	1,0	EN 1601
Existent gum	mg/ml	-	0.04	EN-ISO 6246
Sulphur content <sup>3/</sup>	mg/kg	-	10	ASTM D 5453
Copper corrosion		-	Class 1	EN-ISO 2160
Lead content	mg/l	-	5	EN 237
Phosphorus content	mg/l	-	1.3	ASTM D 3231

<sup>1/</sup> 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 should 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 the questions as to whether a fuel meets the requirements of the specifications, the terms of ISO 4259 should be applied.

<sup>2/</sup> The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils must not be added.

<sup>3/</sup> The actual sulphur content of the fuel used for the Type VI test shall be reported.

ALTERNATIVELY

Type: Petrol (E5)

Parameter	Unit	Limits <sup>1/</sup>		Test method
		Minimum	Maximum	
Research octane number, RON		95.0	—	EN 25164 prEN ISO 5164
Motor octane number, MON		85.0	—	EN 25163 prEN ISO 5163
Density at 15 °C	kg/m <sup>3</sup>	743	756	EN ISO 3675 EN ISO 12185
Vapour pressure	kPa	56.0	95.0	EN ISO 13016-1 (DVPE)
Water content	% v/v		0.015	ASTM E 1064
Distillation:				
– Evaporated at 70 °C	% v/v	24.0	44.0	EN-ISO 3405
– Evaporated at 100 °C	% v/v	50.0	60.0	EN-ISO 3405
– Evaporated at 150 °C	% v/v	82.0	90.0	EN-ISO 3405
– Final boiling point	°C	190	210	EN-ISO 3405
Residue	% v/v	—	2.0	EN-ISO 3405
Hydrocarbon analysis:				
– Olefins	% v/v	3.0	13.0	ASTM D 1319
– Aromatics	% v/v	29.0	35.0	ASTM D 1319
– Benzene	% v/v	—	1.0	EN 12177
– Saturates	% v/v		Report	ASTM 1319
Carbon/hydrogen ratio			Report	
Carbon/oxygen ratio			Report	
Induction period <sup>2/</sup>	minutes	480	—	EN-ISO 7536
Oxygen content <sup>4/</sup>	% m/m		Report	EN 1601
Existent gum	mg/ml	—	0.04	EN-ISO 6246
Sulphur content <sup>3/</sup>	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content	mg/l	—	1.3	ASTM D 3231
Ethanol <sup>5/</sup>	% v/v	4.7	5.3	EN 1601/EN 13132

<sup>1/</sup> 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.

<sup>2/</sup> 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.

<sup>3/</sup> The actual sulphur content of the fuel used for the Type 1 test shall be reported.

<sup>4/</sup> Ethanol meeting the specification of prEN 15376 is the only oxygenate that shall be intentionally added to the reference fuel.

<sup>5/</sup> There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

Annex 14, paragraphs 3. to 3.2.4.1., amend to read:

"3. TYPE I TEST METHODS

3.1. EXTERNALLY CHARGEABLE (OVC HEV) WITHOUT AN OPERATING MODE SWITCH

3.1.1. Two tests shall be performed under the following conditions:

Condition A: Test shall be carried out with a fully charged electrical energy/power storage device.

Condition B: Test shall be carried out with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity).

The profile of the state of charge (SOC) of the electrical energy/power storage device during different stages of the Type I test is given in Appendix 1.

3.1.2. Condition A

3.1.2.1. The procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving (on the test track, on a chassis dynamometer, etc.):

- (a) At a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up;
- (b) Or, if a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine does not start up for a defined time/distance (to be specified between technical service and manufacturer);
- (c) Or with manufacturers' recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

3.1.2.2. Conditioning of vehicle

3.1.2.2.1. For compression-ignition engined vehicles, the Part Two cycle described in Appendix 1 of Annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.1.2.5.3. below.

3.1.2.2.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.1.2.5.3. below.

3.1.2.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 °C and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room, and the electrical energy/power storage device is fully charged as a result of the charging prescribed in paragraph 3.1.2.4. below.

3.1.2.4. During soak, the electrical energy/power storage device shall be charged:  
(a) With the on board charger if fitted; or  
(b) With an external charger recommended by the manufacturer, using the normal overnight charging procedure.

This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalization charges or the servicing charges.

The manufacturer shall declare that during the test, a special charge procedure has not occurred.

3.1.2.5. Test procedure

The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.

3.1.2.5.2. The test procedures defined in either paragraph 3.1.2.5.2.1. or 3.1.2.5.2.2. may be used in line with the procedure chosen in Regulation No. 101, Annex 8, paragraph 3.2.3.2.

3.1.2.5.2.1. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

3.1.2.5.2.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and continue over a number of repeat test cycles. It shall end on conclusion of the final idling period in the first extra-urban (Part Two) cycle during which the battery reached the minimum state of charge according to the criterion defined below (end of sampling (ES)).

The electricity balance  $Q$  [Ah] is measured over each combined cycle, using the procedure specified in Appendix 2 of Annex 8 to Regulation No. 101, and used to determine when the battery minimum state of charge has been reached.

The battery minimum state of charge is considered to have been reached in combined cycle  $N$  if the electricity balance measured during combined cycle  $N+1$  is not more than a 3 per cent discharge, expressed as a percentage of the nominal capacity of the

battery (in Ah) in its maximum state of charge, as declared by the manufacturer. At the manufacturer's request additional test cycles may be run and their results included in the calculations in paragraphs 3.1.2.5.5. and 3.1.4.2. provided that the electricity balance for each additional test cycle shows less discharge of the battery than over the previous cycle.

In between each of the cycles a hot soak period of up to 10 minutes is allowed. The power train shall be switched off during this period.

- 3.1.2.5.3. The vehicle shall be driven according to Annex 4, or in case of special gear shifting strategy, according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers' information). For these vehicles the gear shifting points prescribed in Annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in Annex 4 shall apply.
- 3.1.2.5.4. The exhaust gases shall be analyzed according to Annex 4.
- 3.1.2.5.5. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant in grams per kilometre for Condition A shall be calculated ( $M_{1i}$ ).

In the case of testing according to paragraph 3.1.2.5.2.1., ( $M_{1i}$ ) is simply the result of the single combined cycle run.

In the case of testing according to paragraph 3.1.2.5.2.2., the test result of each combined cycle run ( $M_{1ia}$ ), multiplied by the appropriate deterioration and  $K_i$  factors, shall be less than the limits prescribed in paragraph 5.3.1.4. of this Regulation. For the purposes of the calculation in paragraph 3.1.4  $M_{1i}$  shall be defined as:

$$M_{1i} = \frac{1}{N} \sum_{a=1}^N M_{1ia}$$

where:

i: pollutant

a: cycle

- 3.1.3. Condition B
  - 3.1.3.1. Conditioning of vehicle
    - 3.1.3.1.1. For compression-ignition engined vehicles the Part Two cycle described in Appendix 1 of Annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.1.3.4.3. below.

3.1.3.1.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.1.3.4.3. below.

3.1.3.2. The electrical energy/power storage device of the vehicle shall be discharged while driving (on the test track, on a chassis dynamometer, etc.):

(a) At a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up;

(b) Or if a vehicle can not reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine just does not start up for a defined time/distance (to be specified between technical service and manufacturer);

(c) Or with manufacturers' recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

3.1.3.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 °C and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room.

3.1.3.4. Test procedure

3.1.3.4.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.

3.1.3.4.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

3.1.3.4.3. The vehicle shall be driven according to Annex 4, or in case of special gear shifting strategy, according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers' information). For these vehicles the gear shifting points prescribed in Annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in Annex 4 shall apply.

3.1.3.4.4. The exhaust gases shall be analyzed according to Annex 4.

3.1.3.5. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition B shall be calculated ( $M_{2i}$ ). The test results  $M_{2i}$ , multiplied by the appropriate deterioration



and  $K_i$  factors, shall be less than the limits prescribed in paragraph 5.3.1.4. of this Regulation.

3.1.4. Test results

3.1.4.1. In the case of testing according to paragraph 3.1.2.5.2.1.

For communication, the weighted values shall be calculated as below

$$M_i = (De \cdot M_{1i} + Dav \cdot M_{2i}) / (De + Dav)$$

where:

$M_i$  = mass emission of the pollutant  $i$  in grams per kilometre.

$M_{1i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.1.2.5.5.

$M_{2i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.1.3.5.

$De$  = vehicle electric range, according to the procedure described in Regulation No. 101, Annex 9, where the manufacturer must provide the means for performing the measurement with the vehicle running in pure electric mode.

$Dav$  = 25 km (average distance between two battery recharges).

3.1.4.2. In the case of testing according to paragraph 3.1.2.5.2.2.

For communication, the weighted values shall be calculated as below:

$$M_i = (Dovc \cdot M_{1i} + Dav \cdot M_{2i}) / (Dovc + Dav)$$

where:

$M_i$  = mass emission of the pollutant  $i$  in grams per kilometre.

$M_{1i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.1.2.5.5.

$M_{2i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.1.3.5.

$Dovc$  = OVC range according to the procedure described in Regulation No. 101, Annex 9.

$Dav$  = 25 km (average distance between two battery recharges).

3.2. EXTERNALLY CHARGEABLE (OVC HEV) WITH AN OPERATING MODE SWITCH

3.2.1. Two tests shall be performed under the following conditions:

3.2.1.1. Condition A: Test shall be carried out with a fully charged electrical energy/power storage device.

3.2.1.2. Condition B: Test shall be carried out with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity).

3.2.1.3. The operating mode switch shall be positioned according the table below:

Battery state of charge	Hybrid-modes	- Pure electric - Hybrid	- Pure fuel consuming - Hybrid	- Pure electric - Pure fuel consuming - Hybrid	- Hybrid mode n (1) ... - Hybrid mode m (1)
		Switch in position	Switch in position	Switch in position	Switch in position
Condition A Fully charged		Hybrid	Hybrid	Hybrid	Most electric hybrid mode (2)
Condition B Min. state of charge		Hybrid	Fuel consuming	Fuel consuming	Most fuel consuming mode (3)

Notes:

(1) For instance: sport, economic, urban, extra-urban position ...

(2) Most electric hybrid mode:

The hybrid mode which can be proven to have the highest electricity consumption of all selectable hybrid modes when tested in accordance with condition A of paragraph 4. of Annex 10 to Regulation No. 101, to be established based on information provided by the manufacturer and in agreement with the technical service.

(3) Most fuel consuming mode:

The hybrid mode which can be proven to have the highest fuel consumption of all selectable hybrid modes when tested in accordance with condition B of paragraph 4. of Annex 10 to Regulation No. 101, to be established based on information provided by the manufacturer and in agreement with the technical service.

3.2.2. Condition A

3.2.2.1. If the pure electric range of the vehicle is higher than one complete cycle, on the request of the manufacturer, the Type I test may be carried out in pure electric mode. In this case, engine preconditioning prescribed in paragraph 3.2.2.3.1. or 3.2.2.3.2. can be omitted.

3.2.2.2. The procedure shall start with the discharge of the electrical energy/power storage device of the vehicle while driving with the switch in pure electric position (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent  $\pm$  5 per cent of the maximum thirty minutes speed of the vehicle (determined according to Regulation No. 101).

Stopping the discharge occurs:

- (a) When the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed; or
- (b) When an indication to stop the vehicle is given to the driver by the standard on-board instrumentation; or
- (c) After covering the distance of 100 km.

If the vehicle is not equipped with a pure electric mode, the electrical energy/power storage device discharge shall be achieved by driving the vehicle (on the test track, on a chassis dynamometer, etc.):

- (a) At a steady speed of 50 km/h until the fuel consuming engine of the HEV starts up; or
- (b) If a vehicle cannot reach a steady speed of 50 km/h without starting up the fuel consuming engine, the speed shall be reduced until the vehicle can run a lower steady speed where the fuel consuming engine does not start up for a defined time/distance (to be specified between technical service and manufacturer); or
- (c) With manufacturers' recommendation.

The fuel consuming engine shall be stopped within 10 seconds of it being automatically started.

3.2.2.3. Conditioning of vehicle

3.2.2.3.1. For compression-ignition engined vehicles the Part Two cycle described in Appendix 1 to the Annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.2.2.6.3. below.

3.2.2.3.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.2.2.6.3. below.

3.2.2.4. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 °C and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room, and the electrical energy/power storage device is fully charged as a result of the charging prescribed in paragraph 3.2.2.5.

3.2.2.5. During soak, the electrical energy/power storage device shall be charged:

- (a) With the on board charger if fitted; or
- (b) With an external charger recommended by the manufacturer, using the normal overnight charging procedure.

This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalisation charges or the servicing charges.

The manufacturer shall declare that during the test, a special charge procedure has not occurred.

3.2.2.6. Test procedure

3.2.2.6.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.

3.2.2.6.2. The test procedures defined in either paragraph 3.2.2.6.2.1. or 3.2.2.6.2.2. may be used in line with the procedure chosen in Regulation No. 101, Annex 8, paragraph 4.2.4.2.

3.2.2.6.1.1. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).

3.2.2.6.1.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and continue over a number of repeat test cycles. It shall end on conclusion of the final idling period in the first extra-urban (Part Two) cycle during which the battery has reached the minimum state of charge according to the criterion defined below (end of sampling (ES)).

The electricity balance  $Q$  [Ah] is measured over each combined cycle, using the procedure specified in Appendix 2 of Annex 8 to Regulation No. 101, and used to determine when the battery minimum state of charge has been reached.

The battery minimum state of charge is considered to have been reached in combined cycle  $N$  if the electricity balance measured during combined cycle  $N+1$  is not more than a 3 per cent discharge, expressed as a percentage of the nominal capacity of the

battery (in Ah) in its maximum state of charge, as declared by the manufacturer. At the manufacturer's request additional test cycles may be run and their results included in the calculations in paragraphs 3.2.2.7. and 3.2.4.3. provided that the electricity balance for each additional test cycle shows less discharge of the battery than over the previous cycle.

In between each of the cycles a hot soak period of up to 10 minutes is allowed. The power train shall be switched off during this period.

- 3.2.2.6.3. The vehicle shall be driven according to Annex 4, or in case of special gear shifting strategy, according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers' information). For these vehicles the gear shifting points prescribed in Annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in Annex 4 shall apply.
- 3.2.2.6.4. The exhaust gases shall be analysed according to Annex 4.
- 3.2.2.7. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant in grams per kilometre for Condition A shall be calculated ( $M_{1i}$ ).

In the case of testing according to paragraph 3.2.2.6.2.1., ( $M_{1i}$ ) is simply the result of the single combined cycle run.

In the case of testing according to paragraph 3.2.2.6.2.2., the test result of each combined cycle run  $M_{1ia}$ , multiplied by the appropriate deterioration and  $K_i$  factors, shall be less than the limits prescribed in paragraph 5.3.1.4. of this Regulation. For the purposes of the calculation in paragraph 3.2.4.,  $M_{1i}$  shall be defined as:

$$M_{1i} = \frac{1}{N} \sum_{a=1}^N M_{1ia}$$

where:

i : pollutant

a: cycle

### 3.2.3. Condition B

#### 3.2.3.1. Conditioning of vehicle

- 3.2.3.1.1. For compression-ignition engines the Part Two cycle described in Appendix 1 to the Annex 4 shall be used. Three consecutive cycles shall be driven according to paragraph 3.2.3.4.3. below.

- 3.2.3.1.2. Vehicles fitted with positive-ignition engines shall be preconditioned with one Part One and two Part Two driving cycles according to paragraph 3.2.3.4.3. below.
- 3.2.3.2. The electrical energy/power storage device of the vehicle shall be discharged according to paragraph 3.2.2.2.
- 3.2.3.3. After this preconditioning, and before testing, the vehicle shall be kept in a room in which the temperature remains relatively constant between 293 and 303 K (20 °C and 30 °C). This conditioning shall be carried out for at least six hours and continue until the engine oil temperature and coolant, if any, are within  $\pm 2$  K of the temperature of the room.
- 3.2.3.4. Test procedure
- 3.2.3.4.1. The vehicle shall be started up by the means provided for normal use to the driver. The first cycle starts on the initiation of the vehicle start-up procedure.
- 3.2.3.4.2. Sampling shall begin (BS) before or at the initiation of the vehicle start up procedure and end on conclusion of the final idling period in the extra-urban cycle (Part Two, end of sampling (ES)).
- 3.2.3.4.3. The vehicle shall be driven according to Annex 4, or in case of special gear shifting strategy, according to the manufacturer's instructions, as incorporated in the drivers' handbook of production vehicles and indicated by a technical gear shift instrument (for drivers' information). For these vehicles the gear shifting points prescribed in Annex 4, Appendix 1 are not applied. For the pattern of the operating curve the description according to paragraph 2.3.3. in Annex 4 shall apply.
- 3.2.3.4.4. The exhaust gases shall be analysed according to Annex 4.
- 3.2.3.5. The test results shall be compared to the limits prescribed in paragraph 5.3.1.4. of this Regulation and the average emission of each pollutant for Condition B shall be calculated ( $M_{2i}$ ). The test results  $M_{2i}$ , multiplied by the appropriate deterioration and  $K_i$  factors, shall be less than the limits prescribed in paragraph 5.3.1.4. of this Regulation.
- 3.2.4. Test results
- 3.2.4.1. In the case of testing according to paragraph 3.2.2.6.2.1.

For communication, the weighted values shall be calculated as below:

$$M_i = (D_e \cdot M_{1i} + D_{av} \cdot M_{2i}) / (D_e + D_{av})$$

where:

- $M_i$  = mass emission of the pollutant  $i$  in grams per kilometre.  
 $M_{1i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.2.2.7.  
 $M_{2i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.2.3.5.  
 $D_e$  = vehicle electric range with the switch in pure electric position, according to the procedure described in Regulation No. 101, Annex 9. If there is not a pure electric position, the manufacturer must provide the means for performing the measurement with the vehicle running in pure electric mode.  
 $D_{av}$  = 25 km (average distance between two battery recharge).

3.2.4.2. In the case of testing according to paragraph 3.2.2.6.2.2.

For communication, the weighted values shall be calculated as below

$$M_i = (D_{ovc} \cdot M_{1i} + D_{av} \cdot M_{2i}) / (D_{ovc} + D_{av})$$

where:

- $M_i$  = mass emission of the pollutant  $i$  in grams per kilometre.  
 $M_{1i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with a fully charged electrical energy/power storage device calculated in paragraph 3.2.2.7.  
 $M_{2i}$  = average mass emission of the pollutant  $i$  in grams per kilometre with an electrical energy/power storage device in minimum state of charge (maximum discharge of capacity) calculated in paragraph 3.2.3.5.  
 $D_{ovc}$  = OVC range according to the procedure described in Regulation No. 101, Annex 9.  
 $D_{av}$  = 25 km (average distance between two battery recharges)."

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