

EU provisional position based on ECE/EB.AIR/WG.2009/20 as amended by ECE/EB.AIR/WG.5/2011/2 Strikeout means provisions proposed to be deleted and bold underlined proposed amendment to text. "Explanatory text" originally included in the draft is deleted (but not shown). Tables would also be renumbered. General application dates for obligations are specified in annex X, but for this annex a number of other implementation dates may be relevant. For key source categories cars, light and heavy duty road vehicles as well as the major non-road mobile machinery two options have been retained in view of further negotiations.

Annex VIII

LIMIT VALUES FOR FUELS AND NEW MOBILE SOURCES

Section A applies to Parties other than Canada and the United States of America, section B applies to Canada and section C applies to the United States of America

1. The annex ~~contains~~ **specifies emission** limit values for NO_x, expressed as nitrogen dioxide (NO₂) equivalents, for hydrocarbons, most of which are volatile organic compounds, for carbon monoxide (CO) and for dust¹ as well as environmental specifications for marketed fuels for vehicles.
2. The timescales for applying the limit values in this annex are laid down in annex [X], **[unless specified in the tables below]**.

A. Parties other than Canada and the United States of America

Passenger cars and light-duty vehicles

¹ In the context of this Protocol, dust and TSP have the same meaning. In the following tables, the terms Particulate Matter or Particulates are used to keep the coherence with the EC directives used.

3. Emission limit values for power-driven vehicles with at least four wheels and used for the carriage of passengers (category M) and goods (category N) are given in table 1. They are based on the European regulations Euro 3 to Euro 6.

Table 1: Limit values for passenger cars and light-duty vehicles

Category		Class, application date	Reference mass (RW) (kg)	Limit values ^{d/}											
				Carbon monoxide		Total Hydrocarbons (HC)		NMVOC		Nitrogen oxides		Hydrocarbons and nitrogen oxides combined		Particulates matter ^{e/}	
				L1 (g/km)		L2 (g/km)		L3 (g/km)		L4 (g/km)		L2 + L4 (g/km)		L5 (g/km)	
			Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	
Euro 3	M ^{b/}	All	All	2.3	0.64	0.20	-	-	-	0.15	0.50	-	0.56	-	0.05
	N ₁ ^{c/}	I	RW ≤ 1305	2.3	0.64	0.20	-	-	-	0.15	0.50	-	0.56	-	0.05
		II	1305 < RW ≤ 1760	4.17	0.80	0.25	-	-	-	0.18	0.65	-	0.72	-	0.07
		III	1760 < RW	5.22	0.95	0.29	-	-	-	0.21	0.78	-	0.86	-	0.10
Euro 4	M ^{b/}	All	All	1.0	0.50	0.10	-	-	-	0.08	0.25	-	0.30	-	0.025
	N ₁ ^{c/}	I _r	RW ≤ 1305	1.0	0.50	0.10	-	-	-	0.08	0.25	-	0.30	-	0.025
		II _r	1305 < RW ≤ 1760	1.81	0.63	0.13	-	-	-	0.10	0.33	-	0.39	-	0.04
		III _r	1760 < RW	2.27	0.74	0.16	-	-	-	0.11	0.39	-	0.46	-	0.06
Euro 5	M ^{b/}	2009	All	1.0	0.50	0.10	-	0.068	-	0.06	0.18	-	0.23	0.0050	0.0050
	N ₁ ^{c/}	I, 2009	RW ≤ 1305	1.0	0.50	0.10	-	0.068	-	0.06	0.18	-	0.23	0.0050	0.0050
		II, 2010	1305 < RW ≤ 1760	1.81	0.63	0.13	-	0.090	-	0.075	0.235	-	0.295	0.0050	0.0050

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Euro 6		III, 2010	1760 < RW	2.27	0.74	0.16	-	0.108	-	0.082	0.28	-	0.35	<u>0.0050</u>	<u>0.0050</u>
	N ₂	2010		2.27	0.74	0.16	-	0.108	-	0.082	0.28	-	0.35	<u>0.0050</u>	<u>0.0050</u>
	M ^{b/}	2014	All	1.0	0.50	0.10	-	0.068	-	0.06	0.08	-	0.17	<u>0.0050</u>	<u>0.0050</u>
	N ₁ ^{c/}	I, 2014	RW ≤ 1305	1.0	0.50	0.10	-	0.068	-	0.06	0.08	-	0.17	<u>0.0050</u>	<u>0.0050</u>
		II, 2015	1305 < RW ≤ 1760	1.81	0.63	0.13	-	0.090	-	0.075	0.105	-	0.195	<u>0.0050</u>	<u>0.0050</u>
		III, 2015	1760 < RW	2.27	0.74	0.16	-	0.108	-	0.082	0.125	-	0.215	<u>0.0050</u>	<u>0.0050</u>
	N ₂	2015		2.27	0.74	0.16	-	0.108	-	0.082	0.125	-	0.215	<u>0.0050</u>	<u>0.0050</u>

a/ VLE expressed as a number of particulates /km are also defined for Euro 6

b/ Except vehicles whose maximum mass exceeds 2,500 kg.

c/ And those category M vehicles specified in note b.

d/ Test cycle specified by

e/ Vehicle Category M; vehicles class I...

Heavy-duty vehicles

4. Limit values for engines for heavy-duty vehicles are given in tables 2 and 3 depending on the applicable test procedures.

Table 2: Limit values for heavy-duty vehicles - European steady-state cycle (ESC) and European load-response (ELR) tests

Row	Application date	Carbon monoxide	Hydrocarbons (g/kWh)	Nitrogen oxides	Particulates matter	Smoke
		(g/kWh)		(g/kWh)	(g/kWh)	(m ⁻¹)
A (EURO III)		2.1	0.66	5.0	0.10 / 0.13 ^{a/}	0.8
B1 (EURO IV)		1.5	0.46	3.5	0.02	0.5
B2 ("EURO V")	2008	1.5	0.46	2.0	0.02	0.5
"EURO VI"	2013	1.5	0.13	0.40	0.010	

a/ For engines with a swept volume below 0.75 dm³ per cylinder and a rated power speed above 3,000 revolutions per minute.

Table 3: Limit values for heavy-duty vehicles - European transient cycle (ETC) test

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Row	Application date	Carbon monoxide (g/kWh)	Non-methane hydrocarbons (g/kWh)	Methane ^{a/} (g/kWh)	Nitrogen oxides (g/kWh)	Particulates (g/kWh) ^{b/}
A (2000) EURO III		5.45	0.78	1.6	5.0	0.16 / 0.21 ^{c/}
B1 (2005) EURO IV		4.0	0.55	1.1	3.5	0.03
B2 (2008) EURO V	2008	4.0	0.55	1.1	2.0	0.03

a/ For natural gas engines only.

b/ Not applicable to gas-fuelled engines at stage A and stages B1 and B2.

c/ For engines with a swept volume below 0.75 dm³ per cylinder and a rated power speed above 3,000 revolutions per minute.

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Table 3 bis: Limit values for heavy-duty vehicles European transient cycle (ETC) test

	Application date	Carbon monoxide (g/kWh)	Total Hydrocarbons (g/kWh)	Non-methane hydrocarbons (g/kWh)	Methane (g/kWh)	Nitrogen oxides (g/kWh)	Particulates (g/kWh) ^{b/}
"EURO VI" (CI)	2013	4.0	0.160			0.40	0.010
"EURO VI" (PI)	2013	4.0		0.160	0.50	0.40	0.010

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PI: Positive ignition, CI: Compression ignition

Compression-ignition (CI) and spark-ignition (SI) non-road vehicles and machines

5. Limit values for agricultural and forestry tractors and other non-road vehicle/machine engines are listed in tables 4 to 8.

Table 4: Limit values (stage IIIA) for diesel engines for non-road mobile machines, agricultural and forestry tractors

Net power (P) (kW)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)	Particulate matter (g/kWh)
130 ≤ P ≤ 560	3.5	4.0	0.2
75 ≤ P < 130	5.0	4.0	0.3
37 ≤ P < 75	5.0	4.7	0.4
19 ≤ P < 37	5.5	7.5	0.6

Table 5: Limit values (stage IIIB) for diesel engines for non-road mobile machines, agricultural and forestry tractors

Net power (P) (kW)	Application date	Carbon monoxide (g/kWh)	Hydrocarbons (g/kWh)	Nitrogen oxides (g/kWh)	Particulate matter (g/kWh)
130 ≤ P ≤ 560	<u>2009</u>	3.5	0.19	2.0	0.025
75 ≤ P < 130	<u>2010</u>	5.0	0.19	3.3	0.025
56 ≤ P < 75	<u>2010</u>	5.0	0.19	3.3	0.025
37 ≤ P < 56	<u>2011</u>	5.0	4.7		0.025

Table 6: Limit values (stage IV) for diesel engines for non-road mobile machines, agricultural and forestry tractors

Net power (P) (kW)	Application date	Carbon monoxide (g/kWh)	Hydrocarbons (g/kWh)	Nitrogen oxides (g/kWh)	Particulate matter (g/kWh)
130 ≤ P ≤ 560	<u>2012</u>	3.5	0.19	0.4	0.025
56 ≤ P < 130	<u>2013</u>	5.0	0.19	0.4	0.025

[Exhaust emissions from non-road machinery may not exceed the particle count of 1×10^{12} 1/kWh for solid particles with a diameter greater than 23 nm, calculated on the basis of the current recognised status of technology, namely the UNECE particle measurement programme, and in accordance with the NRSC and NRTC test cycles specified in Directive 97/68/EC.]

Table 7: Limit values (stage I) for spark-ignition engines for non-road mobile machines

Hand-held engines				
Displacement (cm³)		Carbon monoxide (g/kWh)	Hydrocarbons (g/kWh)	Nitrogen oxides (g/kWh)
Disp < 20		805	295	5.36
20 ≤ disp. < 50		805	241	5.36
Disp ≥ 50		603	161	5.36
Non-hand-held engines				
Displacement (cm³)		Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)	
Disp < 66		519	50	
66 ≤ disp. < 100		519	40	
100 ≤ disp. < 225		519	16.1	
Disp ≥ 225		519	13.4	

Table 8: Limit values (stage II) for spark-ignition engines for non-road mobile machines

Hand-held engines		
Displacement	Carbon monoxide	Sum of hydrocarbons

(cm ³)	(g/kWh)	and oxides of nitrogen (g/kWh) ^{a/}
Disp < 20	805	50
20 ≤ disp. < 50	805	50
Disp ≥ 50	603	72
Non-hand-held engines		
Displacement (cm ³)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)
Disp < 66	519 610	50
66 ≤ disp. < 100	519 610	40
100 ≤ disp. < 225	519 610	16.1
Disp ≥ 225	519 610	12.4 12.1

a/ The NOx emissions for all engine classes must not exceed 10 g/kWh.

Locomotives and railcars

6. Limit values for locomotives and railcars are listed in tables 9 to 12.

Table 9: Limit values (stage IIIA) for propulsion of locomotives

Net power (P) (kW)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)		Particulate matter (g/kWh)
RL A:- 130 ≤ P ≤ 560	3.5	4.0		0.2
Net power (P) (kW)	Carbon monoxide	Hydrocarbons	Nitrogen oxides	Particulate

	(g/kWh)	(g/kWh)	(g/kWh)	matter (g/kWh)
RH A: P > 560	3.5	0.4 <u>0.5</u>	6.0	0.2
RH A: Engines with P > 2,000 and disp. > 5 l/cylinder	3.5	0.4	7.4	0.2

Table 10: Limit values (stage IIIA) for propulsion of railcars

Net power (P) (kW)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)	Particulate matter (g/kWh)
RCA: 130 < P	3.5	4.0	0.2

Table 11: Limit values (stage IIIB) for engines used for propulsion of railcars

Net power (P) (kW)	Carbon monoxide (g/kWh)	Hydrocarbons (g/kWh)	Nitrogen oxides (g/kWh)	Particulate matter (g/kWh)
RCA RCB : 130 < P	3.5	0.19	2.0	0.025

Table 12: Limit values (stage IIIB) for engines used for propulsion of locomotives

Net power (P) (kW)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)	Particulate matter (g/kWh)
RCARB : 130 < P	3.5	4.0	0.025

~~Inland waterway vessels~~

7. Limit values for inland waterway vessels are listed in table 13.

Table 13: Limit values (stage IIIA) for engines for propulsion of inland waterways vessels

Displacement (liters per cylinder/kW)	Carbon monoxide (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (g/kWh)	Particulate matter (g/kWh)
V1:1 Disp. < 0.9 Power ≥ 37 kW	5.0	7.5	0.4
V1:2 0.9 ≤ disp. < 1.2	5.0	7.2	0.3
V1:3 1.2 ≤ disp. < 2.5	5.0	7.2	0.2
V1:4 2.5 ≤ disp. < 5.0	5.0	7.2	0.2
V2:1 5.0 ≤ disp. < 15	5.0	7.8	0.27
V2:2 15 ≤ disp. < 20 Power < 3300 kW	5.0	8.7	0.5
V2:3 15 ≤ disp. < 20 Power > 3300 kW	5.0	9.8	0.5
V2:4 20 ≤ disp. < 25	5.0	9.8	0.5
V2:5 25 ≤ disp. < 30	5.0	11.0	0.5

~~Recreational crafts~~

8. Limit values for ~~inland waterway vessels~~ **recreational crafts** are listed in table 14.

Table 14: Limit values for engines in recreational crafts

Engine type	CO (g/kWh) CO = A + B/P ⁿ _N			VOC Hydrocarbons (g/kWh) VOC HC = A + B/P ⁿ _N			NO _x [g/kWh]	PM [g/kWh]
	A	B	n	A	B	n		
2-stroke	150	600	1	30	100	0,75	10	Not Appl.
4-stroke	150	600	1	6	50	0,75	15	Not Appl.
CI	5	0	0	1,5	2	0,5	9,8	1

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Not Appl.: Not Applicable

Where A, B and n are constants ~~and in accordance with table 3.1.1~~, P_N is the rate engine power in kW and the emissions are measured in accordance with the harmonised standards.

Motorcycles and mopeds

9. Limit values for motorcycles and mopeds are given in tables 15 to 18.

Table 15: Limit values (stage I) for motorcycles and 3- and 4-wheelers (> 50 cm³; > 45 km/h)

Engine type	Limit values
2-stroke	CO = 8 g/km HC = 4 g/km NO _x = 0.1 g/km
4-stroke	CO = 13 g/km HC = 3 g/km NO _x = 0.3 g/km

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Note: For 3- and 4-wheelers, the limit values have to be multiplied by 1.5.

Table 16: Limit values (stage II) for motorcycles (> 50 cm³; > 45 km/h)

Engine type	Limit values
Motorcycle < 150cc	HC = 1.2 g/km NO _x = 0.3 g/km
Motorcycle > 150cc	HC = 1.0 g/km NO _x = 0.3 g/km

Table 17: Limit values (stage III) for motorcycles (> 50 cm³; > 45 km/h)

Engine type size	Limit values
Motorcycle < 150cc	HC = 0.8 g/km NO _x = 0.15 g/km
Motorcycle > 150cc	HC = 0.3 g/km NO _x = 0.15 g/km

Table 18: Limit values for mopeds ($\leq 50 \text{ cm}^3$; $< 45 \text{ km/h}$)

Stage	Limit values	
	CO (g/km)	HC + NO _x (g/km)
I	6.0 ^{a/}	3.0 ^{a/}
II	1.0 ^{b/}	1.2

a/ For 3- and 4-wheelers, multiply by 2.

b/ For 3- and 4-wheelers, 3.5 g/km.

Fuel quality

10. Environmental quality specifications for petrol and diesel are given in tables 19 to 20.

Table 19: Environmental specifications for marketed fuels to be used for vehicles equipped with positive-ignition engines

Type: Petrol

Parameter	Unit	Limits	
		Minimum	Maximum
Research octane number		95	-
Motor octane number		85	-
Reid vapour pressure, summer period ^{a/}	kPa	-	60
Distillation:			
evaporated at 100°C	% v/v	46	-
evaporated at 150°C	% v/v	75	-
Hydrocarbon analysis:			
- olefins	% v/v	-	18.0 ^{b/}
- aromatics		-	35
- benzene		-	1
Oxygen content	% m/m	-	<u>2.733.7</u>
Oxygenates:			

Parameter	Unit	Limits	
		Minimum	Maximum
- Methanol, stabilizing agents must be added	% v/v	-	3
- Ethanol, stabilizing agents may be necessary	% v/v	-	5 10
- Iso-propyl alcohol	% v/v	-	12 12
- Tert-butyl alcohol	% v/v	-	7 15
- Iso-butyl alcohol	% v/v	-	10 15
- Ethers containing 5 or more carbon atoms per molecule	% v/v	-	15 22
Other oxygenates ^{c/}	% v/v	-	10 15
Sulphur content	mg/kg	-	10

a/ The summer period shall begin no later than 1 May and shall not end before 30 September. For member States **Parties** with arctic conditions the summer period shall begin no later than 1 June and not end before 31 August and the **Reed Vapour Pressure (RVP)** is limited to 70 kPa.

b/ Except for regular unleaded petrol (minimum motor octane number (MON) of 81 and minimum research octane number (RON) of 91), for which the maximum olefin content shall be 21% v/v. These limits shall not preclude the introduction on the market of a member States **Party** of another unleaded petrol with lower octane numbers than set out here.

c/ Other mono-alcohols with a final distillation point no higher than the final distillation point laid down in national specifications or, where these do not exist, in industrial specifications for motor fuels.

Table 20: Environmental specifications for marketed fuels to be used for vehicles equipped with compression-ignition engines

Type: Diesel fuel

Parameter	Unit	Limits	
		Minimum	Maximum
Cetane number		51	-
Density at 15°C	kg/m ³	-	845
Distillation point: 95%	°C	-	360
Polycyclic aromatic hydrocarbons	% m/m	-	11 8

Sulphur content	mg/kg	-	10
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