

Global Motor Vehicle Emissions Regulations

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1. European Union

Table 1 EU Emission Limits for Petrol Cars (g/km) ^(a)

PETROL	As from ^(b) :	CO	HC	NO _x
EURO I*	1/7/1992	4.05	0.66	0.49
EURO II*	1/1/1996	3.28	0.34	0.25
EURO III	1/1/2000	2.30	0.20	0.15
EURO IV	1/1/2005	1.00	0.10	0.08

* As measured on new test cycle for application in year 2000.

Table 2 EU Emission Limits for Diesel Cars (g/km) ^(a)

DIESEL	As from ^(b) :	CO	HC	NO _x	PM
EURO I*	1/7/1992	2.88	0.20	0.78	0.14
EURO II*	1/1/1996	1.06	0.19	0.73	0.10
EURO III	1/1/2000	0.64	0.06	0.50	0.05
EURO IV	1/1/2005	0.50	0.05	0.25	0.025

* As measured on new test cycle for application in year 2000.

Notes:

- a) "Euro 3 and 4" (Directive 98/69/EC): Standards also apply to light commercial vehicles (<1305 kg).
 b) The above dates refer to new vehicle types; dates for new vehicles are 1 year later.

**Table 3 EU Emission Limits for Light Commercial Vehicles (Classes N1, N2 and N3)
 Light Commercial Vehicles N1 Class (<1350 kg) Emission Limits (g/km).**

N1	As from:	Fuel Type:	CO	HC	NO _x	HC + NO _x	PM
EURO I*	1/10/1994	All	2.72	-	-	0.97	0.14
EURO II*	1/1/1998	Petrol	2.2	-	-	0.5	-
		Diesel	1.0	-	-	0.60	0.1
EURO III	1/1/2001	Petrol	2.3	0.2	0.15	-	-
		Diesel	0.64	-	0.5	0.56	0.05
EURO IV	1/1/2006	Petrol	1	0.1	0.08	-	-
		Diesel	0.5	-	0.25	0.3	0.025

* For Euro I and II the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Light Commercial Vehicles N2 Class (1305-1760 kg) Emission Limits (g/km).

N2	As from:	Fuel Type:	CO	HC	NO _x	HC + NO _x	PM
EURO I*	1/10/1994	All	5.17	-	-	1.4	0.19
EURO II*	1/1/1998	Petrol	4	-	-	0.65	-
		Diesel	1.2	-	-	1.1	0.15
EURO III	1/1/2002	Petrol	4.17	0.25	0.18	-	-
		Diesel	0.8	-	0.65	0.72	0.07
EURO IV	1/1/2006	Petrol	1.81	0.13	0.1	-	-
		Diesel	0.63	-	0.33	0.39	0.04

* For Euro I and II the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Light Commercial Vehicles N3 Class (>1760 kg) Emission Limits (g/km).

N3	As from:	Fuel	CO	HC	NO _x	HC +	PM
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		Type:				NO _x	
EURO I*	1/10/1994	All	6.9	-	-	1.7	0.25
EURO II*	1/1/1998	Petrol	5	-	-	0.8	-
		Diesel	1.35	-	-	1.3	0.2
EURO III	1/1/2002	Petrol	5.22	0.29	0.21	-	-
		Diesel	0.95	-	0.78	0.86	0.1
EURO IV	1/1/2006	Petrol	2.27	0.16	0.11	-	-
		Diesel	0.74	-	0.39	0.46	0.06

* For Euro I and II the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Table 4 Emission Limits for Heavy Duty Vehicles. (G/kWh)

	As from:	Test cycle	CO	Total HC	Non-Methane HC	NO _x	Particulate Matter
EURO I	1/10/1993	13-mode	4.5	1.10	-	8	0.612 <85 kW 0.36 >85 kW
EURO II	1/10/1996	13-mode	4.0	1.10	-	7	0.15 ^(a)
EURO III	1/1/2000	ESC ^(c)	2.1	0.66	-	5	0.10 0.13 ^(b)
		ETC ^(d)	5.5	0.78	1.6	5	0.16 0.21 ^(b)
EURO IV	1/10/2005	ESC ^(c)	1.5	0.46	-	3.5	0.02
		ETC ^(d)	4.0	0.55	1.1	3.5	0.03
EURO V	1/10/200	ESC ^(c)	1.5	0.46	-	2	0.02

	8	ETC ^(d)	4.0	0.55	1.1	2	0.03
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Notes:

- (a) Until 30/11/1998 the particulate limit for engines <700 cc per cylinder and with a rated power speed of more than 3000 rpm was 0.25 g/kWh
- (b) For engines <750 cc per cylinder and with a rated power speed greater than 3000 rpm
- (c) Measured on the European Standard Cycle (ESC)
- (d) Measured on the European Transient Cycle (ETC)

Table 5 Relevant Petrol and Diesel Fuel Specification Limits

PETROL	2000	2005
RVP summer	60	-
Aromatics	42	35
Benzene	1	-
Olefins	18	-
Oxygen	2,7	-
Sulphur	150	50

DIESEL	2000	2005
CETANE # (MIN)	51	-
Density 15°C	845	-
Distillation 95°C	360	-
Polyaromatics	11	-
Sulphur	350	50

Table 6 ECE Regulation 40/40.01 for Exhaust Emission Limits for Motorcycles with 4-stroke Engines.

	CO (g/km)	
Reference Weight R ⁽¹⁾ (kg)	ECE 40 ⁽²⁾	ECE 40.01 ⁽²⁾
<100	25 {30}	17.5 {21}
100-300	$(25+25^{\frac{(R-100)}{200}})/200$	$(17.5+17.5^{\frac{(R-100)}{200}})/200$
{100-300}	$(30+30^{\frac{(R-100)}{200}})/200$	$(21+21^{\frac{(R-100)}{200}})/200$
>300	50 (60)	35 (42)
	HC(g/km)	
Reference Weight R ⁽¹⁾ (kg)	ECE 40 ⁽²⁾	ECE 40.01 ⁽²⁾

	CO (g/km)	
< 100	7{10}	4.2(6)
100-300	$(7 + 3^{\frac{(R-100)}{200}})/200$	$(4.2 + 1.8^{\frac{(R-100)}{200}})/200$
{100-300}	$\{10 + 4^{\frac{(R-100)}{200}}\}/200$	$(6 + 2.4^{\frac{(R-100)}{200}})/200$
>300	10 {14}	6 (8.4)

- Notes: 1) Reference weight (R) - Motorcycle weight + 75 kg.
2) Limits are for type approval. Limits given in parenthesis () apply to conformity of production.

Table 7 ECE Regulation 40/40.01 for Exhaust Emission Limits for Motorcycles with 2-stroke Engines.

	CO(g/km)	
Reference Weight R ⁽¹⁾ (kg)	ECE 40 ⁽²⁾	ECE40.01 ⁽²⁾
<100	16 (20)	12.8
100 - 300	$(16 + 24^{\frac{(R-100)}{200}})/200$	$(12.8 + 19.2^{\frac{(R-100)}{200}})/200$
{100 - 300}	$(20 + 30^{\frac{(R-100)}{200}})/200$	$(16 + 24^{\frac{(R-100)}{200}})/200$
>300	40 (50)	32 (40)
	HC (g/km)	
Reference Weight R ⁽¹⁾ (kg)	ECE 40 ⁽²⁾	ECE 40.01 ⁽²⁾
< 100	10 (13)	8 (10.4)
100 - 300	$(10 + 5^{\frac{(R-100)}{200}})/200$	$(8 + 4^{\frac{(R-100)}{200}})/200$
{100 - 300}	$(13 + 8^{\frac{(R-100)}{200}})/200$	$(10.4 + 6.4^{\frac{(R-100)}{200}})/200$
>300	15(21)	12 (16.8)

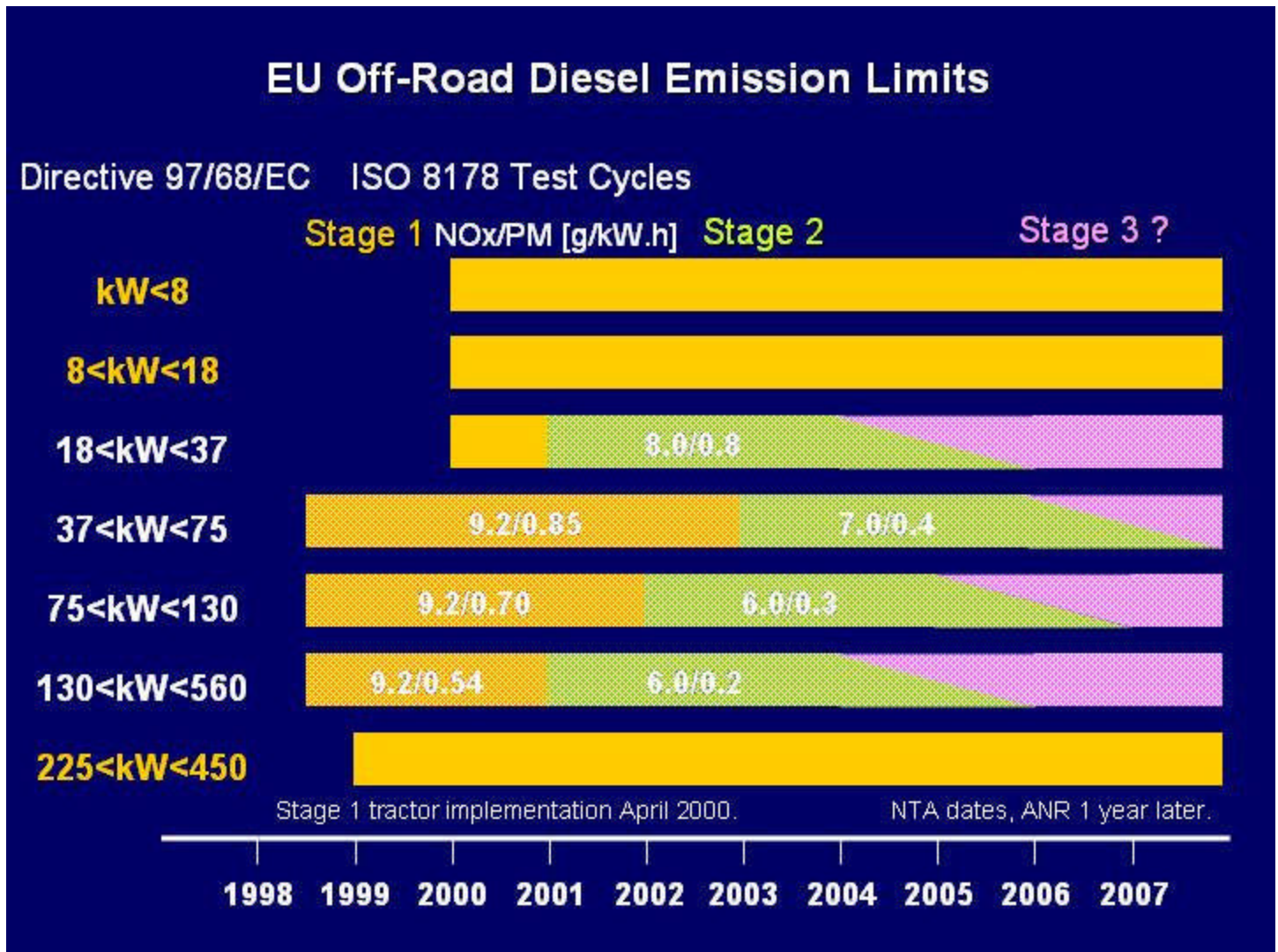
- Notes: 1) Reference weight (R) = Motorcycle weight + 75 kg.
2) Limits are for type approval. Limits given in parenthesis () apply to conformity of production.

Table 8 ECE Regulation 47 for Exhaust Emission Limits for Mopeds

Vehicle type	2-Wheeled		3-Wheeled	
Pollutant	CO g/km	HC g/km	CO g/km	HC g/km

Vehicle type	2-Wheeled		3-Wheeled	
Licensing	8.0	5.0	15.0	10.0
Production	9.6	6.5	18.0	13.0

Table 9 EU Off Road Limit Values



2. United States

Table 10 US Tier 1 Emission Standards For Light-Duty Vehicles (Passenger Cars) And Light-Duty Trucks Of Up To 6000 Lbs. Gvwr

	5 Years or 50,000 Miles					10 Years or 100,000 Miles			
	NMHC	CO	Cold CO	NOx	PM	NMHC	CO	NOx	PM
Non-Diesel									
LDTs (0-3,750 LBS. LVW) and Light-duty Vehicles	0.25	3.4	10	0.4	-	0.31	4.2	0.6	-
LDTs (3,751-5,750 LBS. LVW)	0.32	4.4	12.5	0.7	-	0.40	5.5	0.97	-
Diesel									
LDTs (0-3,750 LBS. LVW) and Light-duty Vehicles	0.25	3.4	-	1.0	0.08	0.31	4.2	1.25	0.10
LDTs (3,751-5,750 LBS. LVW)	0.32	4.4	-	-	0.08	0.40	5.0	0.97	0.10

Table 11 US Tier 1 Emission Standards For Light-Duty Trucks Of More Than 6,000 Lbs. Gvwr

LDT Test Weight	5 Years or 50,000 Miles			10 Years or 120,000 Miles			
	NMHC	CO	NOx	NMHC	CO	NOx	PM
3,751-5,750	0.32	4.4	0.7*	0.46	6.4	0.98	0.10
Over 5,750	0.39	5.0	1.1*	0.56	7.3	1.53	0.12

Standards are expressed in grams per mile (gpm).

*Not applicable to diesel-fueled LDTs.

Table 12 NLEV Exhaust Emission Standards (g/mi) For LDV's and LLDTs (50,000 miles)

Vehicle Type	Model Year	Fleet Average NMOG	NOX	CO
LDV and LDT (0-3750 LVW)	1999*	0.148	0.2	3.4
	2000*	0.095	0.2	3.4
	2001 and later**	0.075	0.2	3.4
LDT (3751-5750 LVW)	1999*	0.190	0.4	4.4
	2000*	0.124	0.4	4.4
	2001 and later**	0.100	0.4	4.4

* 9 Northeastern States and DC, except New York and Massachusetts

** All states except California, New York, Massachusetts, Vermont and Maine, which have the California standards.

Table 13 Tier 2 Light-Duty Full Useful Life Exhaust Emission Standards

(Grams per mile)

Bin#	NOx	NMOG	CO	HCHO	PM	Comments
10	0.6	0.156/0.230	4.2/6.4	0.018/0.027	0.08	a,b,c,d
9	0.3	0.090/0.180	4.2	0.018	0.06	a,b,e
The above temporary bins expire in 2006 (for LDVs and LLDTs) and 2008 (for HLDTs)						

8	0.20	0.125/0.156	4.2	0.018	0.02	b,f
7	0.15	0.090	4.2	0.018	0.02	
6	0.10	0.090	4.2	0.018	0.01	
5	0.07	0.090	4.2	0.018	0.01	
4	0.04	0.070	2.1	0.011	0.01	
3	0.03	0.055	2.1	0.011	0.01	
2	0.02	0.010	2.1	0.004	0.01	
1	0.00	0.000	0.0	0.000	0.00	

NOTES

- a. Bin deleted at end of 2006 model year (2008 for HLDTs).
- b. The higher of the two temporary NMOG, CO and HCHO values apply only to HLDTs.
- c. An additional higher temporary bin restricted to MDPVs is discussed below.
- d. Optional temporary NMOG standard of 0.280 g/mi applies for qualifying LDT4s and MDPVs only.
- e. Optional temporary NMOG standard of 0.130 g/mi applies for qualifying LDT2s only.
- f. Higher temporary NMOG value of 0.156g/mi deleted at end of 2008 model year.

Table 14 Highway Heavy-Duty Emission Standards

YEAR	HC (g/bhp-hr)	CO (g/bhp-hr)	HC + NOX (g/bhp-hr)	NOx (g/bhp-hr)	DIESEL PARTICULATE (g/bhp-hr)
<u>Diesel:</u>					
1991-93	1.3	15.5		5.0	0.25
1994-97	1.3	15.5		5.0	0.10
1998	1.3	15.5		4.0	0.10
2004	1.3	15.5	2.4**		
<u>Urban Buses:</u>					
1991-92	1.3	15.5		5.0	0.25
1993	1.3	15.5		5.0	0.10
1994-95	1.3	15.5		5.0	0.07
1996-97	1.3	15.5		5.0	0.05*
1998	1.3	15.5		4.0	0.05*

Otto-cycle	HC (g/bhp-hr)	CO (g/bhp-hr)		NOx (g/bhp-hr)	EVAPORATIVE HC (g/test)
1991-97 (A)					
(B)	1.1	14.4		5.0	3.0
	1.9	37.1		5.0	4.0
1998					
(A)					
(B)	1.1	14.4		4.0	3.0
	1.9	37.1		4.0	4.0

Note:

"(A)" denotes the standard for engines in trucks ? 14,000 lbs. Gross Vehicle Weight Rating (GVWR).

"(B)" denotes the standard for engines in trucks ? 14,000 lbs. GVWR.

*.07 g/bhp-hr in-use.

** optional standards of 2.5 are permitted with a NMHC Cap of 0.5

Table 15 Heavy-Duty Engine Exhaust Emissions Standards Starting in 2007

	Standard (g/bhp-hr)		Phase-In by Model Year ^a			
			2007	2008	2009	2010
Diesel	NOx	0.20	50%	50%	50%	100%
	NMHC	0.14				
	PM	0.01	100%	100%	100%	100%
Gasoline	NOx	0.20	0%	50%	100%	100%
	NMHC	0.14				
	PM	0.01				

^a Percentages represent percent of sales.

Table 16 US EPA Standards For Large Nonroad CI Engines

Net Power (kW)	HC (g/kW-hr)	CO (g/kW-hr)	NOX (g/kW-hr)	PM (g/kW-hr)	Smoke (A/L/P)	Implementation Data
<560?	1.3	11.4	9.2	0.54	20/15/50	January 1, 2000
? 130 to ? 560						January 1, 1996
?75 to <130			9.2		20/15/50	January 1, 1997

Net Power (kW)	HC (g/kW-hr)	CO (g/kW-hr)	NOX (g/kW-hr)	PM (g/kW-hr)	Smoke (A/L/P)	Implementation Data
?37 to <75			9.2		20/15/50	January 1, 1998

Table 17 Emission Standards For CI Non Road Engines in g/kW-hr (g/hp-hr)

Engine Power	Tier	Model Year	NMHC + NOx	CO	PM
kW<8 (hp<11)	Tier 1	2000	10.5 (7.8)	8.0 (6.0)	1.0 (0.75)
	Tier 2	2005	7.5 (5.6)	8.0 (6.0)	0.80 (0.60)
8?kW<19 (11?hp<25)	Tier 1	2000	9.5 (7.1)	6.6 (4.9)	0.80 (0.60)
	Tier 2	2005	7.5 (5.6)	6.6 (4.9)	0.80 (0.60)
19?kW<37 (25?hp<50)	Tier 1	1999	9.5 (7.1)	5.5 (4.1)	0.80 (0.60)
	Tier 2	2004	7.5 (5.6)	5.5 (4.1)	0.60 (0.45)
37?kW<75 (50?hp<100)	Tier 2	2004	7.5 (5.6)	5.0 (3.7)	0.40 (0.30)
	Tier 3	2008	4.7 (3.5)	5.0 (3.7)	—
75?kW<130 (100?hp<175)	Tier 2	2003	6.6 (4.9)	5.0 (3.7)	0.30 (0.22)
	Tier 3	2007	4.0 (3.0)	5.0 (3.7)	—
130?kW<225 (175?hp<300)	Tier 2	2003	6.6 (4.9)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	—
225?kW<450 (300?hp<600)	Tier 2	2001	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	—
450?kW<560 (600?hp<750)	Tier 2	2002	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)
	Tier 3	2006	4.0 (3.0)	3.5 (2.6)	—
kW?560 (hp?750)	Tier 2	2006	6.4 (4.8)	3.5 (2.6)	0.20 (0.15)

Table 18 Tier 4 PM Emission Standards (g/bhp-hr)

Rated Power	Model Year					
	2008	2009	2010	2011	2012	2013
<25 hp	0.30 ^a					
25 to <75 hp	0.22 ^b					0.02
75 to <175 hp					0.01	
175 to 750 hp				0.01		

Notes:

Walsh, 6/3/2005,

- a) For air-cooled, hand-startable, direct injection engines under 11 hp, a manufacturer may instead delay implementation until 2010 and demonstrate compliance at a PM standard of 0.45 g/bhp-hr.
- b) A manufacturer has the option of skipping the 0.22 g/bhp-hr PM standard for all 50-75 hp engines; the 0.02 g/bhp-hr PM standard would then take effect in 2012 for all 50-75 hp engines.

Table 19 Tier 4 NOx and NMHC Emission Standards (g/bhp-hr)

Rated Power	NOx	NMHC
25 to <75 hp	3.5 NMHC + NOx ^a	3.5 NMHC + NOx ^a
75 to <175 hp	0.30	0.14
175 to 750 hp	0.30	0.14

Notes:

- a) This is the existing Tier 3 combined NMHC+NOx standard for the 50-75 hp engines in this category; in 2013 it would apply to the 25-50 hp engines as well.

Table 20 Tier 4 NOx and NMHC Phase-in Schedule

Rated Power	Model Year			
	2011	2012	2013	2014
25 to <75 hp			100%	
75 to <175 hp		50% ^a	50% ^a	100% ^a
175 to 750 hp	50%	50%	50%	100%

Notes:

- a) Manufacturers may use banked Tier 2 NMHC+NOx credits to demonstrate compliance with the proposed 75-175 hp engine NOx standard in this year. Alternatively, manufacturers may forego this special banked credit option and meet an alternative phase-in schedule.

Table 21 Exhaust Emissions Standards For Locomotives

Tier & Duty Cycle	Gaseous and Particulate Emissions (g/bhp-hr)			
	HC	CO	NOx	PM
Tier 0 Line-Haul Duty Cycle	1.00	5.0	9.5	0.60
Tier 0 Switch Duty Cycle	2.10	8.0	14.0	0.72
Tier 1 Line-Haul Duty Cycle	0.55	2.2	7.4	0.45
Tier 1 Switch Duty Cycle	1.20	2.5	11.0	0.54
Tier 2 Line-Haul Duty Cycle	0.30	1.5	5.5	0.20
Tier 2 Switch Duty Cycle	0.60	2.4	8.1	0.24

Table 22 Emissions Standards and Dates for Marine Diesel Engines

Category	Displacement	Starting	NOx-	PM	CO
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	(liters/cylinder)	Date	HC (g/kW- hr)	(g/kW- hr)	(g/kW- hr)
1	Power > 37kW Disp <0.9	2005	7.5	0.40	5.0
	0.9 to 1.2	2004	7.2	0.30	5.0
	1.2 to 2.5	2004	7.2	0.20	5.0
	2.5 to 5.0	2007	7.2	0.20	5.0
2	5.0 to 15	2007	7.8	0.27	5.0
	15 to 20 and Power<3300 kW	2007	8.7	0.50	5.0
	15 to 20 and Power> 3300 kW	2007	9.8	0.50	5.0
	20 to 25	2007	9.8	0.50	5.0
	25 to 30	2007	11.0	0.50	5.0

Table 23 Recreational Marine Diesel Emissions Standard

Engine Size (Liters/cylinder)	Implementation Date	HC + NOx g/kW-hr	PM g/kW-hr	CO g/kW-hr
0.5 to 0.9	2007	7.5	0.40	5.0
0.9 to 1.2	2006	7.2	0.30	5.0
1.2 to 2.5	2006	7.2	0.20	5.0
Above 2.5	2009	7.2	0.20	5.0

Table 24 Emissions Standards for Large SI Engines

Tier/Year	HC + NOx	CO
Tier 1 starting in 2004	4.0 g/kW-hr	50 g/kW-hr

Tier 2 starting in 2007	2.7 g/kW-hr	4.4 g/kW-hr
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Table 25 Phase 1 Standards For Small SI Utility Engines at or below 25 hp (19 kilowatts)^{1, 2}

Class	Application	Displacement	HC&NOx	HC	CO	NOx
I	nonhandheld	<225	16.1		469	
II	nonhandheld	? 225	13.4		469	
III	handheld	<20		295	805	5.36
IV	handheld	? 20, <50		241	805	5.36
V	handheld	? 50		161	603	5.36

Table 26 Phase 2 HC + NOx Emission Standards for Nonhandheld Engines (in g/kW-hr)

Engine Class	Model Year 2001	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class I	25.0	25.0	25.0	25.0	25.0
Class II	18.0	16.6	15.0	13.6	12.1

Table 27 Phase 2 HC + NOx Emission Standards for Handheld Engines (in g/kW-hr) Showing Phase-in by Percentage of Production

Engine Class	HC + NOx Emission Standard	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class III	210	20%	40%	70%	100%
Class IV	172				
Class V	116				

When compared to Phase 1 standards, Phase 2 standards may not *appear* more stringent in all cases. This is because Phase 1 standards are "new engine" standards and Phase 2 standards are in-use standards.

Table 28 Recreational Vehicle Exhaust Emissions Standards

Vehicle	Model Year	Emissions Standards		Phase In
		HC g/kW-hr	CO g/kW-hr	
Snowmobile	2006	100	275	50%
	2007-09	100	275	100%

¹ Applies to engines manufactured from the 1997 model year (except Class V engines which have until January 1, 1998)

² Applies to all SI engines at or below 25 hp, except for those used in aircraft, marine vessels, and recreational equipment.

	2010	75	275	
	2012	75	200	
		HC+NOx g/km	CO g/km	
Off-highway Motorcycle	2006	2.0	25.0	50%
	2007 and later	2.0	25.0	100%
ATVs	2006	1.5	35.0	50%
	2007 and later	1.5	35.0	100%

3. California

Table 29 'LEV1' Exhaust Emissions Standards for Passenger Cars and Light-Duty Trucks Operating on Gasoline.

Note: These vehicles have a useful life of 100,000 miles with standards at both 50,000 mile and 100,000 miles. The 50,000/100,000-mile standards of NMHC = 0.25/0.31, CO = 3.4/4.2 and NOx = 0.4/0.6 are called the 'Tier1' standards that preceded the LEV1 standards.

Vehicle	Durability Basis	Emissions Category	NMOG* (g/mi)	CO (g/mi)	NOx (g/mi)	HCHO (mg/mi)	Diesel PM (g/mi)
PC, LDT <3750LVW	50,000	TLEV	0.125	3.4	0.4	15	n/a
		LEV	0.075	3.4	0.2	15	n/a
		ULEV	0.040	1.7	0.2	8	n/a
	100,000	TLEV	0.156	4.2	0.6	18	0.08
		LEV	0.090	4.2	0.3	18	0.08
		ULEV	0.055	2.1	0.3	11	0.04
LDT 3751-5750 LVW	50,000	TLEV	0.160	4.4	0.7	18	n/a
		LEV	0.100	4.4	0.4	18	n/a
		ULEV	0.050	2.2	0.4	9	n/a
	100,000	TLEV	0.200	5.5	0.9	23	0.10
		LEV	0.130	5.5	0.5	23	0.10
		ULEV	0.070	2.8	0.5	13	0.05

* NMOG is substituted for conventional hydrocarbons because the constituents in the exhaust could change as fuels change in the future; these emissions will be reactivity adjusted for cleaner burning fuels.

Table 30 Implementation Rates for Conventional Vehicles, TLEVs, LEVs, ULEVs, and ZEVs Used to Calculate Fleet Average Standards for Passenger Cars.

MODEL YEAR	TLEV LEV ULEV ZEV* FLEET AVERAGE						0.00 NMOG STANDARD
	0.39	0.25	0.125	0.075	0.040	0.00	
1994	10%	80%	10%				0.250
1995		85	15				0.231
1996		80	20				0.225
1997		73		25%	2%		0.202
1998		48		48	2	2%	0.157
1999		23		73	2	2	0.113
2000				96	2	2	0.073
2001				90	5	5	0.070
2002				85	10	5	0.068
2003				75	15	10	0.062

* The percentage requirements for ZEVs were originally mandatory starting in 1998. The requirement was revised and applicable in 2003; and revised again changing the applicability to 2005 model year.

This table was created for the staff report for the LEV regulation. It was intended to demonstrate how manufacturers could vary the mix of vehicles to attain a fleet NMOG standard. The percent values as shown were used to calculate the NMOG fleet average. Only the NMOG fleet averages are the standards which have to be met; compliance with the percentage levels in the table is not required.

Table 31 California LEV 2 Standards

Vehicle Type	Mileage for Compliance	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Diesel Particulate (g/mi)
All PCs; LDTs<8,500 lbs. GVW	50000	LEV	0.075	3.4	0.05	15	n/a
		LEV ¹	0.075	3.4	0.07	15	n/a
		ULEV	0.04	1.7	0.05	8	n/a
	120000	LEV	0.09	4.2	0.07	18	0.01
		LEV ¹	0.09	4.2	0.1	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.01	1	0.02	4	0.01
	150000	LEV	0.09	4.2	0.07	18	0.01
		LEV ¹	0.09	4.2	0.1	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.01	1	0.02	4	0.01
	MDVs 8,500-10,000 lbs. GVWR	120000	LEV	0.195	6.4	0.2	32
ULEV			0.143	6.4	0.2	16	0.06
SULEV			0.1	3.2	0.1	8	0.06
MDVs 10,001-14,000 lbs. GVWR	120000	LEV	0.23	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06

(1) This optional LEV standard applies to up to 4% of a manufacturers LDT2 fleet with a maximum base payload in excess of 2500 lbs.

After the 2003 model year, Tier 1 standards (0.25 grams per mile NMHC) and TLEV standards were eliminated as available emissions categories.

The 50°F multiplier for LEV, ULEV and SULEVs would be 2.0 for NMOG and Formaldehyde.

The cold temperature carbon monoxide standard would be 10.0 g/mi for PC, LDTs 0-3750 LVW; and 12.5 g/mi for LDTs 3751 LVW-8500 GVW.

Table 32 Implementation Rates for TLEVs, LEVs, ULEVs, SULEVs, and ZEVs Used to Calculate Fleet Average LEV 2 Standards for Passenger Cars and Light-Duty Trucks 0-3750 lb. LVW

Model Year	TLEV	LEV	ULEV	SULEV	ZEV	Fleet Average Requirement
2004	2	48	35	5	10	0.053
2005	2	40	38	10	10	0.049
2006	2	35	41	12	10	0.046
2007	1	30	44	15	10	0.043
2008	1	25	44	20	10	0.04
2009	1	20	49	20	10	0.038
2010±	1	15	49	25	10	0.035

This Table above is from the staff report for the LEV2 regulations. Like the earlier Table 30, it represents the percentages that manufactures could use to meet the fleet NMOG standards. These example percentages were used to calculate the fleet average NMOG requirement but are not themselves targets which manufacturers must meet. The only values that manufacturers must meet are those for fleet NMOG average which is shown in the last column.

Table 33 Implementation Rates for TLEVs, LEVs, ULEVs, SULEVs, and ZEVs Used to Calculate Fleet Average LEV 2 Standards for Light-Duty Trucks 3751- LVW-8500 lb GVW

Year	TLEV	LEV	ULEV	SULEV	Fleet Average
2004	19	81	0	0	0.085
2005	16	63	21	0	0.076
2006	8	48	38	6	0.062
2007	2	43	50	5	0.055
2008	1	35	54	10	0.050

2009	1	25	64	10	0.047
2010±	1	20	64	15	0.043

These percentages represent one way that manufactures could meet the fleet NMOG standards. These are the values that ARB used to calculate the fleet average NMOG requirement targets. The only values that manufacturers must meet are those for fleet NMOG average which is shown in the last column.

Table 34 Speciality Vehicle Engines (less than 25 horsepower) in California

Year	Displacement	HC and NOx	CO	PM
1995-98	<225cc	12.0 g/bhp-hr	300 g/bhp-hr	0.9 g/bhp-hr
1995-98	225cc and greater	10.0	300	0.9
1999 and later	all	3.2	100	0.25

Table 35 Speciality Vehicle Engines and Go-Carts (greater than 25 horsepower) in California

Year	Displacement	HC and NOx	CO	PM
1997 and later	all	3.2	100	0.25

Table 36 Off-Road Motorcycles and All-Terrain Vehicles in California

At a useful life of 5 years or 10,000 km

Year	Displacement	HC	CO
1997-98	greater than 90cc	1.2 g/km *	15.0 g/km
1999 and later	all	1.2 *	15.0

*Can be applied as a corporate average

Table 37 All-Terrain Vehicles (Engine Test Option)

At a useful life of 5 years or 10,000 km equivalent

Year	Displacement	HC and NOx	CO
1997 and later	90 - 225cc	12.0 g/bhp-hr*	300 g/bhp-hr
1999 and later	< 90 cc		
1997 and later	225cc and greater	10.0*	300

*Can be applied as a corporate average

Table 38 Golf Carts in California

Year	HC	CO	NOx	PM
1997 and later	Zero	Zero	Zero	Zero

Table 39 California Exhaust Emission Standards for Large Off-Road SI Engines

(grams per brake horsepower-hour)

Model Year	Engine Displacement	Durability Period (hours)	Hydrocarbon plus Oxides of Nitrogen	Carbon Monoxide
2002 and Subsequent	<1.0 liter	1000	9.0	410
2001 through 2003	1.0 liter or greater	N/A	3.0	37.0
2004 through 2006	1.0 liter or greater	Zero Hours and 3500 hours (as shown by deterioration factor)	3.0 ¹	37.0 ¹
2007 and Subsequent	1.0 liter or greater	5000 hours or 7 years	3.0	37.0

1. For 2004 through 2006 model-year engine families, in-use compliance standards shall be 4.0 g/bhp-hr Hydrocarbon plus Oxides of Nitrogen and 50 g/bhp-hr Carbon Monoxide for a durability period of 5000 hours or 7 years.

Table 40. Small Off-Road Engine Exhaust Emission Standards (≤ 19 kW), HC+NO_x / CO / PM in g/kW-hr

Displacement Category	19 95	19 96	19 97	19 98	19 99	20 00	20 01	20 02	20 03	20 04	Displacement Category	2005	20 06	20 07	20 08	20 09	20 10	20 11	20 12	2013+	
< 20 cc	HC: 295 / NO _x : 5.36 / CO: 805					72 / 536 / 2.0 ^b					< 50 cc	50 / 536 / 2.0 ^b									
≥ 20 cc - < 50cc	HC: 241 / NO _x : 5.36 / CO: 805										< 50 cc	50 / 536 / 2.0 ^b									
≥ 50 cc - ≤ 65 cc	HC: 161 / NO _x : 5.36 / CO: 402										≥ 50 cc - ≤ 80 cc	72 / 536 / 2.0 ^b									
> 65cc - < 225cc	16.1 / 40 / 2 / 1.2 ^a	16.1 / 467 / 1.2 ^a				16.1 / 467 / -	16.1 / 549 / - Horizontal-shaft	> 80cc - < 225cc Horizontal-shaft	16.1 / 549 / -		10 / 549 / -										
							16.1 / 467 / - Vertical-shaft	> 80cc - < 225cc Vertical-shaft	16.1 / 467 / -												
≥ 225 cc	13.4 / 40 / 2 / 1.2 ^a	13.4 / 467 / 1.2 ^a				13.4 / 467 / -	12.1 / 549 / -	≥ 225 cc	12.1 / 549 / -		8.0 / 549 / -										

- a) HC+NO_x, CO and PM standards applicable to all diesel-cycle engines. PM standard is not applicable to spark-ignition engines.
 b) PM standard applicable to all two-stroke engines.

Small Off-Road Engine Evaporative Emissions - Performance and Design Standards

Displacement Category	Requirements		20 06	20 07	20 08	20 09	20 10	20 11	20 12	2013+
≤ 80 cc	Fuel Tank Permeation g ROG/m ² /day		-	2						
Walk-Behind Mowers > 80cc - < 225cc	Performance Requirements*	Diurnal Standard Grams HC/day	-	1.3	1.0					
	Design Requirements	Fuel Hose Permeation g ROG/m ² /day	15	-						-
Non Walk-Behind Mowers > 80cc - < 225cc	Performance Requirements*	Diurnal Standard Grams HC/day	-	1.20 + 0.056 × tank vol.(L)						0.95+0.056×tank vol.
	Design Requirements	Fuel Hose Permeation g ROG/m ² /day	15							
		Fuel Tank Permeation g ROG/m ² /day	-	2.5						1.5
		Carbon Canister or Equivalent Butane Working Capacity Grams HC	-	1.4 g/L (tanks ≥ 3.78 L) or 1.0 g/L (tanks < 3.78L)						
≥ 225 cc**	Performance Requirements*	Diurnal Standard Grams HC/day	-	1.20 + 0.056 × tank vol.(L)						

	Design Requirements	Fuel Hose Permeation g ROG/m ² /day	15		
		Fuel Tank Permeation g ROG/m ² /day	-	2.5	1.5
		Carbon Canister or Equivalent Butane Working Capacity Grams HC	-	1.4 g/L (tanks ≥ 3.78L) or 1.0 g/L (tanks < 3.78L)	

* For model year 2006 only, all engines and equipment with displacements > 80 cc - <225 cc must comply with the fuel hose permeation design requirement. Engines and equipment with displacements ≥ 225 cc must comply with the fuel hose permeation design requirement for model years 2006 and 2007 only.

** Small production volume engines or equipment are exempted from the diurnal standards and the fuel tank permeation standard. In addition, these engines or equipment are not required to be configured with low permeation fuel hoses and carbon canisters until model year 2010.

Table 41 Highway (On-Road) Motorcycles in California

Standards applied at useful life of: 5.0 years or 12000 km for Class I (50-169cc)

5.0 years or 18000 km for Class II (170-279cc)

5.0 years or 30000 km for Class III (280cc and greater)

Year	Displacement	HC	HC and NOx	CO
1978-1979	50 to < 170cc	5.0 g/km		17 g/km
1978-1979	170 to < 750cc	5.0+0.0155(D-170)*		17
1978-1979	≥ 750cc	14		17
1980-1981	≥ 50cc	5.0		17
1982 and later	50 to 279cc	1.0		12
1982-1985 (manufactured prior to March 1, 1985)	≥ 280cc	2.5		12
1985 (manufactured after February 28, 1985)-1987	≥ 280cc	1.4**		12
1988-2003	280 to 699cc	1.0**		12
1988-2003	≥ 700cc	1.4**		12
2004-2007	≥ 280cc		1.4** g/km	12

2008 and later	≥ 280cc		0.8**	12
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* D = engine displacement of motorcycles in cubic centimeters.

** May be applied as a corporate average not to exceed 2.5 g/km HC or HC plus NOx

4. Japan

Table 42 Stage 1 Japanese Exhaust Emission Standards for Passenger Cars.

Spark Ignition Engines ¹				
Test Cycle	Emissions	Units	1978 Standards ^{2,3}	
			Mean ⁴	Max. ^{5,6}
10-15 Mode ² Hot Start Test	HC CO NOx	g/km g/km g/km	0.25 2.1 0.25	0.39 2.7 0.48
11-Mode Cold Start Test	HC CO NOx	g/test g/test g/test	7.0 60.0 4.4	9.5 85.0 5.0
	Evap. CC EM	g/test	2.0 0	
Idle Idle	HC CO	ppm % vol	1200 4.5	
Diesel Engines				
		Until 3.31.00	After 4.1.00	
Smoke Test ⁷ 3-Mode Free Accel.	Blackness of Filter Paper	40%	25%	
10-15 Mode ² Hot Start Test	Ref Mass [kg]	Mean ^{4,8} Max ^{6,8}	Mean ⁴	Max ^{5,6}
	<1265 HC	0.40 0.62		
	CO	2.10 2.70	0.40	0.62
	NOx	0.50 ^a 0.72 ^a	2.10	2.7
	PM	0.20 ^a 0.34 ^a	0.40 ^b	0.55 ^b
			0.08 ^b	0.14 ^b
	>1265 HC	0.40 0.62		
	CO	2.10 2.70	0.40	0.62
	NOX	0.60 ^a 0.84 ^a	2.10	2.70
	PM	0.20 ^a 0.34 ^a	0.40 ^c	0.55 ^c
			0.08 ^c	0.14 ^c

Notes: CC-EM = Crankcase Emission:

1. Covers vehicles [no mass limitation] that serve exclusively for the transport of passengers [maximum 10 people].
2. New Hot Start Test (10-15-Mode) superseded the 10-mode test with effect from 1.11.91 for new models. 1.4.93 for importers. The exhaust emission limits remain unchanged.
3. 80 000 km durability run optional; acceptance of US durability run possible. Advantage: if standards are met over 80,000 km, the

- mandatory periodic catalyst change does not apply. Alternatively certification is allowed with a 30 000 km durability run and demonstration of compliance over 45 000 km [by extrapolation].
4. To be met as a type approval limit and as a production average (for production control 1% of production has to be tested). If sales exceed 2000 per vehicle model per calendar year, the NO_x standards are only applicable if reference mass >1000 kg.
 5. To be met as a type approval limit if sales are less than 2000 per vehicle model per calendar year and generally as an individual limit in series production. For gasoline and diesel engines (Hot Start Test only) deterioration factors from the durability runs have to be applied.
 6. Applicable for simplified certification procedure if sales are less than 1000 per vehicle model per calendar year without durability run. Exhaust emission testing is necessary for every 50th production example per vehicle model.
 7. 3 Mode: Full load smoke test at three specified engine speeds.
Free Acceleration: Start from idle, integrated smoke measurement over a 15 second cycle, (4 sec. maximum acceleration, followed by 11 sec. coast).
 8. Effective Dates
Domestic Manufacturers: 1.10.86 (Manual transmission); 1.10.87 (Automatic transmission)
Importers: 1.04.88 (Manual transmission); 1.10.89 (Automatic transmission)
 - a. Effective Dates
Domestic Manufacturers
Reference Mass <1265 kg): 1.10.94 - New models; 1.4.95 - Existing models
Reference Mass > 1265 kg):1.10.94 - New Models; 1.4.95 Existing models
Importers:
Reference Mass < 1265 kg - 1.4.96 > 1265 kg. - 1.4.96; Effective Date for PM limit: 1.4.96.
 - b. Effective Dates
Domestic Manufacturers - 1.10.98 (New models); 1.9.99 (Existing models)
Importers 1.4.00
 - c. Effective Dates
Domestic Manufacturers - 1.10.97 (New models); 1.7.99 (Existing models)
Importers 1.4.00

Table 43 Stage 2 Limits For Gasoline And LPG Motor Vehicles In Japan (Exhaust Emissions)

Category of Motor Vehicles		Target Values of Permissible Limits (Mean Values)			Measurement Method
		Nitrogen Oxides	Hydrocarbons	Carbon Monoxide	
Ordinary-sized, small-sized and mini-sized motor vehicles fueled by gasoline or LPG and used exclusively for carriage of passengers with a passenger capacity of 10 persons or less (excluding two-wheeled motor vehicles)		0.08	0.08	0.67	10-15 Mode (g/km)
		1.4	2.2	19	11-Mode (g/test)
Mini-sized motor vehicles fueled by gasoline or LPG (excluding those used exclusively for carriage of passengers, those with 2-stroke engine, and two-wheeled motor vehicles)		0.13	0.13	3.3	10-15 Mode (g/km)
		2.2	3.5	38	11- Mode (g/test)
Ordinary-sized and small-sized motor	Those with a gross vehicle weight of	0.08	0.08	0.67	10-15 Mode (g/km)

		Target Values of Permissible Limits (Mean Values)			
vehicles fueled by gasoline or LPG (excluding those used exclusively for carriage of passengers with a passenger capacity of 10 persons or less and two-wheeled motor vehicles)	1700 kg or less	1.4	2.2	19	11-Mode (g/test)
	Those with a gross vehicle weight in excess of 1700 kg but 3500 kg or less	0.13	0.08	2.1	10-15 Mode (g/km)
		1.6	2.2	24	11-Mode (g/test)
	Those with a gross vehicle weight in excess of 3500 kg	1.4	0.58	16	Gasoline 13-Mode (g/kWh)

Implementation Schedule: Light Duty Vehicles - 2000
Medium & Heavy Duty Vehicles - 2001
Mini Vehicles - 2002

Table 44 Diesel Vehicle Limits in Japan

Vehicle Category	NOx	Particulate	Year of Implementation
GVW < 1.7 Tons	0.4 g/km	0.08 g/km	1997
1.7 < GVW < 2.5 Tons (M)	0.7 g/km	0.09 g/km	1997
1.7 < GVW < 2.5 Tons (A)	0.7 g/km	0.09 g/km	1998
2.5 < GVW < 3.5 Tons	4.5 g/kWh	0.25 g/kWh	1997
3.5 < GVW < 12 Tons	4.5 g/kWh	0.25 g/kWh	1998
Above 12 Tons	4.5 g/kWh	0.25 g/kWh	1999

Table 45 Japanese Stage 2 Limits For Diesel Vehicles

Vehicle Category	Test Procedure (Unit)	Component	Current Limit		New Short Term Target	
			Enforcement Year	Limit Value	Enforcement Year	Target Value
Small Sized Cars ~1.25 tons ¹	10-15 Mode (g/km)	NOX	1997	0.4	2002	0.28
		PM		0.08		0.052
		HC	1986	0.4		0.12

			Current Limit		New Short Term Target	
Medium Sized Cars 1.25 tons~ ¹	D13 Mode (g/kWh)	CO	1998	2.1	2003	0.63
		NOx		0.4		0.3
		PM		0.08		0.56
		HC	1986	0.4		0.12
CO		2.1		0.63		
Light Duty Trucks, Buses ~1.7 tons ²		NOX	1997	0.4		0.28
		PM		0.08		0.052
		HC	1988	0.4		0.12
	CO	2.1		0.63		
Light Duty Trucks, Buses 1.7~2.5 tons ²	NOX	1997&1998	0.7	2003	0.49	
	PM		0.09		0.06	
	HC	1993	0.4		0.12	
	CO		2.1		0.63	
Heavy Duty Trucks, Buses 2.5~12 tons ^{2,3}	NOx	1998	4.5	2003	3.38	
	PM		0.25		0.18	
	HC	1994	2.9		0.87	
	CO		7.4		2.22	
Heavy Duty Trucks, Buses 12 tons~ ^{2,4}	NOx	1994	6.00 (DI)	2004	3.38	
			5.00 (IDI)			
		1999	4.5			
	PM	1994	0.7		0.18	
		1999	0.25			
	HC	1994	2.9		0.87	
CO	1999	7.4	2.22			

- (1) Division is made according to the equivalent inertia weight (EIW)
(2) Division is made according to gross vehicle weight (GVW)
(3) Year 1997: GVW 2.5 ~ 3.5 tons; Year 1998: GVW 3.5 ~ 12 tons
(4) DI: Direct Injection; IDI: Indirect Injection

Table 46 Japanese Stage 3 Emissions Limits (2005)

		NOx	PM
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Diesel	EIW<1,250kg	0.14	0.013
	EIW>1,250kg	0.15	0.014
	GVW<1,750kg	0.14	0.013
	1,750kg<GVW<3,500kg	0.25	0.015
	3,500kg<GVW	2.0	0.027
Gasoline	Cars	0.05	
	LDVs	0.05	
	GVW<1,750kg	0.05	
	1,750kg<GVW<3,500kg	0.07	
	3,500kg<GVW	0.7	

Table 47 New Proposed Diesel Vehicle Standards For Japan

		PM	NOx	NMHC	CO	Date in Effect
Passenger Car		0.005 (-62%)	0.08 (-43%)	0.024 (-0%)	0.63 (-0%)	2009
Trucks And Buses	Light-Weight (GVW 1.7t or less)	0.005 (-62%)	0.08 (-43%)	0.024 (-0%)	0.63 (-0%)	2009
	Middle-weight (GVW over 1.7t ~3.5 t or less)	0.007 (-53%)	0.15 (-40%)	0.024 (-0%)	0.63 (-05)	1.7~2.5t 2010 2.5~3.5t 2009
	Heavy-weight	0.01 (-)	0.7 (-65%) (challenge)	0.17 (-0%)	2.22 (-)	3.5~12t 2010

	(GVW over 3.5t)	63%)	target about 1/3 of 0.7) (-88%)		0%)	Over 12t 2009
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Notes:

1. Units – Heavy Weight Trucks: g/kWh; all other in g/km
2. Lower column means percent reduction from 2005 standards
3. GVW = Gross vehicle weight; NMHC = non methane hydrocarbons

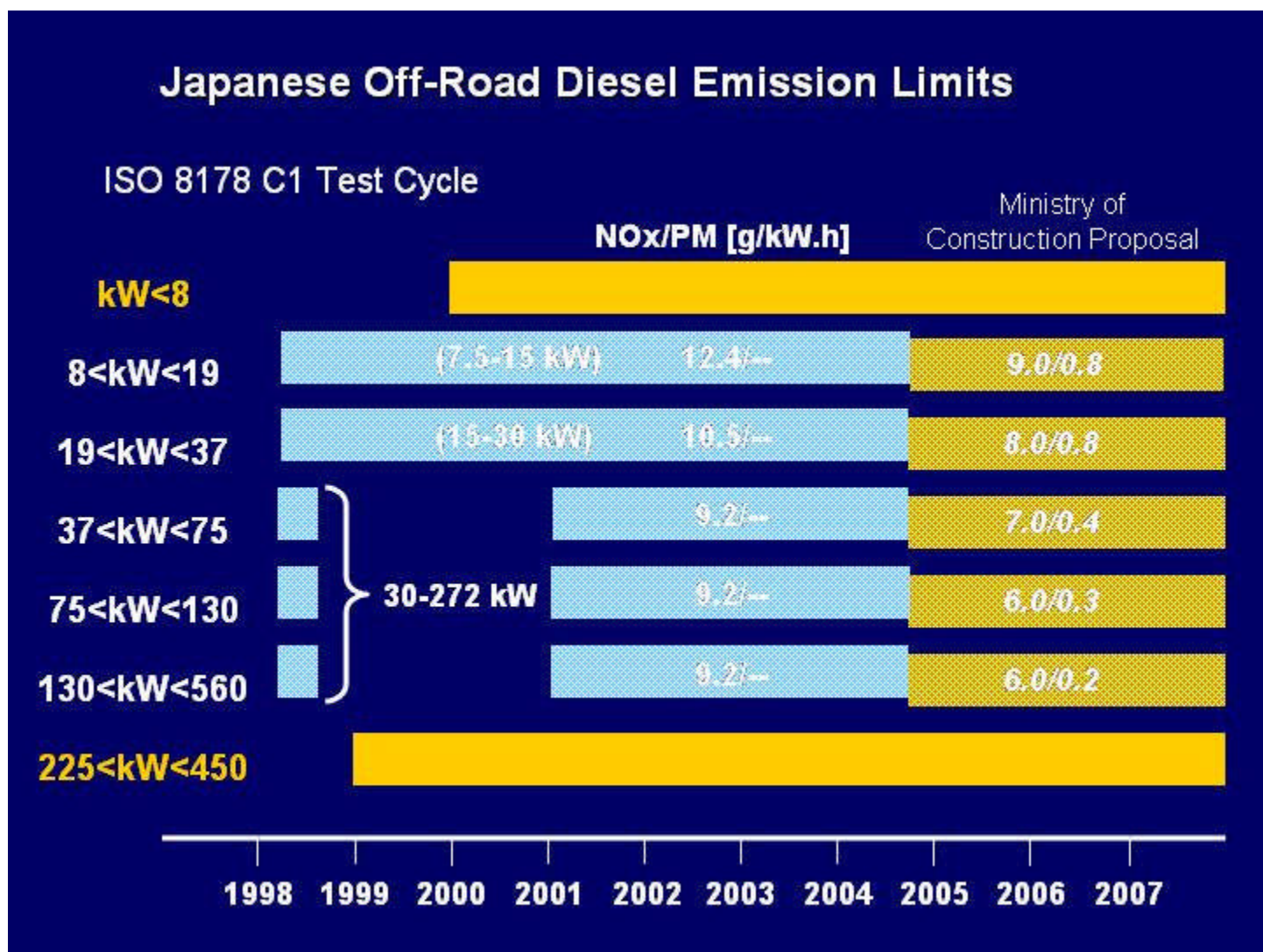
Table 48 New Proposed Gasoline Vehicle Standards For Japan

		PM	NOx	NMHC	CO	Date in Effect
Passenger Car		0.005 (New)	0.05 (0%)	0.024 (-0%)	0.63 (-0%)	2009
Trucks And Buses	Light-Weight (GVW 1.7t or less)	0.005 (New)	0.05 (0%)	0.024 (-0%)	0.63 (-0%)	2009
	Middle-weight (GVW over 1.7t ~3.5 t or less	0.007 (New)	0.07 (0%)	0.024 (-0%)	0.63 (-05)	2009
	Heavy-weight (GVW over 3.5t)	0.01 (New)	0.7 (0%)	0.17 (-0%)	2.22 (-0%)	2009

Notes:

1. Units – Heavy Weight Trucks: g/kWh; all other in g/km
2. Lower column means percent reduction from 2005 standards
3. GVW = Gross vehicle weight; NMHC = non methane hydrocarbons

Table 49 Japanese Off Road Vehicle Emissions Limits



5. Other

Table 50 Automotive Emissions Limits For Argentina For Light Duty Vehicles (2,800 Kg.)

Applicability	1	2	2A	3	1
YEAR	July 1, 1994	July 1, 1994	Jan. 1, 1995	Jan. 1, 1997	Jan. 1, 1999
Exhaust Emissions					
CO g/km	-	24	12	2	2
HC g/km	-	2.1	1.2	0.3	0.3
NOx g/km	-	2	1.4	0.6	0.6
CO Idle %	3	3	2.5	0.5	0.5
HC Idle ppm	600	600	400	250	250
Fuel Evaporation (g/test)	-	-	6	6	6
Crankcase	Zero	Zero	Zero	Zero	Zero
Equivalent To	-	Phase 1	Phase 2	Phase 3	Phase 3
		Brazil	Brazil	Brazil	Brazil
		1988	1992	1997	1997

Applicability:

1. Every Model and Configuration of Argentine manufacture.
2. Every new Configuration of Nationally manufactured or Imported Vehicle
- 2a. Same as 2, with the exception of vehicles not derived from automobiles.
3. Every new vehicle model manufactured in Argentina or imported.

Table 51 Argentina Limits For Heavy Duty Gasoline and Diesel Vehicles

Model Year	Emissions (g/kWh)				%	(ppm)
	CO	HC	NOx	PM	Idle CO*	Idle HC*
1995	11.2	2.4	14.4	.4/.68	3	660
1997	11.2	2.4	14.4	.4/.68	2.5	400
1996 Urban Buses	4.9	1.23	9	.4/.68	-	-
1998 Diesels	4	1.1	7	.15/.255	-	-

* Gasoline fueled only

Table 52 Automotive Emissions Limits For Brazil For Light Duty Vehicles (2,800 Kg.)

Exhaust Emissions			
CO g/km	24	12	2

Exhaust Emissions			
HC g/km	2.1	1.2	0.3
NOx g/km	2	1.4	0.6
Aldehydes		0.15	0.03
PM		0.5	0.5
CO Idle %	3	2.5	0.5
HC Idle ppm	600	400	250
Fuel Evaporation (g/test)	-	6	6
Crankcase	Zero	Zero	Zero
Year	1988	1992	1997

Diesel Passenger Cars are prohibited.

Table 53 Brazil Limits For Heavy Duty Vehicles (Grams per kilowatt hour) (R49 Test Procedure)

Effective Date**	CO	HC	NOx	PM
1/1/96	4.9	1.2	9	0.7/0.4*
1/1/00	4	1.1	7	0.15

*0.7 for engines below 85 kW; 0.4 for engines above.

**The phase in schedule for urban buses and domestically produced engines is slower.

Table 54 Vehicle Emissions Limits For Chile

Vehicle Type	Effective Date	CO	HC	NOx	PM	Test Cycle
		grams/kilometer				
Passenger Cars	1995	2.11	0.25	0.82	0.125	75 FTP
Light Duty Truck (<3860 kg)	1995	6.2	0.5	1.43	0.16	75 FTP
Heavy Duty		grams per kilowatt hour				

Vehicle Type	Effective Date	CO	HC	NOx	PM	Test Cycle
Diesel	Sept '94	4.5	1.1	8	0.36	ECE R 49
	Sept '98	4	1.1	7	0.15	
	Or	Grams per Brake Horsepower Hour				US
	Sept '94	15.5	1.3	6	0.36	
	Sept '98	15.5	1.3	5	0.1	
Heavy Duty Gasoline	Current	37.1	1.9	5	-	
Santiago Urban Bus	Sept '93	15.5	1.3	5	0.25	
	Sept '96	15.5	1.3	5	0.1	
	Or	Grams Per Kilowatt Hour				ECE R 49
	Sept '93	4.5	1.1	8	0.36	
	Sept '96	4	1.1	7	0.15	

Table 55 Vehicle Emissions Limits For Colombia

Vehicle Category	Unit	CO	HC	NOx	HC+NOx
Light Duty	g/km	2.3	0.25	0.62	
Medium Duty	g/km	11.2	1.05	1.43	
Heavy Duty	g/bhp-hr	25			10

Table 56 Australia Applicability of New Emissions ADRs to Each Vehicle Category

R Category	Equivalent ECE Category	Applicable New ADR (a),(b),(c),(d)	2002/3 (Diesel Vehicles) (e)		2003/4 (Petrol Vehicles)		2005/6 (Petrol Vehicles)		2006/7 (Diesel Vehicles)	
			Description	GVM (t)	Category					
Passenger Vehicles										
		Cars	Not Applicable	MA	M1	Light Duty	Euro 2	Euro 2 (f)	Euro 3 (f)	Euro 4
		Forward Control	Not Applicable	MB	M1	Light Duty	Euro 2	Euro 2 (f)	Euro 3 (f)	Euro 4
		Off-road	Not Applicable	MC	M1	Light Duty	Euro 2	Euro 2 (f)	Euro 3 (f)	Euro 4
Buses										
		Light	≤ 5	MD	M2 ≤ 3.5	Light Duty	Euro 2	Euro 2 (f)	Euro 3 (f)	Euro 4
					> 3.5 ≤ 5	Heavy Duty	Euro 3 or US 98 (f)	US 96 (g)	US 98 (g)	Euro 4 or US 2004 (f)
		Heavy	> 5	ME	M3	Heavy Duty	Euro 3 or US 98 (f)	US 96 (g)	US 98 (g)	Euro 4 or US 2004 (f)
Goods Vehicles (Trucks)										
		Light	≤ 3.5	NA	N1	Light Duty	Euro 2	Euro 2 (f)	Euro 3 (f)	Euro 4
		Medium	> 3.5 ≤ 12	NB	N2	Heavy Duty	Euro 3 or US 98 (f)	US 96 (g)	US 98 (g)	Euro 4 or US 2004 (f)
		Heavy	> 12	NC	N3	Heavy Duty	Euro 3 or US 98 (f)	Not applicable	Not applicable	Euro 4 or US 2004 (f)

Notes (a) – (g) to the Table are on the next page.

Notes to Table

(A) The introduction of *Euro 2* standards for light duty petrol and light duty diesel vehicles will be via a new ADR 79/00 *Emission Control for Light Vehicles*, which adopts the technical requirements of ECE R83/04.

(B) The introduction of *Euro 3* standards for light duty petrol vehicles, and *Euro 4* standards for light duty diesel vehicles, will be via a new ADR 79/01 *Emission Control for Light Vehicles*, which adopts the technical requirements of European Council Directive 98/69/EC. Directive 98/69/EC embodies the *Euro 3* and *Euro 4* requirements for light duty petrol and diesel vehicles, however the ADR will only mandate the *Euro 3* (pre 2005) provisions of 98/69/EC for petrol vehicles, but will allow petrol vehicles optional compliance with *Euro 4* standards.

(C) The introduction of *Euro 3* and *Euro 4* standards for medium-heavy duty diesel vehicles (all buses and trucks above 3.5tonnes GVM) will be via a new ADR 80/00 *Emission Control for Heavy Vehicles*, and ADR 80/01 *Emission Control for Heavy Vehicles*, respectively. These ADRs adopt the technical requirements of the proposed European Council Directive [COM(97)627, as amended by COM(98)776 & COM(99)89] amending European Council Directive 88/77/EEC.

(D) These new ADRs (ADRs79/00, 79/01, 80/00, 80/01) will replace the existing ADR37/01 and ADR70/00. The "/00" & "/01" versions represent the 2002-4 and 2005-7 groupings of the new requirements, respectively.

(E) A new smoke ADR (ADR30/01) will also apply to all categories of diesel vehicles. The smoke standard will apply from 2002/3 and will adopt UN ECE R24/03 and allow the US 94 smoke standards as an alternative. This new ADR will replace ADR30/00.

(F) Nominated standards also apply to vehicles fuelled with LPG or NG.

(G) UN ECE & EU do not have standards for medium-heavy petrol engines, hence US EPA is adopted in lieu.

Table 57 Hong Kong Automotive Fuel Specifications		
Starting 1 April 1997		
Diesel		
Properties	Range	ASTM Test Method
Sulphur (% by Wt.)	0.05 Maximum	ASTM D4294
Cetane Number	50 Minimum	ASTM D613
Viscosity (mm ² /s)	2.00-4.50	ASTM D445
Distillation (C) at 95%	370 Maximum	ASTM D86
Density (kg/l)	.820-.860	ASTM D1298/4052
Unleaded Petrol		
Properties	Range	ASTM Test Method
Lead (gr/L)	.005 Maximum	ASTM D3237
Sulphur (% Mass)	.05 Maximum	ASTM D1266
Motor Octane Number	85.0 Minimum	ASTM D2700
Research Octane Number	95.0 Minimum	ASTM D2699
Benzene (% Vol)	5.0 % Maximum	ASTM D4420
Methanol (% Vol) (a)	3 % Maximum	ASTM D5599
Ethanol (% Vol) (a)	5 % Maximum	ASTM D5599
Iso-propyl alcohol (% Vol) (a)	5 % Maximum	ASTM D5599
Tertiary butyl alcohol (% Vol) (a)	7 % Maximum	ASTM D5599
Iso-butyl alcohol (% Vol) (a)	7 % Maximum	ASTM D5599
Ethers containing 5 or more carbon atoms per molecule (% Vol) (a)	10 % Maximum	ASTM D5599
Other organic oxygenates (% Vol) (a)	7 % Maximum	ASTM D5599
Mixture of all organic oxygenates (% weight oxygen) (a)	2.5 % Maximum	ASTM D5599
(a) ref. Directive 85/536/EEC		

Walsh, 6/3/2005,

Table 58 Hong Kong New Petrol Vehicle Exhaust Emission Standards Summary						
	1 January 92	1 April 95	1 April 97	1 October 98	1 April 99	1 October 2000
Vehicle type						
Private Car	Europe ULP Std.(1.10.93); or	<i>EU Phase 1</i> ; or	<i>EU Phase 2</i> ; or	EU Phase 2; or	EU Phase 2; or	<i>EU Phase 3</i> ; or
	US 88; or	US 88; or	<i>US 94</i> ; or	<i>US 96</i> ; or	US 96; or	US 96; or
	Japan 78	Japan 78	Japan 78	Japan 78	Japan 78; and	Japan 78; and
					<i>Evaporative emissions:</i> :	
					EU or US Federal or Japan	EU or US Federal or Japan
Goods vehicles and buses up to 2.5 ton	Europe ULP Std.(1.10.93); or	<i>EU Phase 1</i> ; or	<i>EU Phase 2</i> ; or	EU Phase 2; or	EU Phase 2; or	<i>EU Phase 3</i> ; or
	US 88; or	US 88; or	<i>US 94</i> ; or	<i>US 97</i> ; or	US 97; or	US 97; or
	Japan 88	Japan 88	Japan 88	Japan 88	<i>Japan 94</i> ; and	Japan 94; and
					<i>Evaporative emissions:</i>	
					EU or US Federal or Japan	EU or US Federal or Japan
Goods vehicle and buses between 2.5 and 3.5 ton	Europe Leaded Petrol Std.	<i>EU Phase 1</i> ; or	<i>EU Phase 2</i> ; or	EU Phase 2; or	EU Phase 2; or	<i>EU Phase 3</i> ; or
		<i>US 91</i> ; or	<i>US 94</i> ; or	<i>US 97</i> ; or	US 97; or	US 97; or
		<i>Japan 92</i>	Japan 92	Japan 92	<i>Japan 95</i> ; and	Japan 95; and
					<i>Evaporative emissions:</i>	
					EU or US Federal or Japan	EU or US Federal or Japan
Goods vehicle and buses over 3.5 ton	Europe Leaded Petrol Std.	<i>US 91</i> ; or	US 91; or	<i>US 98</i> ; or	US 98; or	<i>Euro III</i> ; or
		<i>Japan 92</i>	Japan 92	Japan 92	<i>Japan 95</i> ; and	US 98; or
						Japan 95; and
					<i>Evaporative emissions:</i>	
					EU or US Federal or Japan	

Table 59 Hong Kong New Diesel Vehicle Exhaust Emission Standards Summary

	1 January 92	1 April 95	1 April 97	1 October 98	1 April 99	1 October 2000
Vehicle type						
All FAS	K - 2.13	<i>K - 1.20</i>	<i>K - 1.00</i>	K - 1.00	K - 1.00	<i>K - 0.8</i>
Smoke Standard (Light absorption coefficient K/ m ⁻¹)						
Private Car	Europe Diesel Std.(1.10.93); or	<i>EU Phase 1; or</i>	EU Phase 1; or	<i>US California 94</i>	US California 94	<i>EU Phase 3; or</i>
	US 88; or Japan 90	US 88; or <i>Japan 94</i>	US 88; or Japan 94			US California 94
Taxi	Europe Diesel Std.(1.10.93); or	<i>EU Phase 1; or</i>	EU Phase 1; or	EU Phase 1; or	<i>EU Phase 2; or</i>	<i>EU Phase 3; or</i>
	US 88; or Japan 90	US 88; or <i>Japan 94</i>	US 88; or Japan 94	US 88; or Japan 94	<i>US 96; or Japan 98</i>	US 96; or Japan 98
Goods vehicles and buses up to 2.5 ton	Europe Diesel Std.(1.10.93); or	<i>EU Phase 1; or</i>	EU Phase 1; or	<i>EU Phase 2; or</i>	EU Phase 2; or	<i>EU Phase 3; or</i>
	US 88; or Japan 88	US 88; or <i>Japan 93</i>	US 88; or Japan 93	<i>US 97</i>	US 97; or <i>Japan 98</i>	US 97; or Japan 98
Goods vehicle and buses between 2.5 and 3.5 ton	Europe Smoke Std.	<i>EU Phase 1; or</i>	EU Phase 1; or	<i>EU Phase 2; or</i>	EU Phase 2; or	<i>EU Phase 3; or</i>
		<i>US 88</i>	US 88	<i>US 97</i>	US 97	US 97
Goods vehicle and buses over 3.5 ton	Europe Smoke Std.	<i>Euro I; or</i>	<i>Euro II; or</i>	Euro II; or	Euro II; or	<i>Euro III; or</i>
		<i>US 91</i>	<i>US 94</i>	<i>US 98</i>	US 98	US 98

Table 60 New Vehicle Standards For India

Walsh, 6/3/2005,

Category	Standards Effective			
	1991	April 1, 1996	1997	April 1, 2000
Petrol Vehicles (gms/Km)				
Two-Wheelers				
CO	15-35	4.5		2
HC	36079	3.6#		2.0#
Three-Wheelers				
CO	40	6.8		4
HC	15	5.40#		2.0#
Passenger Cars				
CO	14.3-27.1	8.68-12.40	4.34-6.20	2.72
HC	2.0-2.9	3.0-4.36#	1.5-2.18	0.97#
Diesel Vehicles (g/kWh)				
GVW>3.5t				
CO	14	11.2		4.5
HC	3.5	2.4		1.1
NOx	18	14.4		8
PM				0.36
GVW<3.5t				
CO	14	11.2		4.5 or 2.72 g/km
HC	3.5	2.4		1.1
NOx	18	14.4		8
or				
HC+NOx (g/km)				0.97
PM				0.61 or 0.14 g/km

= HC+NOx

Table 61 Fuels Requirements For India

FUEL	METROS	TAJ TRAPEZIUM	STATE CAPITALS	ENTIRE COUNTRY
Low Sulfur Diesel				
Up to 0.5%	April 1, 1996	April 1, 1996		
Up to 0.25%		September 1, 1996		September 1, 1999
Low Lead Petrol (0.15 g/liter)	June 1, 1994	September 1, 1995		December 1996
Unleaded Petrol (0.013 g/liter)	April 1, 1995	April 1, 1995	December 31, 1998	March 31, 2000

Table 62 Emission Standards For New Gasoline and LPG Vehicles in South Korea

Vehicle Type	Date Of Implementation	Test	CO	NOx	Hydrocarbons	
					Exhaust	Evap (g/test)
Small Size Car ³	1991 2/2	CVS-75 g/km	8	1.5	2.1	4
	1996 12/1		2.11	0.62	0.25	2
	2000 1/1		2.11	0.25	0.16	2
Passenger Car	1991 2/2	CVS-75	2.11	0.62	0.25	2

³/Less than 800 cc of Engine Displacement

Vehicle Type	Date Of Implementation	Test	CO	NOx	Hydrocarbons	
					Exhaust	Evap (g/test)
	1998 1/1		2.11	0.4	0.25	
	2000 1/1		2.11	0.25	0.16	
Light Duty Truck ⁴	1991 2/2	CVS-75	6.21	1.43	0.5	2
	1998 1/1		6.21	0.75 ⁵	0.5	
			6.21	1.06 ⁶	0.5	
	2000 1/1 ⁷		2.75	0.25	0.24	
	2000 1/1 ⁸		3.11	0.43	0.29	
	2004 1/1 ⁹		1.27	0.16	0.18	
	2004 1/1 ¹⁰		1.65	0.3	0.24	
Heavy Duty Vehicle	1992 2/2	13-Mode (g/KwH)	33.5	11.4	1.3	-
	2000 1/1		33.5	5.5	1.3	

⁴/GVW < 3 tons

⁵/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

⁶/All other light trucks

⁷/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

⁸/All other light trucks

⁹/Loaded Weight 1.5 tons or less or van capable of seating 15 persons or less.

¹⁰/All other light trucks

Vehicle Type	Date Of Implementation	Test	CO	NOx	Hydrocarbons	
					Exhaust	Evap (g/test)
Motor Cycle (50cc-125cc)	1991 1/1	Idling (%)	5.5	-	1.1/0.45*	-
	1993 1/1		4.5	-	1.1/0.45*	
	1996 1/1		4	-	0.70/0.40*	
	2000 1/1	ECE R40 (g/km)	12.8	-	8.0/4.20*	-

* = 2 stroke/4 stroke

Table 63 Emissions Standards For New Diesel Vehicles in South Korea

Vehicle Type	Date of Implementation	Test	CO	NOX	HC	PM	Smoke
Passenger Car	1991 2/2	6-Mode	980 ppm	850/450 ¹¹	670	-	50%
	1993 1/1	CVS-75 (g/km)	2.11	0.62	0.25	0.12	
	1996 1/1		2.11	0.62	0.25	0.08	
	1998 1/1		1.5	0.62	0.25	0.08	
	2000 1/1		1.2	0.62	0.25	0.05	
Light Duty Truck ¹²	1991 2/2	6-Mode	980 ppm	850/450	670	-	50%
	1993 1/1	CVS-75	980	750/350	670	-	40%
	1996 1/1		6.21 g/km	1.43	0.5	0.31	
	1996 1/1 ¹³		2.11	1.4	0.25	0.14	
	2000 1/1		2.11	1.02	0.25	0.11	
	2004 1/1		1.27	0.64	0.21	0.06	

¹¹/Direct Injection/Indirect Injection

¹²/GVW < 3 tons

¹³/GVW < 2 Tons

Vehicle Type	Date of Implementation	Test	CO	NOX	HC	PM	Smoke
Heavy Duty Vehicle	1991 2/2	6-Mode	980 ppm	850/450	670	-	50%
	1993 1/1			750/350		-	40%
	1996 1/1	13-Mode	4.9 G/kWh	11	1.2	0.9	35%
	1998 1/1			6.0 (9.0)		0.25 (0.5)	25%
	2000 1/1					0.25 (0.1)	
	2002 1/1 ¹⁴					0.15 (0.1)	

() city bus only

¹⁴/Applies to all new heavy duty engines and all city buses.

Table 64 Global Motorcycle Emissions Regulations

Nation	Engine Displacement	Engine/Vehicle Type	Emission Standard				Durability Mileage (km)	Effective Year	Remarks
			CO (g/km)	HC (g/km)	NOx (g/km)	Evap. (g/test)			
Taiwan	< 700 c.c.	2-stroke	7.0	1.0		2.0	15,000	2004	1. ECE R40 Cold Start excluding 0~40 seconds idle
		4-stroke	7.0	2.0		2.0			
	> 700 c.c.	2- or 4-stroke	12.0	2.0		2.0			
China	< 50 c.c.	2-wheeler	1.0	1.2		NA	10,000	2004	1. ECE R40 Warm Start 2. COP to be effective 2005
		3-wheeler	3.5	1.2					
	> 50 c.c.	2-wheeler	5.5	1.2	0.3				
		3-wheeler	7.0	1.5	0.4				
India	NA	2-wheeler	1.5	1.5		NA	30,000	2005	1. IDC Cold Start
	NA	3-wheeler	2.25	2.0			30,000	2005	
Japan	< 50 c.c.	NA	2.0	0.5	0.15	NA	12,000	2006	1. ECE R40 Cold Start
	50~125 c.c.						12,000	2007	
	125~250 c.c. >250 c.c.	NA	2.0	0.3	0.15		24,000	2006 2007	1. Test mode to be determined

