

Environmental Standards

Emission

MOTOR VEHICLES : ENVIRONMENTAL STANDARDS

Vehicular Exhaust Emission Standards (effective for 1990 - 1996)

Standards for emission of smoke, vapour etc. from motor vehicles

- 1) Every motor vehicle shall be manufactured and maintained in such condition and shall be so driven that smoke, visible vapour, grit, sparks, ashes, cinders or only substances or oily substance do not emit therefrom.
- 2) On and from the 1st day of March, 1990, every motorvehicle shall comply with the following standards:
 - a) idling CO (carbon monoxide) emission limit for all four wheeled petrol driven vehicles shall not exceed 3 per cent by volume; and
 - b) idling CO emission limit for all two and three wheeled petrol driven vehicles shall not exceed 4.5 per cent by volume;
 - c) smoke density for all diesel driven vehicles shall to as follows

Method of Test	Maximum Smoke Density		
	Light absorption Co-efficient K(l/m)	Bosch units	Hartridge units
Full load at a speed of 60% to 70% of maximum engine rated speed declared by the manufacture	3.1	5.2	75
Free acceleration	2.3		65

- 3) On and from the 1st day of April, 1991, all petrol driven vehicles shall be so manufactured that they comply, with the mass emission standards as specified at Annexure-I. The breakdown of the operating cycle used for the test shall be as specified at Annexure-II and the reference fuel of such tests shall be as specified in Annexure-III to this schedule.
- 4) On and from the 1st day of April, 1991 all diesel driven vehicles shall be so manufactured that they comply, with the mass emission standard based on exhaust gas capacity specified in Anneuxre-IV to this schedule.
- 5) On and from the 1st day of April, 1992 all diesel driven vehicles shall be so manufactured that they comply with the following levels of emissions under the Indian driving cycle.

Mass of Carbon Monoxide (CO), max, gm/kWH	Mass of Hydrocarbons (HC), max. gm/ kWH	Mass of Nitrogen Oxides (NOx), max. gm/kWH
14	305	18

- 6) Each motor vehicle manufactured on land after the dates specified in paragraphs (2), (3), (4) and (5), shall be certified by the manufacturers to be conforming to the standards specified in the said paragraph and the manufacturer shall further certify that the components liable to effect the emission of gaseous pollutants are so designed, constructed and assembled as to enable to vehicle, in normal use, despite the vibration to which it may be subjected, to comply with the provisions of the said paragraphs.
- 7) Test for smoke emission level and carbomonoxide level for motor vehicles
 - (a) Any officer not below the ran of a sub inspector of police or an Inspector of motor vehicles, who has reason to believe that a motor vehicles is by virtue of smoke emitted from it or other pollutants like carbonmonoxide emitted from it, is likely to cause environmental pollution, endangering the health or safety of any other user of environmental pollution, endangering the health or safety of any other use of the road or the public, may direct the driver of any person incharge of the vehicle to submit the vehicle for undergoing a test to measure the standard of black smoke or the standard of any of the other pollutants.
 - (b) The driver or any person incharge of the vehicle shall upon demand by any officer referred to sub paragraph (a), submit the vehicle for testing for the purpose of measuring the standard of smoke or the levels of other pollutants of both.
 - (c) The measurement of standard of smoke shall be done with a smoke metre of a type approved by the state government and the measurement of the other pollutants like carbon monoxide shall be done with instruments of a type approved by the state government.

ANNEXURE-I

(See Paragraph 3)

MASS EMISSION STANDARDS FOR PETROL DRIVEN VEHICLES

Type Approval Tests:

Two and Three Wheeler Vehicles

Reference Mass, R (Kg)	CO (g/km)	HC (g/km)
R<150	12	6
150 R<350	$12 + \frac{18(R-150)}{200}$	$8 + \frac{4(R-150)}{200}$
R>350	30	12

Light Duty Vehicles:

Reference Mass, rw (Kg)	CO (g/km)	HC (g/km)
1	2	3
rw<1020	14.3	2.0
1020 <1250	16.5	2.1
1250 <1470	18.8	2.1
1470 <1700	20.7	2.3
1700 <1930	22.9	2.5
1930 <2150	24.9	2.7
rw<2150	27.1	2.9

Conformity of Production Tests:

Two and Three Wheeler Vehicles:

Reference Mass, R (Kg)	CO (g/km)	HC (g/km)
R<150	12	6
150 R<350	$15 + \frac{25(R-150)}{200}$	$15 + \frac{5(R-150)}{200}$
R>350	40	15

Light Duty Vehicles:

Reference Mass, rw (Kg)	CO (g/km)	HC (g/km)
1	2	3
rw<1020	17.3	2.7
1020 <1250	19.7	2.2
1250 <1470	22.5	2.8
1470 <1700	24.9	3.0
1700 <1930	27.6	3.3
1930 <2150	29.9	3.5
rw<2150	32.6	3.7

Note: For any of the pollutants referred to above of the three results obtained may exceed the limit specified for the vehicles by not more than 10 per cent.

Mass emission standards refers to the gm. of pollutants emitted per km. run of the vehicle, as determined by a chassis dynamometer test using the Indian Driving Cycle.

ANNEXURE-II

(See Paragraph 3)

Break down of the operating cycle used for the test (km/hr)

No. of Operation	Acceleration (m/sec ²)	Speed (Km/hr)	Duration each operation (second)	Cumulative time (second)
01. Idling	-	-	16	16
02. Acceleration	0.65	14	6	22
03. Acceleration	0.56	14-22	4	26
04. Deceleration	0.63	22-13	4	30
05. Steady speed	-	13	2	32
06. Acceleration	0.56	13-23	5	37
07. Acceleration	0.44	23-31	5	42
08. Deceleration	0.56	31-25	3	45
09. Steady speed	-	25	4	49
10. Deceleration	0.56	25-21	2	51
11. Acceleration	0.45	21-34	8	59
12. Deceleration	0.32	34-42	7	66
13. Deceleration	0.46	42-37	3	69
14. Steady speed	-	37	7	76
15. Deceleration	0.42	37-34	2	78
16. Acceleration	0.32	34-42	7	85
17. Deceleration	0.46	42-27	9	94
18. Deceleration	0.52	27-14	7	101
19. Deceleration	0.26	14-00	7	108

ANNEXURE-III

(See Paragraph 3)

Reference Fuel for Type and Production Conformity Tests

Sl.No.	Characters	Requirements		Method of test
		87 octane	90 octane	
				(ref of P: or IS: 1148*)
1	2	3	4	5
1.	Colour, visual	Orange	Red	-
2.	Copper-strip corrosion	Not worse than No. 1		P:5(1968)
	for 3 hours at 50°C			
3.	Density at 15°C	Not Ltd., but to be reported		P:16(1967)
4.	Distillation:			
a)	Initial boiling point	Not Ltd., but to be reported		P:18(1967)
		*Methods of test for petroleum and its products		
b)	Recovery up to 70°C,	10	10	
	per cent by volume, min.			
c)	Recovery up to 180°C,	50	50	
	per cent by volume, min.			
d)	Recovery up to 180°C,	90	90	
	per cent by volume, min			

f)	Residue percent by volume maximum	2	2	
5)	Octane number (research method)	87	94	P:27 (1960)
6)	Oxidation stability, in minutes, minimum	360	360	P:28(1966)
7)	Residue on evaporation mg/100 ml, max.	4.0	4.0	P:29(1960) (Air jat solvent washed)
8)	Sulphur, total, per cent by weight max.	0.25	0.20	P:34(1966)
9)	Lead content (as Pb), g/l max.	0.56	0.80	P:37(1967) or P:38(1967)
10)	Reid vapour pressure at 38°C kgf.com3.max.	0.70	0.70	P:39(1967)

ANNEXURE-IV

(See Paragraph 4)

Limit Values of Exhaust Gas Opacity Applicable for Diesel Drive Vehicles The Engine Tests at Steady Speed

Nominal Flow G(l/s)	Absorption Coefficient (Km-1)
42	2.00
45	1.91
50	1.82
55	1.75
60	1.68
65	1.61
70	1.56
75	1.50
80	1.46
85	1.41
90	1.38
95	1.34
100	1.31
105	1.27
110	1.25
115	1.22
120	1.20
125	1.17
130	1.15
135	1.31
140	1.11
145	1.09
150	1.07
155	1.07
160	1.04

165	1.02
170	1.01
175	1.00
180	0.99
185	0.97
190	0.96
195	0.95
200	0.93

Diesel Fuel : Specifications for Emission Related Parameters

Sl.No.	Characteristics	Requirement	Method of Test ref. to P:of IS: 1448
(i)	Density at 15°C, kg/m ³	820 to 880(1)	P : 32
(ii)	Centane Number, min	45.0(2)	P : 9
(iii)	Distillation 85 per cent by volume recovery at 0C, max and 95 per cent by volume recovery at 0C, max	350 370	P : 18
(iv)	Sulphur, per cent by mass,	0.50(3)	P : 33

- (1) 820 to 860 by 2000 AD
 48 by 31st December, 1998 (except in the refineries - Digboi, Gauhati and Bongaigaon Refineries & Petrochemicals Ltd.)
 (2) (i) 0.50 per cent by mass by 1st April 1996 in four metros and Taj Trapezium
 (3) (ii) 0.25 per cent by mass by 1st October, 1996 in Taj Trapezium
 (iii) 0.25 per cent by mass by 1st April, 1999 throughout the country

Note:

- (a) Above specifications apply to HSD only
 (b) For new refineries coming during or after 1997 specification applicable by 2000AD and for existing refineries shall be applicable by 1997.

Source : EPA Notification
 [GSR No. 176(E), April 2, 1996]

Diesel Fuel - Specification for the Year 2000 AD

Sl. No.	Characteristic	Requirement		Method of Test Ref To Annex [P:] of IS 1448	
		HSD	LDO		
i)	Acidity, inorganic	Nil	Nil	-	P : 2
ii)	Acidity, total, mg of KOH/g, Max	0.20	-	-	P : 2
iii)	Ash, percent by mass, Max	0.01	0.02	-	P : 4
iv)	Carbon residue (Ramsbottom) on 10 percent residue, percent by mass, Max	0.30(1)	1.5 (On whole sample)	-	P : 8
v)	Cetane number 2), Min	48(3)	-	-	P : 9
vi)	Pour point 4), Max	3°C for winter 15°C for	12°C for winter 21°C for summer	-	P : 10

		summer			
vii)	Copper strip corrosion for 3 h at 100°C	Not worse than No.1	Not worse than No.1	-	P : 15
viii)	Distillation, 85 percent volume recovery at °C, Max 95 percent volume recovery at °C, max	350	-	-	P : 18
ix)	Flash point ⁵⁾ a) Abel, 0C, Min b) Pensky-Martens, °C, Min	35	-	-	P : 20 P : 21
x)	Kinematic viscosity, cSt, at 40°C	2.0 to 5.0	2.5 to 15.7	-	P : 25
xi)	Sediment percent by mass, Max	0.05	0.10	-	P : 30
xii)	Density at 150C, kg/m3	820-8606)	To be reported	-	P:167) P : 32
xiii)	Total sulphur, percent by mass, Max	0.25	1.8	-	P:338)
xiv)	Water content, percent by volume, Max	0.05	0.25	-	P : 40
xv)	Cold filter plugging point (CFPP) ⁴⁾ , Max	6°C for winter 18°C for summer	-	-	P : 10
xvi)	Total sediments ⁹⁾ , mg per 100ml, Max	1.6	-	A	-

- 1) This limit is applicable prior to cetane number improvers, if used. In case a value exceeding the limit is obtained on finished fuels in the market, ASTM D 4046 shall be used to establish the presence of nitrate containing cetane number improvers. In such case the present limit for carbon residue cannot be applied. However, the use of cetane number improvers does not exempt the manufacturer from meeting their requirement prior to the addition of additives.
- 2) When a test engine is not available or when the quantity of the sample is too small for an engine rating Calculated Cetane Index by Four Variable Equation by ASTM D 4737 may be used for estimation of cetane number. The error in prediction of the 'Calculated Cetane Index' by this method will be less than +2 Cetane Number for fuels having Cetane Number within the range of 32 to 56. It may be noted that this method is not applicable to pure hydrocarbons or fuels containing cetane improvers or fuels derived from coal. For arbitration purposes, the direct determination of cetane number by means of the standardized engine test shall be used unless the buyer and the seller agree otherwise.
- 3) For diesel fuel processed from Assam crude, the value of 45 minimum shall apply.
- 4) Winter shall be the period from November to February (both months inclusive) and rest of the months of the year shall be called a summer. The values for maximum pour point and CFPP shall be those as directed by OCC from time to time.
- 5) Diesel fuel for Naval applications including Merchant navy and fishing vessels of 12 metres and above is length shall have a flash point of 66°C, Min, when tested by the method prescribed is IS 1448 [P21] : 1970.
- 6) For diesel fuel processed from Assam crude, the value 820-870 shall apply.
- 7) In case of dispute with regard to the test to be followed, [P- 32] shall be the referee test method.
- 8) The test method given IP 336 may be permitted for testing of total sulphur as an alternative method. However in case of dispute, method gives in [P:33] of IS 1448 shall be the referee method.
- 9) This test shall be carried out only at the refinery or manufacturer's end. As an alternative, the test method ASTM D 2274, may be used and in such case the value of total insolubles shall be 1.5 mg/100 ml, Max. In case of dispute regard to the test to be followed, ASTM D 2274 shall be the referee test method.

Source - IS 1460 : 1995

Diesel Vehicles : Mass Emission Standards (Effective from 1st April, 1996)

Vehicle Category	HC* (g/kwhr)	CO* (g/kwhr)	NOx (g/kwhr)	Smoke
Medium & Heavy Over 3.5 T/GVW	2.4	11.2	14.4	***
Light diesel upto 3.5 T/GVW	2.4	11.2	14.4	**

Reference mass R (kg)	CO** g/km	HC+NOx** g/km
R <1020	5.0	2.0
1020	5.78	2.2
1250	6.4	2.5
1470	7.0	2.7
1700	7.7	2.9
1930	8.2	3.5
R>2150	9.0	40

Note

* The test cycle is as per 13 mode cycle on dynamometer.

** The test should be as per Indian driving cycle with cold start.

The emissions of visible pollutants (smoke) shall not exceed the limit value to smoke density. When

*** expressed as light absorption coefficient given in Annexure (4) at Sr. No. 67 for various nominal flows when tested at constant speeds over full load.

Source : [GSR 609(E) Sept. 15, 1993]

Min. of surface Transport under Motor Vehicle Rules, 1989]

Motor Gasoline: Specifications for Emission Related Parameters

S.No.	Parameter	Requirement	Method of Test ref. to P: of IS : 1448
(i)	Reid Vapour Pressure at 380C, KPa	35 to 70	P:39
(ii)	Benzene, Percent by volume, max	5.0(1)	P:104
(iii)	Lead Content (as Pb) g/l, max	0.15(low leaded(2)	P:38
(iv)	Sulphur, percent by mass, max	0.10 (unleaded)	P:34
		0.013 (unleaded)	
(v)	Potential Gum, g/m3, max	50	ASTM 873:8
(vi)	Gum (solvent Washed) g/m3 max	40	P:29
(vii)	Oxygenates Content Ether (MTBE, ETBE)		
	Alcohol, percent by volume, max	15	
(viii)	Phosphorus	See Foot Note (3)	ASTMD 3231

(1) 3.0 per cent volume maximum in metro cities by 2000 AD.

(2) 0.15 g/l by 31st December, 1996 (for entire country).

0.013 g/l by 1st April 1995 (for all State capitals/UTs and major metro cities);
by 1st December, 1998 (for all State capitals/UTs and major metro cities) and
by 1st April, 2000 AD for the entire country.

(3)(a) Above specifications applies to leaded as well as unleaded petrol except lead content.

(b) For new refineries coming up during or after 1997 the specification applicable by 2000 AD for existing refineries shall be applicable by 1997.

Source : EPA Notification

[GSR No. 176(E), April 2, 1996

Motor Gasolines - Specification for the Year 2000AD

Sl No.	Characteristics	Requirements			Method of Test P:of Annex IS 1448 of this Standard
		Leaded Regular	Unleaded Regular	Unleaded Premium	
i)	Colour, visual	Orange	Colourless	Red	-

ii)	Density, 15C, kg/m ³	710-770	710-770	710-770	[P:16]	-
iii)	Distillation:					
a)	Recovery upto 70°C (E 70),	10-45	10-45	10-45		
b)	Recovery up to 100°C (E 100), percent by volume	40-70	40-70	40-70		
c)	Recovery up to 180°C (E180), percent by volume, Min	90	90	90		
d)	Final boiling point (FBP), Max	215°C	215°C	215°C		
e)	Residue, percent by volume, Max	2	2	2		
iv)	Anti-knock index (AKI), Min	84	84	88	[P:26 and P:27]	-
v)	Existent gum, g/m ³ , Max	40	40	40	[P:29]	(Airjet - solvent washed)
vi)	Potential gum ¹⁾ , g/m ³ , max	50	50	50	P:1472)	-
vii)	Sulphur, total, percent by mass,	0.20	0.10	0.10	[P:34]	-
ix)	Reid vapour pressure (RVP),	35-60	35-60	35-60	[P:39]4)	-
x)	Vapour lock index (VLI), (VLI=10 RVP + 7 E 70), Max					
a)	Summer	750	750	750	-	
b)	Other months	950	950	950		
xi)	Benzene content, percent by volume, max	5.0	5.0	5.0	[P:104]	-
xii)	Copper strip corrosion for 3 h at 50°C	Not more than No. 1			[P:15]	-
xiii)	Water tolerance of gasoline-alcohol blends, temperature for phase separation, °C, Max					
a)	Summer	10	10	10		
b)	Winter ⁶⁾	0	0	0		

1)	To be carried out at the refinery end only, and the limit for this test is meant for produces prior to addition of multifunctional additives, if used. However, the use of multifunctional additives does not exempt the manufacturer from meeting this requirement prior to addition of additives.
2)	This test shall be carried out on the gasoline before addition of multifunctional detergent/dispersant additives, as these may interfere with the test.
3)	For unleaded motor gasoline test method ASTM D 5059/IP 352 shall be followed.
4)	For the gasoline-alcohol blends, the dry vapour test method given in Annex A shall be followed.
5)	From May to July in Central India and northern plains in India.
6)	In winter it is expected that temperature may be lower than 0°C in the northern hilly region and hence phase separation shall not take place till -10°C.

(Source : IS - 1460 - 1995)

Petrol Driven Vehicles : Mass Emission Standards Effective from 1st April, 1996 to 2000

i) Passenger Cars

Cubic Capacity (cm ³)	Carbon Monoxide (gm/km)	HC + NO _x (gm/km)
C<1,400	3.68	3.00
C>1,400<2,000	11.20	3.84
C>2,000	12.40	4.36

Note:

1.	The tests will be as per Indian Driving Cycle with warm start.
2.	There should be no crackcase emission.

3.	Evaporative emission should not be more than 2.0 g/test.	
ii)	Three Wheelers (for all categories)	
	CO, g/km	6.75
	HC + NOx, g/km	5.40
iii)	Two Wheelers (for all categories)	
	CO, g/km	4.50
	HC + NOx, g/km	3.60

Light Duty vehicles:

(Passenger cars)

20% relaxation in the standards for carbon monoxide and 20% in combined HC & NOs for the COP volumes would be given.

Two & Three wheeler vehicles:

10% relaxation in the standards for carbon monoxide and 20% in combined HC & NOx for the COP volumes would be given.

[Source G.S.R. 609(E) Sept. 15], 1993
Min. of Surface Transport under Motor Vehicles Rules; 1989]

Noise Standards for Motor Vehicles

Every motor vehicle shall be constructed and maintained so as to conform to noise standards as indicated in the table below, and these Standards shall be tested as per Indian Standards IS : 3028.

Category of Vehicles	Maximum Permissible Noise Level
Two wheelers (Petrol driven)	80 dB (A)
All passengers cars, all Petrol driven three- wheelers and diesel driven two wheelers	82 dB (A)
Passenger or Light Commercial Vehicles including three wheelers vehicles fitted with diesel engine with gross vehicles weight upto 4000 kgs.	85 dB (A)
Passenger or Commercial Vehicles with gross vehicles weight above 4000 kgs and upto 12000 kgs	89 dB (A)
Passenger or Commercial Vehicles with gross vehicles weight above 12000 kgs.	91 dB (A)

(Source : Central Motor Vehicles Rules, 1989)

Mass Emission Standards for Petrol Driven Vehicles (for vehicles fitted with Catalytic Converter) effective for 1998 to 2000

Type Approval Test

(1) Passenger Cars

Cubic Capacity (cm ³)	Carbon Monoxide (gm/km)		HC+NOx (gm/km)	
	Passenger cars fitted with Catalytic Converter	Passenger cars not fitted with Catalytic Converter	Passenger cars fitted with Catalytic Converter	Passenger cars not fitted with Catalytic Converter
C < 1400	4.34	8.68	1.50	3.0
1400 < C < 2000	5.60	11.20	1.92	3.84

C > 2000	6.20	12.40	2.18	4.36
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Note :

- The test will be as per Indian driving cycle with warm start. However, with effect from 1st April, 1998 the test will be as per Indian driving cycle with cold start for catalytic converter fitted vehicles as:

Soak Temperature	:	20o - 30 o C
Soak Period	:	6 - 30 hrs.
Preparatory running before sampling	:	4 cycles
Number of test cycles	:	6
Break Down of cycles	:	Indian driving cycle

- For passenger cars not fitted with catalytic converter, the test will continue to be with warm start as per existing procedure, till 01.04.2000.
 - There should be no crankcase emission
 - Evaporative emission should not be more than 2.0 gm per test.
 - COP Standards** : 20% relaxation in the standards for Carbon Monoxide and combined HC+NOx would be given.
 - For vehicles fitted with Catalytic converter a deterioration factor of 1.2 on Type Approval limits will be applicable for durability.
- (II) *Three Wheelers (for all categories)*

CO	(gms/km)	6.75
HC+NOx	(gms/km)	5.40

Note :

- The test will be as per Indian driving cycle with warm start. However, with effect from 1st April, 1998, the test will be as per Indian driving cycle with cold start.
 - COP Standards** : 20% relaxation in the standards for Carbon Monoxide and combined HC+NOx would be given.
- (III) *Two Wheelers (for all categories)*

CO	(gms/km)	4.50
HC+NOx	(gms/km)	3.60

Note :

- The test will be as per Indian driving cycle with warm start. However, with effect from 1st April, 1998, the test will be as per Indian driving cycle with cold start.
- COP Standards** : 20% relaxation in the standards for Carbon Monoxide and combined HC+NOx would be given.

Annexure 1

Nominal Flow G(l/s)	Light Absorption Coefficient K(l/m)	Normal Flow G(l/s)	Light Absorption Coefficient K(l/m)
42	2.26	120	1.37
45	2.19	125	1.345
50	2.08	130	1.32
55	1.985	135	1.30
60	1.90	140	1.27
65	1.84	145	1.25
70	1.775	150	1.205
75	1.72	160	1.19
80	1.665	165	1.17
85	1.62	170	1.155
90	1.574	175	1.14
95	1.535	180	1.125
100	1.495	185	1.11
105	1.465	190	1.095
110	1.425	195	1.08

115	1.395	200	1.065
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Source : Central Motor Vehicle Rules, 1989
GSR 461(E), Jan. 21, 1990

Mass Emission Standards for Vehicles Manufactured on and after 1st April, 2000

A. For Petrol Driven Vehicles

Passenger Cars	CO(g/km)	HC+NOx (g/km)
Type Approval	2.72	0.97
Conformity of Production	3.16	1.13

Notes :

The test shall be as per the modified Indian Driving Cycle, with cold start as specified in Annexure IV 'B', on chasis dynamometer.

There should be no crankcase emission.

Evaporative emission should not be more than 2 gm/test.

For vehicles fitted with Catalytic Converter, a deterioration factor of 1.2 on Type Approval Limits will be applicable for durability.

Commercial fuel shall be as notified by the Ministry of Environment & Forests vide Notification No. GSR 176 (E), dated the 2nd April, 1996.

Reference test fuel shall be as specified in Annexure IV C.

2 - Wheelers and 3 - Wheelers	CO (g/km)		HC+NOx (g/km)	
	2-wheelers	3-wheelers	2-wheelers	3-wheelers
Type Approval	2.0	4.0	2.0	2.0
Conformity of Production	2.4	4.8	2.4	2.4

Notes :

The test shall be as per the Indian Driving Cycle, with cold start on Chassis Dynamometer as specified in Annexure IV B to the Principal Rules.

Commercial fuel shall be as notified by the Ministry of Environment & Forests vide Notification No. GSR 176 (E), dated the 2nd April, 1996.

Reference test fuel shall be as specified in Annexure IV C.

B. For Diesel Vehicles (Including Two and Three Wheelers)

1. Vehicles with GVW exceeding 3.5 ton

Pollutants	Limits for	
	Type Approval	Conformity of Production
CO (g/kWh)	4.5	4.9
HC (g/kWh)	1.1	1.23
NOx (g/kWh)	8.0	9.0
PM (g/kWh) for engines with power exceeding 85 kW	0.36	0.4

PM (g/kWh) for engines with power exceeding 85 kW	0.36	0.4
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II. Vehicles with GVW equal to or less than 3.5 tonne

Pollutants	Limits for	
	Type Approval	Conformity of Production
CO (g/kWh)	4.5	4.9
HC (g/kWh)	1.1	1.23
NOx (g/kWh)	8.0	9.0
PM (g/kWh) for engines with power exceeding 85 kW	0.36	0.4
PM (g/kWh) for engines with power equal to or less than 85 kW	0.61	0.68

OR Chassis Dynamometer Test

Reference Mass(kg)	Limits for Type Approval (gm/km)			Limits for conformity of Production (gm/km)		
	CO	HC+NOx	PM	CO	HC+NOx	PM
R <1250	2.72	0.97	1.14	3.16	1.13	0.18
1250 < R <1700	5.17	1.40	0.19	6.0	1.60	0.22
1700 > R	6.90	1.70	0.25	8.0	2.0	0.29

Notes :

The test for vehicles with GVW equal to or less than 3.5 ton shall be as per the 13 mode cycles on engine dynamometer specified in Annexure IVA to the principal rules.

The test shall be as per the Indian Driving Cycles, for 2 wheelers and 3 wheelers and modified Indian Driving Cycle for 4 wheelers with cold start, as specified in Annexure IVB on Chassis Dynamometer.

For vehicles fitted with catalytic converters a deterioration factor 1.1 of CO; 1.0 for HC+NOx and 1.2 for PM on type approval limits will be applicable for durability.

The emission of visible pollutants (smoke) shall not exceed the limit value to smoke density, when expressed as light absorption co-efficient for various nominal flows as in Annexure to Rule15(9) (Notification No. GSR 163 (E) dated 29th March, 1996), when tested at constant speeds over full load. These smoke limits are without correction factor and engines are to be tested with conditioned air supplied to the engine to maintain atmospheric factor of 0.98 to 1.02.

Commercial fuel shall be as notified by Ministry of Environment and Forests vide Notification No. GSR 176 (E) dated 2nd April, 1996.

Reference test fuel shall be as specified in Annexure IV D.

Source : Central Motor Vehicles Rules, 1989
GSR 493 (E) dated August 28, 1997

ANNEXURE IV B

[See Rule 115 (10)] Driving Cycles and Cold Start

A. For all 2 and 3 Wheelers except diesel vehicles

Cold Start Procedures:

Test Cell Condition

Soak Temperature	20° - 30°C
Soak Period	6 - 30 hrs
Preparatory running before sampling	Idling of 40 seconds and 4 cycles
Number of test cycles	6
Break down of cycles	Indian Driving Cycles As per Annexure II to principal rules.

B. For all Other Vehicles Including Diesel 2,3 and 4 Wheelers:

Cold Start Procedure:

Test Cell Condition

Soak Temperature	20° - 30° C
Soak Period	6 - 30 hrs
Preparatory running before sampling	Idling of 40 seconds and 4 cycles
Number of test cycles*	4 cycles of Part one and I cycle of Part
two Break down of cycles*	Modified Indian Driving Cycle as per Table I and II

For diesel 2 & 3 wheelers

- Number of test cycles - 6
- Breakdown of cycles - Indian Driving Cycle
- As per Annexure II to principal rules

Modified Indian Driving Cycle for Year 2000

Table I Operating Cycle on the Chassis Dynamometer (Part one)

No. of Operation	Operation	Phase	Acceleration (m/s ²)	Speed (km/h)	Duration of each		Cumulative time(s)	Gear to be used in the case of manual gear box
					Operation(s)	Phase (s)		
1	Idling				11	11	11	As PM-5sK1 (*)
2	Acceleration	2	1.04	0-15	2	4	15	1
3	Steady Speed	3		15	8	8	23	1
4	Deceleration	4	-0.69	15-10	2		25	1
5	Deceleration, Clutch disengaged							
6	Idling	5			23	21	48	16sPM-5sK1(*)
7	Acceleration	6	0.83	0-15	5		54	1
8	Gear Change				2	12	56	
9	Acceleration		0.94	15-32	5		61	2
10	Steady Speed	7		32	24	24	85	2
11	Deceleration	8	-0.75	32-10	8		93	2
12	Deceleration, clutch disengaged		-0.92	10-0	3	11	96	K2 (*)
13	Idling	9			21	21	117	16 s PM - 5 s K1 (*)
14	Acceleration		0.83	0-15	5	26	122	1
15	Gear Change				2		124	
16	Acceleration		0.62	15-35	9		133	2
17	Gear Change						135	
18	Acceleration						143	3

19	Steady Speed						155	3
20	Deceleration						163	3
21	Steady Speed	13		35	13	13	176	3
22	Gear Change				2		178	
23	Deceleration		-0.86	32-10	7		185	2
24	Deceleration, Clutch disengaged	14	-0.92	10-0	3	188		K2 (*)
25	Idling	15			7	7	195	7 s PM (*)

(*) PM = Gearbox in neutral, clutch engaged
K1, K2 = First or second gear engaged, clutch disengaged

Modified Indian Driving Cycle for Year 2000

Table II Operating Cycle on the Chassis Dynamometer (Part Two)

No. of Operation	Operation	Phase	Acceleration (m/s ²)	Speed (km/h)	Duration of each		Cumulative time(s)	Gear to be used in the case of manual gear box	
					Operation(s)	Phase (s)			
1	Idling	1			20	20	20	K1 (*)	
2	Acceleration	2	0.83	0-15	5	41	25	1	
3	Gear Change				2		27	-	
4	Acceleration		3	0.62	15-35		9	36	2
5	Gear Change		4				2	38	-
6	Acceleration		5	0.52	35-50		8	46	3
7	Gear Change		6	0.83			2	48	-
8	Acceleration			0.43	50-70		13	61	4
9	Steady Speed		3		70		50	50	111
10	Deceleration	4	-0.69	70-50	8	8	119	4 s.5 + 4 s.4	
11	Steady Speed	5		50	69	69	188	4	
12	Acceleration	6	0.43	50-70	13	13	201	4	
13	Steady Speed	7		70	50	50	251	5	
14	Acceleration	8	0.24	70-90	24	24	275	5	
15	Steady Speed	9		90	83	83	358	5	
16	Deceleration	10	-0.69	90-80	4	22	362	5	
17	Deceleration		-1.04	80-50	8		370	5	
18	Deceleration		-1.39	50-00	10		380	K2 (*)	
19	Idling	11			20	20	400	PM (*)	

(*) PM = Gearbox in neutral, clutch engaged
K1, K2 = First or second gear engaged, clutch disengaged

ANNEXURE IV C (SEE RULE 115 (10)) REFERENCE FUEL PETROL

	Minimum	Maximum	ASTM Method
Research Octane Number	95.0		D 2699
Motor Octane Number	85.0		D 2700
Density at 15°C (kg/l)	0.718	0.762	D 1298
Reid Vapour pressure	0.56 bar	0.64 bar	D 323
Distillation:			
boiling point	24°C	40 °C	D 86
10% vol. point	42o C	58 °C	

50% vol. point	90 °C	110 °C	
90% vol. point	155 °C	180 °C	
Final boiling point	190 °C	215 °C	
Residue		2%	D 86
Hydrocarbon Analysis:		20% vol.	
Olefins			D 1319
Aromatics	(including max. 5% vol. benzene)*	45% vol.	(*) D 3606/D 2267
Saturates	balance		D 1319
Oxidation Stability	480 minutes		D 525
Resistant Gum		4 mg/100 ml	D 381
Sulphur Content		0.04% mass	D 1266/D 2622/ D 2785
Copper Corrosion at 50o C		1	D 130
Lead Content		0.005 g/l	D 3237
Phosphorous Content		0.0013 g/l	D 3231

* Addition of oxygenates prohibited

**ANNEXURE IV D
(SEE RULE 115 (10))
REFERENCE FUEL DIESEL**

	Minimum	Maximum	ASTM Method
Cetane Number	49	53	D 613
Density at 15°C (kg/l)	0.835	0.845	D 1298
Distillation: 50 % point 90% point	245 °C 320 °C	340 °C	D 86
Final boiling point	-	370 °C	
Flash point	55 °C		D 93
CFPP	-	(--) 5 °C	EN 116 (CEN)
Viscosity at 40 °C	2.5mm ² /s	3.5mm ² /s	1. D 445
Sulphur content	to be reported	0.3% mass	D 1266/D 2622/ D 2785
Copper corrosion	155 °C		D 130
Conrdson carbon residue (10% DR)	190 °C	0.2% mass	D 189
Ash content		0.01 % mass	D 482
Water content		0.05 % mass	D 95/D 1744
Neutralization (strong acid) Ne		0.20 mg/KOH/g	
Oxidation stability		2.5 mg/100 ml	D 2274
Additives	*		

It must not contain any metallic additives or cetane improver additives

Mass Emission Standards (Bharat Stage-II) (Effective from April 1, 2000)

(A) Motor Cars with seating capacity of and upto 6 persons (including driver) and Gross Vehicle Mass (GVM) not exceeding 2500 kg.

Vehicles with	Standard (Type Approval=COP) (g/km)		
	CO	(HC+Nox)	PM
Gasoline engine	2.2	0.5	-

Diesel engine	1.0	0.7	0.08
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(B) Four-wheeler Passenger Vehicles with GVW equal to or less than 3500 kg and designed to carry more than 6 persons (including driver) or maximum mass of which exceeds 2500 kg.

Class	Ref. Mass(rw) kg	Limit Values for Type Approval (TA) as well as COP				
		Mass of CO(g/km)	Mass of HC+NOx (g/km)	Mass of PM(g/km)		
				Gasoline	Diesel	Diesel
I	rw<1250	2.2	1.0	0.5	0.7	0.08
II	1250 <1700	4.0	1.25	0.6	1.0	0.12
III	1700>rw	5.0	1.5	0.7	0.7 1.2	0.17

Notes :

1. The test including driving cycle shall be as per sub-rule (10), with the modifications that:
 - i. there shall be no relaxation of norms for COP purposes,
 - ii. the tests shall be on Chasis dynamometer
 - iii. the driving cycle shall be at a maximum speed of 90 kmph, and
 - iv. the reference fuel shall be of a maximum of 0.05% sulphur content.
2. Commercial fuel or meeting above norms shall be upto 0.05% mass maximum sulphur content.
3. There shall be no crankcase emissions for petrol driven vehicles.
4. Evaporative emission shall not be more than 2.0 g/test from petrol driven vehicles.
5. For the above vehicles when fitted with catalytic converter deterioration factor shall be as follows:
Gasoline engines : CO = 1.2; (HC+NOx)= 1.2;
Diesel engines : CO = 1.1; (HC+NOx) = 1.0' PM = 1.2.
Provided that the vehicle manufacturers may opt for an aging test of 80,000 kms for evaluating deterioration factor, as per procedure that may be laid down by the Central Government.
6. For diesel engine vehicles, the emission of visible pollutants (smoke) shall not exceed the limit value to smoke density, when expressed as light absorption coefficient for various nominal flows as in Annexure-I to Rule 115(9) when tested at constant speeds over full load.

[Source : Central Motor Vehicles Rules, 1989
GSR 77 (E), dated January 31, 2000]

Emission of Smoke and Vapour from Agriculture Tractors Driven by Diesel Engines

1. Every agriculture tractor manufactured on and from the date of commencement of this rule shall be maintained in such condition and shall be so used that visible and gaseous pollutants emitted by them comply with the standards as prescribed in this rule.
2. Every manufacturer of agriculture tractor shall comply with the standards for visible pollutants, emitted by them, when tested as per the procedure described in IS 12062 : 1987.
3. The emission of visible pollutants shall not exceed the limit values given below when tested on engine dynamometer at 80% load at six equally spaced speeds, namely:
 1. 55% of rated speed declared by the manufacturer of 1000 rpm whichever is higher,
 - and
 2. rated speed declared by the manufacturer.

Maximum Smoke Density

Light absorption coefficient K(l/m)

3.25

Hartridge Units

75

4. (4) All diesel driven agriculture tractors shall be so manufactured and produced that they comply with the following standards of gaseous pollutants, emitted by them in addition to those of visibility pollutants as

provided in sub-rule (2) when tested as per the procedures described under ISO 8178-4 'C1' 8 mode cycle, namely:

The weighted average mass of carbon monoxide (CO), Hydrocarbons (HC) and mass oxides of Nitrogen (NOx) in g/kwhr emitted during the test shall not exceed the limits given below, both for type approval and COP tests, namely:

Mass of Oxides of Nitrogen (NOx) - 18.0 g/kwhr
Mass of Carbon Monoxide (CO) - 14.0 g/kwhr
Mass of Hydrocarbon (HC) - 3.5 g/kwhr

[Source : Central Motor Vehicles Rule, 1989, GSR 627(E) September, 99]

Mass Emission Standards for Compressed Natural Gas Driven Vehicles

Mass emission standards for vehicles when operating on Compressed Natural Gas shall replace Hydrocarbon by Non Methane Hydrocarbon. Non Methane Hydrocarbon (NMHC) may be estimated by an analyzer or by the following formula, namely:

$NMHC = HC \times (1 - K/100)$

Where HC = total hydrocarbon measured

K = % Methane content in natural gas fuel

Methane content in Compressed Natural Gas to be used as reference fuel shall not be less than 70%.

1. **For gasoline vehicles with OE fitment** : Prevalent type approval norms shall be applicable with "Non Methane Hydrocarbon" in place of total Hydrocarbon.
2. **For in-use gasoline vehicles** : The in-use vehicles fitted with CNG kits shall meet the emission norms prescribed for gasoline vehicles as applicable to the prevailing norms corresponding to the year of manufacture of the vehicle for purposes of CNG kit approval, the kit supplier shall obtain the certificate from any of the test agencies authorised under rule 126 based on vehicles of engine capacity in the range of (a) upto 750 cc, (b) from 751 cc to 1300 cc, and (c) from 1301 cc and above, and such kits shall be permissible to be retrofitted on any vehicle falling in the respective engine capacity range. For purposes of COP for such a kit, kit supplier/manufacturer shall have the certificate of the kit renewed after every 5 years.
3. **For diesel vehicles with OE fitment** : Prevalent type-approval norms for diesel vehicles shall be applicable with "Non Methane Hydrocarbon" in place of total Hydrocarbon.
4. **For in use diesel vehicles** : The in-use diesel vehicles when converted for operation on CNG, shall meet type approval norms for diesel vehicles corresponding to the year of manufacturer of the vehicle and the procedure for testing shall be as applicable to in-use gasoline vehicles. Such converted vehicles shall also meet road-worthiness requirements as may be specified by the Central Government.

Explanation :

1. For OE fitment and retrofitment on "In-use" vehicles, the responsibility of Type Approval shall be that of the vehicle manufacturer and kit manufacturer/importer respectively.
2. The Type Approval of CNG kit for retrofitment shall be valid for five years from the date of issue and shall be renewable.
3. Four-wheeled/three-wheeled vehicles converted for dedicated operation on CNG and fitted with a standby gasoline tank not exceeding 5 ltr/ 3 ltr/2 lts capacity respectively, shall be exempted from mass emission test, crank case test and evaporative emission test.
4. The retrofitment of CNG kits in in-use vehicles, shall be carried by workshops authorised by the kit manufacturer/kit supplier.

[Source : Central Motor Vehicles Rules, 1989
GSR 77 (E), dated January 31, 2000]

