CHAPTER 1 : OVERALL REQUIREMENTS

1. Scope :

1.1 This Part applies to the emission of gaseous pollutants from spark ignition engined (petrol) vehicles effective from 1st April, 1991. The method of test for mass emission given in this Part may also be used at the manufacturer's option for compression ignition engined vehicles with Gross Vehicle Weight (GVW) not exceeding 3500 kg, instead of Part V.

2. Definitions :

2.1 Spark Ignition Engine : Means an internal combustion engine in which the combustion of the air/fuel mixture is initiated at given instants by a hot spot, usually an electric spark.

2.2 Idle Speed : Means the engine rate, in revolution per minute, with fuel system controls (accelerator and choke) in the rest position, transmission in neutral and clutch engaged in the case of vehicles with manual or semi-automatic transmission, or with selector in park or neutral position when an automatic transmission is installed, as recommended by the manufacturer.

2.3 Normal Thermal Conditions : Means the thermal conditions attained by an engine and its drive line after a run of at least 15 minutes on a variable course, under normal traffic conditions.

2.4 Gaseous Pollutants : Means carbon monoxide, hydrocarbons (assuming a ratio of $CH_{1.85}$) and oxides of nitrogen, (being expressed in Nitrogen dioxide NO2 equivalent.)

2.5 Unladen Mass : Means the mass of the vehicle in running order without crew, passengers or load, but with the fuel tank 90% full and the usual set of tools and spare wheel on board where applicable.
In the case of 3-wheeled tractors, designed for coupling to a semi-trailer, the unladen mass will be that of the drawing vehicle.

2.6 Reference Mass : Means the "Unladen Mass" of the vehicle increased by a uniform figure of 75 Kg for 2 wheeled vehicles; and 150 Kg for all other vehicles.

2.7 Gross Vehicle Weight (GVW) : Means the technically permissible maximum weight declared by the vehicle manufacturer.

In case of the 3 wheeled vehicles designed to be coupled to a semi-trailer, the mass GVW to be taken into consideration when classifying that vehicle, shall be the maximum weight of the tractor in running order, plus the weight transferred to the tractor by the laden semi-trailer in static condition.

2.8 Cold Start Device : Means a device which enriches the air fuel mixture of the engine temporarily and thus to assist engine start up like choke.

2.9 Starting Aid : Means a device which assists engine start up with- out enrichment of the fuel mixture, e.g. glow plug, change of injection timing for fuel-injected spark ignition engine, etc.

2.10 Type Approval of a vehicle : Means the type approval of a vehicle model with regard to the limitation of the emission of gaseous pollutants from the engine.

2.11 Vehicle Model : Means a category of power-driven vehicles which do not differ in such essential respects as the equivalent inertia determined in relation to the reference weight of engine and vehicle characteristics which effects the vehicular emission and listed in Chapter 2 of this Part.

2.11 Vehicle for Type Approval Test : Means the fully built vehicle incorporating all design features for the model submitted by the vehicle manufacturer.

2.13 Vehicle for Conformity of Production : Means a vehicle selected at random from a production series of vehicle model which has already been type approved.

3. Application for Type Approval :

3.1 The application for type approval of a vehicle model with regard to limitation of the emission of gaseous pollutants from its engine shall be submitted by the vehicle manufacturer with a description of the engine and vehicle model comprising all the particulars referred to in Chapter 2 of this Part.

A vehicle representative of the vehicle model to be type approved shall be submitted to the testing agency responsible for conducting tests referred in para 5 of this Part.

4. Type Approval :

If the vehicle submitted for type approval pursuant to these rules, meet the requirements of para 5 below, approval of that vehicle model shall be granted. The approval of the vehicle model pursuant to this part shall be communicated to the vehicle manufacturer and nodal agency by the testing agency in the form of certificate of compliance to the CMVR, as envisaged in Rule-126 of CMVR.

5. Specification and Tests :

5.1 General : The components liable to affect the emission of gaseous pollutants shall be so designed, constructed and assembled to enable the vehicle, in normal use, despite the vibrations to which they may be subjected to comply with the provisions of this rule.

5.2 Specifications concerning the emissions of pollutants

5.2.1 The vehicle shall be subjected to tests of Type I and II as specified below according to the category it belongs.

5.2.2 Type I Test: (Verifying the average emission of gaseous pollutants)

5.2.2.1 The vehicle shall be placed on a dynamometer bench equipped with a means of load and inertia simulation. A test lasting a total of 648 seconds and comprising six cycles as described in Chapter 3 of this Part shall be carried out, without interruption. During the test the exhaust gases shall be diluted with air and a proportional sample collected in one or more bags. The contents of the bags will be analysed at the end of the test. The total volume of the diluted exhaust must be measured.

5.2.2.2 The test shall be carried out by the procedure described in Chapter 3 of this Part. The methods used to collect and analyse the gases shall be those prescribed. Other analysis methods may be approved if it is found that they yield equivalent results.

5.2.2.3 Subject to the provisions of para 5.2.2.7 the test shall be repeated three times.

5.2.2.4 For a spark ignition engined vehicle of a given category and given reference weight, the mass/km of the carbon monoxide and hydrocarbons obtained shall not be more than the amounts shown in paragraph. For spark ignition engined vehicles the value of NOx will be measured and recorded during the test, but no limits are set for NOx at present.

5.2.2.5 Emission Standard for Type I Test :

5.2.2.5.1 Three Wheeled Vehicles and its derivatives, including tractors for semi trailers of GVW not exceeding 1000 kg and 2 wheeled vehicles

THREE WHEELED VEHICLES AND ITS DERIVATIVES INCLUDING TRACTORS FOR SEMI TRAILERS OF GVW NOT EXCEEDING 1000Kg. AND TWO WHEELED VEHICLES

Reference mass , more than	R (Kg) Upto and including	CO (g/km)	HC (g/km)
----	150	12	8
150	350	$12 + \frac{18(R-150)}{200}$	$8 + \frac{4(R-150)}{200}$
350	----	30	12

5.2.2.5.2 ALL OTHER VEHICLES

Reference mass, more than	R (Kg) Upto and including	CO (g/km)	HC (G/km)
----	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	23.0	2.5
1930	2150	24.9	2.7
2150	----	27.1	2.9

5.2.2.6 Nevertheless, for each of the pollutants referred to in the foregoing para, not more than one of the three results obtained may exceed by not more than 10% the limit prescribed in that para for the vehicle concerned, provided the arithmetical mean of the three results rounded off to the second decimal place is not exceeding the prescribed limit. Where the prescribed limits are exceeded

for more than one pollutant (carbon monoxide and hydrocarbons), it shall be immaterial whether this occurs in the same test or in different tests.

5.2.2.6.1 If one of the three results obtained of each of the pollutants exceeds by more than 10% the limit prescribed in Para for the vehicle concerned, the test may be continued as specified in Para 5.2.2.6.1 below.

5.2.2.6.2 The number of tests prescribed in Para 5.2.2.3 above may, on the request of the manufacturer, be increased to 10 tests provided that the arithmetical mean (x) of the three results for carbon monoxide and/or for the emissions of hydrocarbons (rounded off to the second decimal place) falls between 100 and 110% of the limit (L). In this case, the decision, after testing, shall depend exclusively on the average results obtained from all 10 tests (rounded off to the second decimal place)i.e. $x < L$.

5.2.2.7 The number of tests prescribed in Para 5.2.2.3 above shall be reduced in the conditions hereinafter defined, where V_1 is the result of the first test and V_2 the result of the second test for each of the pollutants referred to in Para 5.2.2.4 above.

5.2.2.7.1 Only one test shall be performed if V_1 readings of carbon monoxide as well as the hydrocarbon are less than or equal to L i.e. $V_1 <= 0.70$ L.

5.2.2.7.2 Only two tests shall be performed if the results of V_1 readings of both the carbon monoxide and hydrocarbons are $V_1 < 0.85$ L, and if, at the same time, one of these values is $V_1 > 0.70$ L. In addition, the V_2 readings of both the carbon monoxide and hydrocarbon must satisfy the requirement that - $(V_1 + V_2) <= 1.70$ L and $V_2 <=$ L.
Fig.1 depicts the scheme.

5.2.3 Type II Test (Test for carbon monoxide emissions at idling speed)

5.2.3.1 This is applicable only for spark ignition engined vehicles.

5.2.3.2 The carbon monoxide content by volume of the exhaust gases emitted with the engine idling must not exceed 4.5%, for three wheeled vehicles and its derivatives, including tractors for semi-trailers of GVW not exceeding 1000 kg and two wheeled vehicles and 3.0% for all other vehicles when a test is made in accordance with the provisions of Chapter 9 of this Part.

6. Modifications of the vehicle Model :

6.1 Every modification in the essential characteristics of the vehicle model shall be intimated by the vehicle manufacturer to the test agency which type approved the vehicle model. The test agency may either

6.1.1 Consider that the vehicle with the modifications made may still comply with the requirement, or Require a further test to ensure further compliance.

6.2 In case of 6.1.1 above, the testing agency shall extend the type approval covering the modified specification or the vehicle model shall be subjected to necessary tests. In case, the vehicle complies with the requirements, the test agency shall extend the type approval.

6.3 Any changes to the procedure of PDI and running in concerning emission shall also be intimated to the test agency by the vehicle manufacturer, whenever such changes are carried out.

7. Model Changes :

7.1 Vehicle models of Different Reference Weights and coast down coefficients :

Approval of a vehicle model may under the following conditions be extended to vehicle models which differ from the type approved only in respect of their reference weight.

7.1.1 Approval may be extended to vehicle model of a reference weight requiring merely the use of the next higher or next lower equivalent inertia.

7.1.2 If the reference weight of the vehicle model for which extension of the approval is requested requires the use of a flywheel of equivalent inertia higher than that used for the vehicle model already type approved, extension of the approval shall be granted.

7.1.3 If the reference weight of the vehicle model for which extension of the type approval is requested requires the use of a flywheel of equivalent inertia lower than that used for the vehicle model already approved, extension of the type approval shall be granted if the masses of the pollutants obtained from the vehicle already approved are within the limits prescribed for the vehicle for which extension of the approval is requested.

7.1.4 If different body configurations are used with the same power plant & drive line & the change in the load equation due to changes in the coefficient of resistances that is less than that would be caused by the change of inertia to one step lower or one step higher than the inertia setting of the type approved vehicle, the approval may be extended.

7.2 Vehicle models with Different Overall Gear Ratios :

7.2.1 Approval granted to a vehicle model may under the following conditions be extended to vehicle models differing from the type approved only in respect of their overall transmission ratios;

7.2.1.1 For each of the transmission ratios used in the Type I Test, it shall be necessary to determine the proportion

$$E = (V_2 - V_1)/V_1,$$

where V_1 and V_2 are respectively the speed at 1000 rev/min of the engine of the vehicle model type approved and the speed of the vehicle model for which extension of the approval is requested.

7.2.2 If for each gear ratio E <= 8%, the extension shall be granted without repeating the Type I Tests.

7.3 Vehicle models of Different Reference Weights, coefficient of coast down and Different Overall Transmission Ratios
Approval granted to a vehicle model may be extended to vehicle models differing from the approved type only in respect of their reference weight, coefficient of coast down and their overall transmission ratios, provided that all the conditions prescribed in Para 7.1 and 7.2 above are fulfilled.

7.4 Note : When a vehicle type has been approved in accordance with the provisions of Para 7.1 to 7.3 above, such approval may not be extended to other vehicle types.

8 Conformity of Production :

8.1 Every produced vehicle of the model approved under this rule shall conform, with regard to components affecting the emission of gaseous pollutants by the engine to the vehicle model type approved. The procedure for carrying out conformity of production tests is given in Part VI of this document.

8.2 Type I Test : Verifying the average emission of gaseous pollutants : For verifying the conformity of production in a Type I Test, the following procedure is adopted :-

8.2.1 The vehicle sample taken from the series, as described in 8.1 is subjected to the test described in para 5.2.2 above. The mass/km of the Carbon monoxide and Hydrocarbon emitted by the vehicle shall not be more than the limit values given in para (instead of para 5.2.2.5) for the category and given reference weight.

8.2.2 Limit Values for Conformity of Production Tests for Spark Ignition Engined Vehicles

8.2.2.1 THREE WHEELED VEHICLES AND ITS DERIVATIVES INCLUDING TRACTORS FOR TRAILERS , GVW NOT EXCEEDING 1000Kg. AND TWO WHEELED VEHICLES

Reference mass R (Kg), more than	Reference mass R (Kg) Upto and including	CO (g/km)	HC (g/km)
----	150	15	10
150	350	$15 + \frac{25(R-150)}{200}$	$10 + \frac{5(R-150)}{200}$
350	----	40	15

8.2.2.2 ALL OTHER VEHICLES

Reference mass, more than	R (Kg) Upto and including	CO (g/km)	HC (G/km)
----	1020	17.3	2.7
1020	1250	19.7	2.7
1250	1470	22.5	2.8
1470	1700	24.9	3.0
1700	1930	27.6	3.3
1930	2150	29.9	3.5
2150	----	32.6	3.7

8.2.3 If the vehicle taken from the series does not satisfy the requirements of para 8.2.2 above, the manufacturer may ask for measurements to be performed on a sample of vehicles taken from the series and including the vehicle originally taken. The manufacturer shall specify the size n of the sample subject to 'n' being minimum 2 and maximum 10, including the vehicle originally taken. The vehicles other than originally tested shall be subjected to single Type I test. The result to be taken into consideration for the vehicle taken originally is the arithmetical mean of the three Type I tests carried

out on the vehicle. The arithmetical mean $\bar{x}$ of the results obtained with the sample and the standard deviation S of the sample shall then be determined for each gaseous pollutant (rounded off to the second decimal point) The production of the series shall then be deemed to conform if the following condition is met :

$$\bar{x} + k.S <= L$$

where $S^2 = \Sigma (x - \bar{x})^2 / (n-1)$

x - any one of the individual results obtained with the sample n.

L - the limit value prescribed in para 8.2.2 above for each gaseous pollutant considered; and

k - a statistical factor dependent on n and given by the following table :

n	2	3	4	5	6	7	8	9	10
k	0.973	0.613	0.489	0.421	0.376	0.342	0.317	0.296	0.279

If $n >= 20$, $k = 0.860 / \sqrt{n}$

8.2.4 Alternatively if the manufacturer requests so, the conformity of production can be verified by the following alternative sampling plan.

8.2.4.1 A failed vehicle is one whose test results, lead to one or more of the limit values in Para 8.2.4.2 being exceeded.

8.2.4.2 The production of the series is deemed to conform or not to conform by testing vehicles comprising a test sample until a

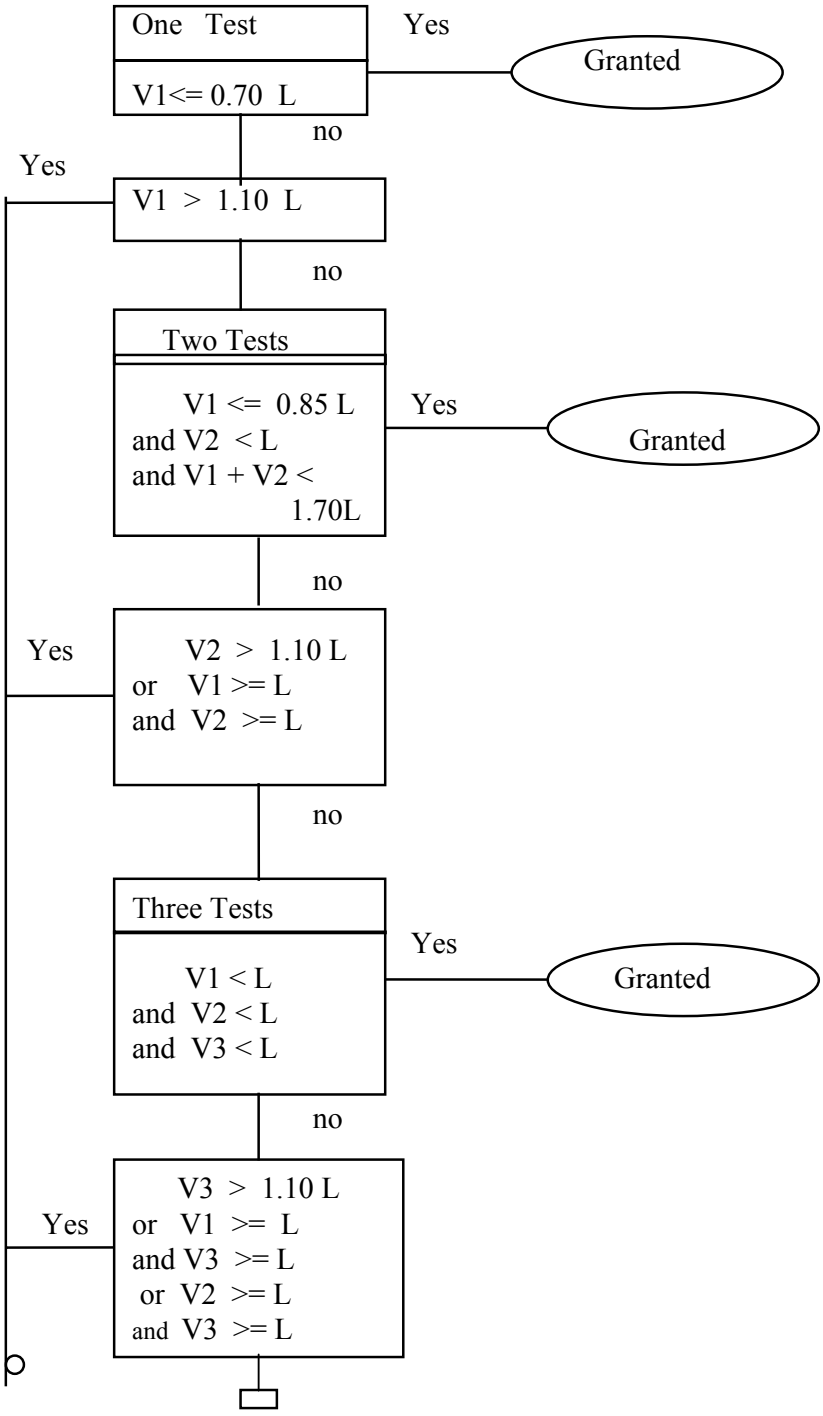
pass decision is reached for all limit values or a fail decision is reached for one limit value. A pass decision is reached when the cumulative number of failed vehicles as defined in Para 8.2.4.1 for each limit value is less than or equal to pass decision number appropriate to the cumulative number of vehicles tested. A fail decision is reached when the cumulative number of failed vehicles for one limit value is greater than or equal to the fail decision number appropriate to the cumulative number of vehicles tested. Once a pass decision has been made for a particular limit value the number of vehicles whose results exceed that limit values must not be considered any further for the purposes of checking conformity of production The pass and fail decision

numbers associated with the cumulative number of vehicles tested are illustrated in the figure 2 given in the following table.

8.3 Type II Test : Carbon-monoxide emission at idling speed

When the vehicle taken from the series for the type I test mentioned in 8.2 para above, subjected to the test described in Chapter 9 of this Part for verifying the carbon monoxide emission at idling speed should meet the limit values specified in para 5.2.3.2 above. If it does not, another 10 vehicles shall be taken from the series at random and shall be tested as per Chapter 9 of this Part. At least 9 vehicles should meet the limit values specified in para 5.2.3.2 above. In addition, two vehicles at random should be selected from the above lot of 10 and subjected to a Type I test mentioned in para 8.2 above and they should meet the requirements of para 8.2.2 above. Then the series is deemed to conform.

Fig.1 :- FLOW SHEET FOR THE TYPE APPROVAL / COP TESTS
(Please ref. para. 5.2.2.7.3 of chapter 1 of Part 3)



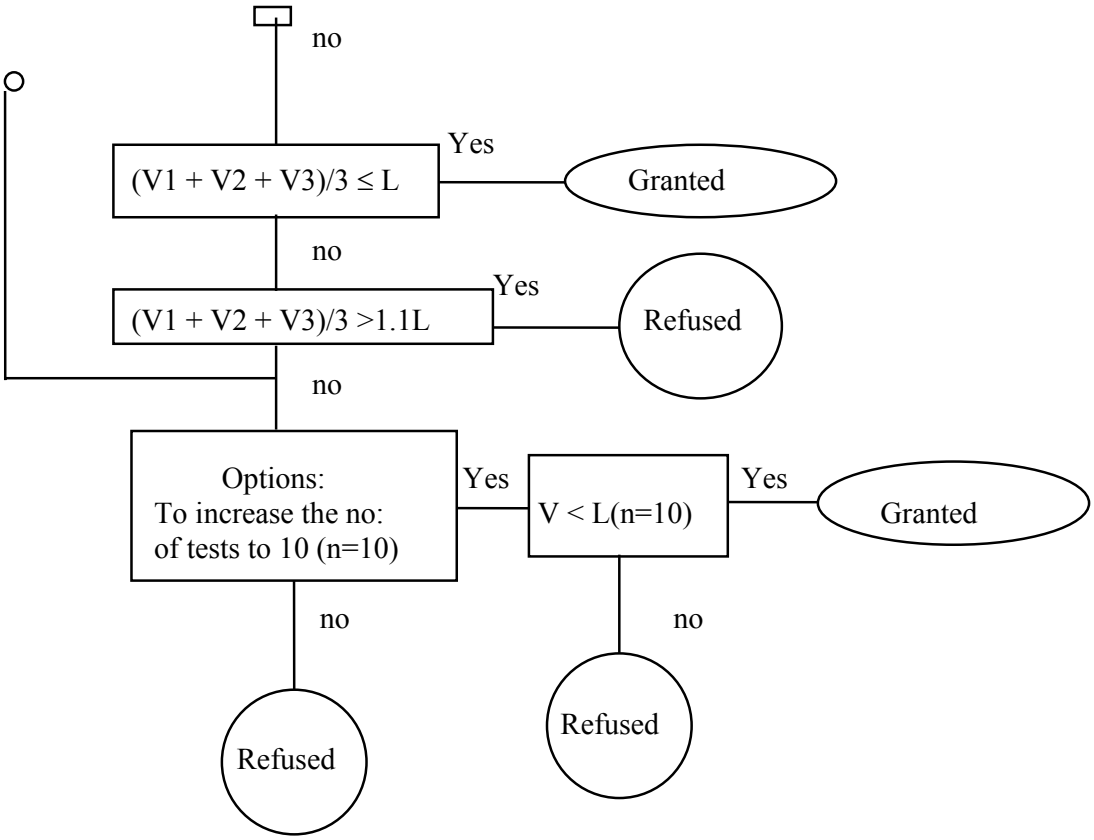

no
Yes
(V1 + V2 + V3)/3 ≤ L
Granted
no
Yes
(V1 + V2 + V3)/3 >1.1L
Refused
no
Options:
To increase the no:
of tests to 10 (n=10)
Yes
V < L(n=10)
Yes
Granted
no
no
Refused
Refused

FIG. 2 :-TABLE : PASS FAIL CRITERIA (See para. 8.2.4.2 of chapter 1 of Part 3)

Cumulative number vehicles tested	Pass decision (No. of failures)	Fail decision (No. of failures)	Cumulative number of vehicles tested	Pass decision (No. of failures)	Fail decision (No. of failures)
1	(‘)	(:)	31	14	20
2	(‘)	(:)	32	14	21
3	(‘)	(:)	33	15	21
4	(‘)	(:)	34	15	22
5	0	(:)	35	16	22
6	0	6	36	16	23
7	1	7	37	17	23
8	2	8	38	17	24
9	2	8	39	18	24
10	3	9	40	18	25
11	3	10	41	19	26
12	4	10	42	19	26
13	4	11	43	20	27
14	5	11	44	21	27
15	5	12	45	21	28
16	6	12	46	22	28
17	6	13	47	22	29
18	7	13	48	23	29
19	7	14	49	23	30
20	8	14	50	24	30
21	8	15	51	24	31

22	9	15	52	25	31
23	9	16	53	25	32
24	10	16	54	26	32
25	11	17	55	26	33
26	11	17	56	27	33
27	12	18	57	27	33
28	12	19	58	28	33
29	13	19	59	28	33
30	13	20	60	32	33

(,) SERIES NOT ABLE TO PASS AT THIS STAGE

(:) SERIES NOT ABLE TO FAIL AT THIS STAGE