

CHAPTER 1 : OVERALL REQUIREMENTS

1 Scope :

This Part applies to the emissions of visible pollutants from compression ignition engines (diesel) vehicles, effective from 1st April 1991.

2 Definitions :

- 2.1 Compression Ignition Engine : Means an internal combustion engine which operates on compression ignition principle (Diesel) Engines.
- 2.2 Smoke Density : Means the light absorption coefficient of the exhaust gases emitted by the vehicle expressed in terms of m^{-1} or in other units such as Bosch, Hartridge, % Opacity, etc. Fig.1 shows the relation between light absorption coefficient, expressed in m^{-1} % Opacity, Hartridge Smoke Unit (HSU) and Bosch Smoke units.
- 2.3 Opacity Meter : Means an instrument for continuous measurement of the light absorption coefficient of the exhaust gases emitted by vehicles.
- 2.4 Maximum Rated Speed : Means the maximum speed permitted by governor at full load.
- 2.5 Minimum Rated Speed : Means either the highest of the following three engine speeds 45% of maximum net power speed, 1000 rev/min, minimum speed permitted by the idling control,
OR
such lower speed as the manufacturer may request.
- 2.6 Net Power : Means the power of a C.I. engine as defined in Chapter 6 of this Part.
- 2.7 Unladen Mass : Means the mass of the vehicle in running order without crew, passengers or load, but with the fuel tank full 90% and the usual set of tools and spare wheel on board where applicable.
- 2.8 Gross Vehicle Weight (GVW) : Means the technically permissible maximum weight declared by the vehicle manufacturer.
- 2.9 Cold Start Device : Means a device which enriches the airfuel mixture of the engine temporarily and thus to assist engine start up.
- 2.10 Starting Aid : Means a device which assists the engine start up without enrichment of the fuel mixture, e.g. glow plug, change of injection timing, etc.

- 2.11 Type Approval of Vehicles : Means the type approval of a vehicle model with regard to the limitation of the emission of visible pollutants from the engine.
- 2.12 Vehicle Model : Means a category of power driven vehicles which do not differ in such essential respects of the vehicle characteristics which affects the vehicular emission and listed in Chapter 2 of this Part.
- 2.13 Vehicle for Type Approval Test : Means the fully built test vehicle incorporating all design features for the model submitted by the vehicle manufacturer.
- 2.14 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 limitations of the emission of visible 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.
- 3.2 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 below.
- 4 Type Approval :
If the vehicle submitted for approval pursuant to these rules, meet the requirements of para 5.0 below, approval of 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 CMVR, as envisaged in Rule-126 of CMVR.
- 5 Specifications and Tests :
- 5.1 General : The components liable to affect the emission of visible pollutants shall be so designed, constructed and assembled to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Rule.
- 5.2 Emissions at steady speeds over full load :
- 5.2.1 The test shall be carried out on an engine.
- 5.2.2 The power of the engine shall be measured on a test bench at steady speeds of the engine as detailed in full load curve as detailed in Chapter 6 of this Part. The

measured power may differ from the power specified by the manufacturer in Chapter of this Part as given below.

5.2.2.1 For Type Approval :

- For Single cylinder engines, $\pm 5\%$ at maximum power point and $\pm 10\%$ at other measurement points and for all other engines by $\pm 2\%$ at maximum power point and $+ 6\%$ and $- 2\%$ at other measurement points.

5.2.2.2 For Conformity of Production : At maximum power point by $\pm 10\%$ for single cylinder engines and $- 5\% / + 8\%$ for other engines.

5.2.3 In the case of a test on a vehicle it should be established that the fuel flow is not less than that declared by the manufacturer.

5.2.4 The emissions of visible pollutants when tested as detailed in Chapter 3 of this Part shall not exceed the limit values of light absorption coefficient given below for various nominal flows (from 1-4-1996):

Nominal Flow	Light Absorption Coefficient K(1/m)	Nominal Flow G(1/s)	Light Absorption Coefficient K(1/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	1.575	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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5.3 Emissions under free acceleration :

5.3.1 This is applicable for naturally aspirated and supercharged (turbocharged) engines.

5.3.2 The test shall be carried out on an engine installed on a test bench or on a vehicle. If the engine test is a bench test, it shall be carried out as soon as possible after the test for measurement of opacity under full load at steady speed. In particular the cooling water and the oil shall be at the normal temperature stated by the manufacturer. If the test is carried out on a stationary vehicle, the engine shall first be brought to normal operating conditions during a road run or on a dynamic test. The test shall be carried out as soon as possible after completion of this warming up period.

5.3.3 The emissions of visible pollutants under free acceleration, when tested according to the procedure detailed in Chapter 4 shall not exceed 2.45/m when expressed as light absorption coefficient.

5.3.4 At the request of the manufacturer additional tests described in Chapter 4 of this Part shall be performed to obtain free acceleration values for derivatives of the approved engine permitted by 7.0 below.

5.3.4.1 If the engine manufacturer desires to have the visible pollutants measured over a smaller range of torque and/or speed than is allowed by Para 7.0 below, then the approval of the engine type will be for the limited range of torque and speed.

5.3.4.2 If at a later stage it is desired to extend the approval of the engine to cover the whole of the torque/speed range allowed by Para 7.0 below then a further engine would have to be submitted for test so that the visible pollutants can be established for that part of the load/speed range which has previously been omitted.

5.3.5 If in order to meet some parts of the torque and speed ranges it is necessary to have additional specifications then these shall be declared in the format of Chapter 2 of this Part.

5.3.6 The value of the free acceleration absorption coefficient for the engine will be appropriately chosen in accordance with iterated speed and torque from the matrix of values established by the method in Chapter 4 of this Part.

5.4 Equivalent measuring instruments shall be allowed. If an instrument other than those described in Chapter 7 of this Part used, its equivalent for the engine considered shall be required to be proved.

6. Modification of the engine/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 Engine model. The test agency may consider that the vehicle/Engine model with the modifications either

6.1.1 comply with requirements

OR

6.1.2 require a further test to ensure compliance.

6.2 In case of 6.1.1 above, the testing agency shall extend the type approval covering the modified specifications. In case of 6.1.2 above, the vehicle/Engine model shall be subjected to necessary tests. In case the vehicle complies with the requirements, the test agency shall extend the type approval. 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 :

The approval may be extended without carrying out any type test for the following conditions ;

7.1 Maximum rated speed not greater than 100% nor less than 75% of that of the engine in the type approval test;

7.2 Minimum rated speed not less than that of the engine in the type approval test;

7.3 Rated torque not greater than 100%, nor less than 70% of that of the engine at the speed in the type approval test;

7.4 Steady state absorption values are not greater than 1.1 times the values obtained in the type approval test and do not exceed the prescribed limits in 5.2.4 of this Part.

7.5 Exhaust back pressure not greater than that of the engine in the type approval test;

7.6 Exhaust system volume does not differ by more than 40%;

7.7 Intake depression not greater than that of the engine in the type approval test;

7.8 Moment of inertia of a new combined fly wheel and transmission is within $\pm 15\%$ of the fly wheel and transmission system approved.

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 visible 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.

8.1.1 For verifying the conformity of production in the case of a vehicle with a naturally aspirated/supercharged (turbocharged) compression ignition engine, the vehicle selected at random from the series production should be subjected to the free acceleration test described in para 5.3 above and Chapter 4 of this part without running in of the vehicle or after running in of the engine in case the engine is

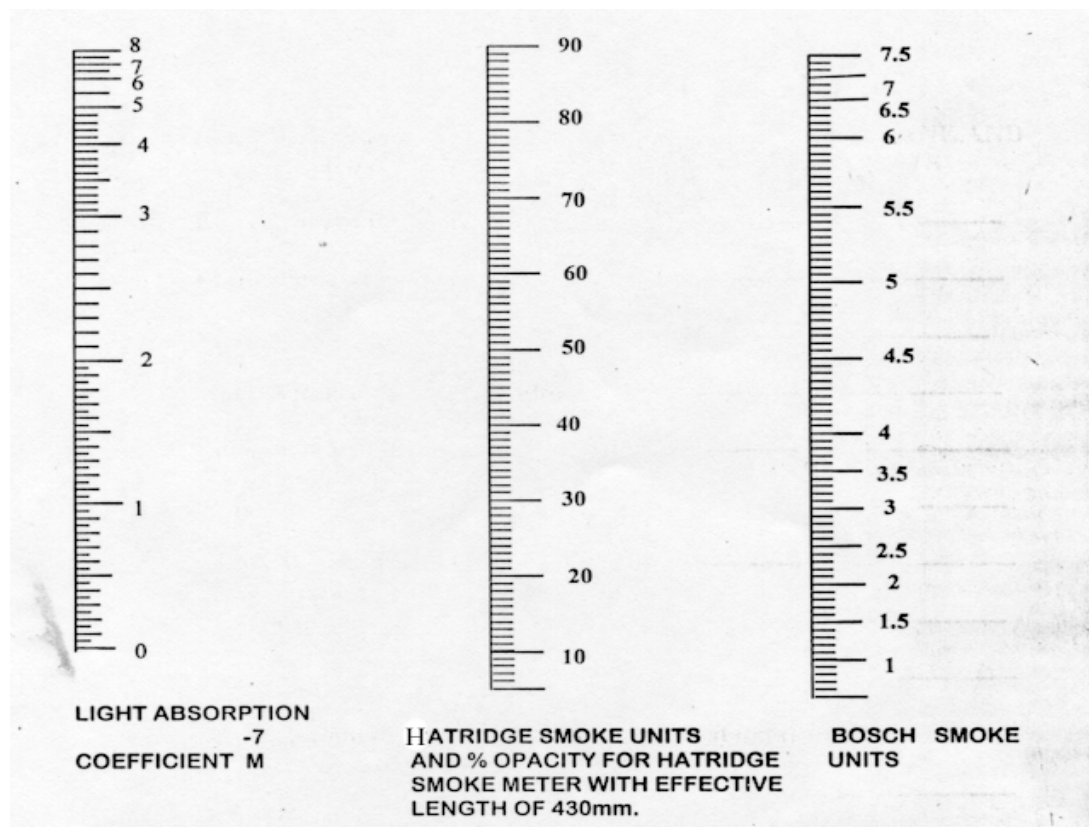
offered, and the light absorption coefficient shall be below 2.45/m. On the request of the manufacturers, commercially available fuel may be used instead of reference fuel.

- 8.1.2 If it does not, another 10 engines/vehicles shall be taken from the series at random and shall be tested as per Chapter 4 of this Part. At least 9 engines/vehicles should meet the limit values specified in para 5.3 above.

Further, two engines/vehicles selected at random from the above lot of 10 should be subjected to emissions at steady speeds over full load*, prescribed in para 5.2 above and described in Chapter 3 of this Part. If both the samples meet the requirements of para 5.2 above the series is deemed to conform.

- 8.1.3 If the net power does not full fill the requirements of 5.2.2.2, two more engines are tested in the same way.

- 8.1.3.1 If the net power figure does not full fill the requirements of 5.2.2.2, the production shall be considered not to confirm the requirements of regulations.



(NOT TO THE SCALE)

Fig.1 Diesel Engine Exhaust Smoke Value Correlation Chart
(Ref. Para 2.2 of Chapter 1 of Part 4)

NOTE : THE CORRELATION BETWEEN BOSCH SMOKE UNITS AND OTHER HAS BEEN ESTABLISHED ONLY FOR STEADY STATE CONDITIONS. HENCE THIS IS NOT APPLICABLE FOR THE FREE ACCELERATION TESTS