# PART I : DETAILS OF STANDARDS AND TEST PROCEDURS FOR MEASUREMENT OF CARBON MONOXIDE AND HYDRO CARBON EMISSIONS AT IDLING FOR IN-SERVICE VEHICLES FITTED WITH SI ENGINES

1. Scope & Field of application:

1.1 This Part applies to the emissions of carbon monoxide and hydro carbon at idling from in-service vehicles fitted with spark ignition engines, as referred in CMVR-115 (2)(a) and for issue of "Pollution under control certificate" to be issued by authorised agencies under CMVR-115 (7).

1.2 This part specifies standard and test procedure for the determination of the volumetric concentration of exhaust carbon monoxide (CO) and hydrocarbon (HC) emissions from road vehicles equipped with spark ignition engines running at idle speed.

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 min. on a variable course, under normal traffic conditions.

3.0 Test Procedure:

3.1 Instrument

3.1.1 The Instrument used for the measurement of CO and HC shall be a type approved instrument as given in CMVR-116 (3) and meeting the requirements specified in Part-VIII. For measurement of idling CO and HC emissions of in-use 2, 3 and 4 wheeler (other than Bharat Stage II and above compliant) vehicles, 2 Gas analyser type approved as per Chapter II

of Part VIII shall be used. For measurement of idling CO and HC emissions of in-use 4 wheeler vehicles (Bharat Stage II and above compliant), 4 Gas analyser type approved as per Chapter III of Part VIII shall be used. The tachometer to measure engine idling speed shall have an accuracy of ± 50 rpm.

3.1.2 The Instrument shall be prepared, used and maintained following the directions given in the instrument manufacturer's operation manual, and it shall be serviced and calibrated at such intervals as to ensure accuracy.

3.1.3 The electronic calibration shall be carried out at least once after switching on the instrument and thereafter a maximum time period of four hours. The span calibration using gas bottle shall be carried out at least once in four months and whenever instrument is moved to a different place. The total record of calibration shall be maintained and if it is observed during calibration that the calibration is shifted more than the accuracy, the calibration period shall be suitably reduced.

The calibration shall be performed well away from the exhaust of motor vehicles whose engines are running.

3.1.4 If the sample handling system is not integral with the analyser, the effectiveness of the condensate traps and all connections of the gas sampling system shall be checked. It shall be checked that filters are clean; that filter holders are fitted with their gaskets and that these are in good conditions.

3.1.5 If the Instrument is not self-compensated for non-standard conditions of altitude and ambient temperature or not equipped within a manually controlled system of compensation, the span calibration shall be performed with calibration gas.

3.1.6 It shall be ensured that the sample handling line and probe are free from contaminants and condensates.

3.2 Vehicle Preparation

3.2.1 It shall be checked that the road vehicle exhaust system is leak proof and that the manual choke control has been returned to the rest position.

3.2.2 It shall be checked that the gas sampling probe can be inserted into the exhaust pipe to a depth of at least 300 mm. If this proves impossible owing to the exhaust pipe configuration, a suitable extension to the exhaust pipe(s), making sure that the connection is leak proof, shall be provided.

3.2.3 The vehicle shall have attained normal thermal conditions as defined in 2.3, immediately prior to the measurement.

3.2.4 The vehicle idling speed shall be checked and set as per 2.2, as prescribed by the manufacturer, with all the accessories switched off.

3.3 Measurement

3.3.1 Immediately preceding the measurement, the engine is to be accelerated to a moderate speed with no load, maintained for at least 15 seconds, then returned to idle speed as set in 3.2.4.

3.3.1.1 While the engine idles, the sampling probe shall be inserted into the exhaust pipe to a depth not less than 300 mm.

3.3.3 After the engine speed stabilises, the reading shall be taken.

3.3.4 The value of CO and HC concentration reading shall be recorded.

3.3.5 In cases where gadgets or devices are incorporated in the exhaust system, for dilution of the exhaust, both CO and CO2 shall be measured using an instrument having facility to measure both CO and $CO_2$. If the total of the measured values of CO and $CO_2$ (T. CO and T. $CO_2$) concentration exceed 15% for four stroke engines and 10% for two stroke engines, the measured value of CO shall be taken as carbon monoxide emissions from the vehicle.

If it does not, the corrected value (T corrected) shall be taken, as given below: -

T corrected = T CO x 15/ (T CO + T $CO_2$)
For 4-stroke engines
= T CO x 10/ (T CO + T $CO_2$)
For 2-stroke engines

3.3.6 Multiple exhaust outlets shall be connected to a manifold arrangement terminating in a single outlet. If a suitable adopter is not available, the arithmetic average of the concentrations from the multiple pipes may be used.

3.3.7 If the measurement is to be repeated, the entire procedure of para 3.0 shall be repeated.

3.3.8 For the purpose of PUC (Pollution Under Control) certification, if the idling CO and/or HC are not within limits as per 4.0 below, the testing shall be discontinued and the vehicle owner shall be advised to resubmit the vehicle after repair / service.

4.0 Test Limits :

4.1 The vehicle when tested as per 3.0 above shall meet the following limits.

| Sr. No. | Vehicle Type (Petrol) | CO % | *HC (n – hexane equivalent) ppm |
|---|---|---|---|
| 1. | 2&3—Wheeler (2/4-stroke) (Manufactured on and before 31st March 2000) | 4.5 | 9000 |
| 2. | 2&3—Wheeler (2-stroke) (Manufactured after 31st March 2000) | 3.5 | 6000 |
| 3. | 2&3 – Wheeler (4-stroke) (Manufactured after 31st March 2000) | 3.5 | 4500 |
| 4. | 4-wheelers manufactured as per Pre Bharat Stage-II norms | 3.0 | 1500 |
| 5. | 4-Wheelers manufactured as per Bharat Stage-II, Bharat Stage-III or subsequent norms | 0.5 | 750 |

***NOTES :**

(i) Idling emission standards for vehicles when operating on CNG shall replace Hydrocarbon (HC) by Non Methane Hydrocarbon (NMHC). NMHC may be estimated by the following formula:

NMHC = 0.3 x HC

Where HC = Hydrocarbon measured (n – hexane equivalent)

(ii) Idling emission standards for vehicles when operating on LPG shall replace Hydrocarbon (HC) by Reactive Hydrocarbon (RHC). RHC may be estimated by the following formula:

RHC = 0.5 x HC

Where HC = Hydrocarbon measured (n – hexane equivalent)

5.0 Code of Practice for Authorised PUC Test Agencies :

The PUC test agencies authorised for issue of "Pollution Under Control Certificate" as per CMVR-115(7) shall comply with following Code of Practice.

5.1 The Type Approval certificate supplied by PUC equipment manufacturer / supplier shall be displayed in the PUC center.

5.2 The operator training certificate issued by PUC equipment manufacturer / supplier shall be displayed in the PUC center.

5.3 PUC operator shall submit the monthly report of all tested in-use vehicles along with test printout in original to the Transport Department.

5.4 PUC operator shall enter into AMC for a period of 5 years with the respective PUC equipment manufacturer based on the finalized charges.

6.0 Renewal of PUC Operator Licence

The licence of PUC operator shall be renewed by the concerned Transport Authorities provided the PUC operator follows Code of Practice as per 5.0 above.