

## Chapter 1

### OVERALL REQUIREMENTS

#### 1. Scope

- 1.1. This Part applies to the tailpipe emission of vehicles equipped with spark ignition engines (Petrol, CNG and LPG) and compression ignition engines (Diesel) for all M & N Category vehicles with GVW upto 3.5 tons for Bharat Stage IV.

At the request of the manufacturers, type-approval pursuant to TAP 115/116 issue 4 may be extended from M1 or N1 vehicles equipped with compression ignition engines which have already been type-approved, to M2 and N2 vehicles having a reference mass not exceeding 2,840 kg and meeting the conditions of Para 6 & 7 of this chapter.

- 1.1.1 Refer Chapter 16 of this part for tailpipe emission of Hybrid Electric vehicles.
- 1.2. The method of test for mass emission given in this Part may also be used at the manufacturer's option for compression ignition engine vehicles wherever applicable with Gross Vehicle Weight (GVW) not exceeding 3500 kg, instead of Part XV.
- 1.3. This Part should be read in conjunction with applicable Gazette Notification under CMVR for which the vehicle is subjected to test.

#### 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. **Compression Ignition Engine:** Means an engine, which works on the compression-ignition principle (e.g. diesel engine).
- 2.3. **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 semiautomatic transmission, or with selector in park or neutral position when an automatic transmission is installed, as recommended by the manufacturer.
- 2.4. **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.

2.5. **Gaseous Pollutants:** Means the exhaust gas emissions of carbon monoxide, oxides of nitrogen, expressed in nitrogen dioxide (NO<sub>2</sub>) equivalent, and hydrocarbons assuming a ratio of:

- C<sub>1</sub>H<sub>1.85</sub> for petrol,
- C<sub>1</sub>H<sub>1.86</sub> for diesel,
- C<sub>1</sub>H<sub>2.525</sub> for LPG,
- CH<sub>4</sub> for NG.

2.6. **Particulate Pollutants:** Means components of exhaust gas, which are removed from the diluted exhaust gas at a maximum temperature of 52°C (325 K) by means of filters described in Chapter 3 of this part

## 2.7. Tailpipe emissions means

- For positive ignition engines, the emission of gaseous pollutants.
- For compression ignition engines, the emission of gaseous and particulate pollutants.

2.8. Evaporative emissions means the hydrocarbon vapors lost from the fuel system of a motor vehicle other than those from tailpipe emissions.

2.8.1. Tank breathing losses are hydrocarbon emissions caused by temperature changes in the fuel tank (assuming a ratio of C<sub>1</sub>H<sub>2.33</sub>).

2.8.2. Hot soak losses are hydrocarbon emissions arising from the fuel system of a stationary vehicle after a period of driving (assuming a ratio of C<sub>1</sub> H<sub>2.20</sub>).

2.9. **Engine crankcase :** means the spaces in, or external to, an engine which are connected to the oil sump by internal or external ducts through which gases and vapors can escape.

2.10. **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.

2.11. **Reference Mass:** Means the "Unladen Mass" of the vehicle increased by a uniform figure of 150 kgs.

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

2.13. **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.

- 2.14. **Starting Aid:** Means a device which assists engine start up without enrichment of the fuel mixture, e.g. glow plug, change of injection timing for fuel-injected spark ignition engine, etc.
- 2.15. **Engine capacity means:** For reciprocating piston engines, the nominal engine swept volume.
- 2.16. **Anti pollution device:** means those components of the vehicles that control and / or limit tail pipe and evaporative emissions.
- 2.17. **OBD an on-board diagnostic system** for emission control which has the capability of identifying the likely area of malfunction by means of fault codes stored in computer memory.
- 2.18. **Type Approval of a vehicle:** Means the type approval of a vehicle model with regard to the limitation of tailpipe emissions from the vehicles.
- 2.19. **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.
- 2.20. **Vehicle for Type Approval Test:** Means the fully built vehicle incorporating all design features for the model submitted by the vehicle manufacturer.
- 2.21. **Vehicle for Conformity of Production:** Means a vehicle selected at random from a production series of vehicle model which has already been type approved.
- 2.22. **Hybrid Vehicle (HV)** means a vehicle with at least two different energy converters and two different energy storage systems (on vehicle) for the purpose of vehicle propulsion.
- 2.23. **Hybrid Electric Vehicle (HEV)** means a vehicle that, for the purpose of mechanical propulsion, draws energy from both of the following on-vehicle sources of stored energy/power
- a consumable fuel
  - an electrical energy/power storage device (e.g.: battery, capacitor, flywheel/ generator etc.)
- 2.24 **Bi Fuel** means a vehicle that can run part-time on petrol and also part-time on either LPG or NG
- 2.25 **Mono-fuel vehicle** means a vehicle that is designed primarily for permanent running on LPG or NG, but may also have a petrol system for emergency

purposes for starting only, where the petrol tank does not contain more than 15 litres of petrol.

- 2.26 **Periodically regenerating system** " means an anti-pollution device (e.g. catalytic converter, particulate trap) that requires a periodical regeneration process in less than 4,000 km of normal vehicle operation. During cycles where regeneration occurs, emission standards can be exceeded. If a regeneration of an anti-pollution device occurs at least once per Type I test and that has already regenerated at least once during vehicle preparation cycle, it will be considered as a continuously regenerating system which does not require a special test procedure.

At the request of the manufacturer, the test procedure specific to periodically regenerating systems will not apply to a regenerative device if the manufacturer provides data to the type approval authority that, during cycles where regeneration occurs, emissions remain below the standards given in applicable Gazette Notification applied for the concerned vehicle category after agreement of the test agency.

- 2.27 **Defeat Device** means any element of design which senses temperature, vehicle speed, engine rotational speed, transmission gear, manifold vacuum or any other parameter for the purpose of activating, modeling, delaying or deactivating the operation of any part of the emission control system, that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use. Such an element of design may not be considered a defeat device if

- 2.27.1 The need of the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle, or
- 2.27.2 The device does not function beyond the requirements of engine starting or,
- 2.27.3 Conditions are substantially included in the Type I or Type VI test procedure.

- 2.28 **Fuel Requirement by the Engine** means the type of fuel normally used by the engine.

- Petrol
- LPG (liquid petroleum gas)
- NG (Natural Gas)
- Either petrol or LPG
- Either petrol or NG
- Diesel fuel

### 3. Application for Type Approval

- 3.1. The application for type approval of a vehicle model with regard to limitation of its tailpipe emissions, evaporative emissions, durability of anti-pollution devices as well as to its on-board diagnostic (OBD) system from the vehicles 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 Chapter. Should the application concern an on-board diagnostic (OBD) system the procedure described in Chapter 13, Para 3 for OBD I & Chapter 14, Para 3 for OBD II as applicable must be followed.

- 3.1.1. Should the application concern an on-board diagnostic (OBD) system, it must be accompanied by the additional information required in chapter 2 of this part.

3.1.1.1. Declaration by the manufacturer for OBD II:

- i. In the case of vehicles equipped with positive-ignition engines, the percentage of misfires out of a total number of firing events that would result in emissions exceeding the limits given in Para 3.3.2 of Chapter 14 if that percentage of misfire had been present from the start of a Type I test as described in Para 5.3.1 of Chapter 3;
- ii. In the case of vehicles equipped with positive-ignition engines, the percentage of misfires out of a total number of firing events that could lead to an exhaust catalyst, or catalysts, overheating prior to causing irreversible damage;

3.1.1.2. Detailed written information fully describing the functional operation characteristics of the OBD system, including a listing of all relevant parts of the vehicle's emission control system, i.e. sensors, actuators and components, that are monitored by the OBD system;

3.1.1.3. a description of the malfunction indicator (MI) used by the OBD system to signal the presence of a fault to a driver of the vehicle;

3.1.1.4. the manufacturer must describe provisions taken to prevent tampering with and modification of the emission control computer;

3.1.1.5. when appropriate, copies of other type-approvals with the relevant data to enable extensions of approvals;

3.1.1.6.if applicable, the particulars of the vehicle family as referred to in Chapter 13, Annex 3 or Chapter 14, Annex 2 as applicable.

3.1.2. For the tests described in Para 5 & 6 of Chapter 13 or Para 3 of Chapter 14 as applicable, a vehicle representative of the vehicle type or vehicle family fitted with the OBD system to be approved must be submitted to the test agency responsible for the type-approval test. If the test agency determines that the submitted vehicle does not fully represent the vehicle type or vehicle family described in Chapter 13, Annex 3 or Chapter 14, Annex 2 as applicable, an alternative and if necessary an additional vehicle must be submitted for test in accordance with Para 5 of Chapter 13 or Para 3 of Chapter 14.

3.2. A model of the information document relating to tailpipe emissions, evaporative emissions, durability and the on-board diagnostic (OBD) system is given in Chapter 2.

3.2.1. Where appropriate, copies of other type-approvals with the relevant data to enable extension of approvals and establishment of deterioration factors must be submitted.

3.3. For the tests described in Para 5 of this Chapter a vehicle representative of vehicle type to be approved must be submitted to the / testing agency responsible for the type-approval test.

#### **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 tailpipe and evaporative emissions 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 tailpipe emissions)

5.2.2.1. The vehicle shall be placed on a Chassis dynamometer bench equipped with a means of load and inertia simulation.

5.2.2.2. A test lasting a total of 19 minutes and 40 seconds made up of two parts, One and Two shall be performed without interruption. An unsampled period of not more than 20 seconds may, with the agreement of the manufacturer, be introduced between the end of Part One and the beginning of Part Two in order to facilitate adjustment of the test equipment.

If reference fuel is available, vehicles that are fuelled with LPG or CNG shall be tested in the type I test for variations in the composition of LPG or CNG, as set out in 3.2 of chapter 3 of this part. Vehicles that can be fuelled either with LPG or CNG to be tested for Fuel A & Fuel B in case of LPG and G20 & G25 in case of CNG.

Reference Fuel shall be used for Type Approval and Conformity of Production one year after the same is available to the test agencies. Till then, Commercial CNG/LPG fuel shall be used as per applicable Gazette Notification under CMVR.

5.2.2.3.1 Part One of the test cycle is made up of 4 elementary urban cycles. Each elementary urban cycle comprises 15 phases (idling, acceleration, steady speed, and deceleration).

5.2.2.3.2 Part Two of the test cycle is made up of one extra urban cycle. The extra urban cycle comprises 13 phases (idling, acceleration, steady speed, and deceleration).

5.2.2.4. 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 shall be measured. Carbon monoxide (CO), hydro carbon (HC) and nitrogen oxide emissions (NO<sub>x</sub>), and in addition particulate matter (PM) the case of vehicles equipped with compression ignition engines shall be recorded. Carbon dioxide shall also be recorded for the purpose of calculation of fuel consumption.

5.2.2.5. The test shall be carried out by the procedure described in Chapter 3 of Part XIV. The methods used to collect and analyse the gases and to remove and weigh the particulates shall be as prescribed.

5.2.2.6. Subject to the provisions of the paragraphs 5.2.2.8 & 5.2.2.9, the test shall be repeated three times, the test results shall be multiplied by

appropriate deterioration factors as notified in CMVR and, in the case of periodically regenerating systems also must be multiplied by the  $K_i$  factors obtained from Chapter 15 of Part XIV of this document. The resulting masses of gaseous emission and, in the case of vehicles equipped with compression-ignition engines, the mass of particulates obtained in each test shall not exceed the applicable limits.

5.2.2.7. Type Approval Mass Emission Standards for Type I test:

Mass emission standards (Bharat Stage IV) for vehicles (4 wheelers) shall be as per the details given in Rule No. 115 [15 (b) (i)] of CMVR, as amended from time to time, for petrol and diesel vehicles. For CNG and LPG vehicles, this rule should be read in conjunction with the rule 115(B) and 115(C).

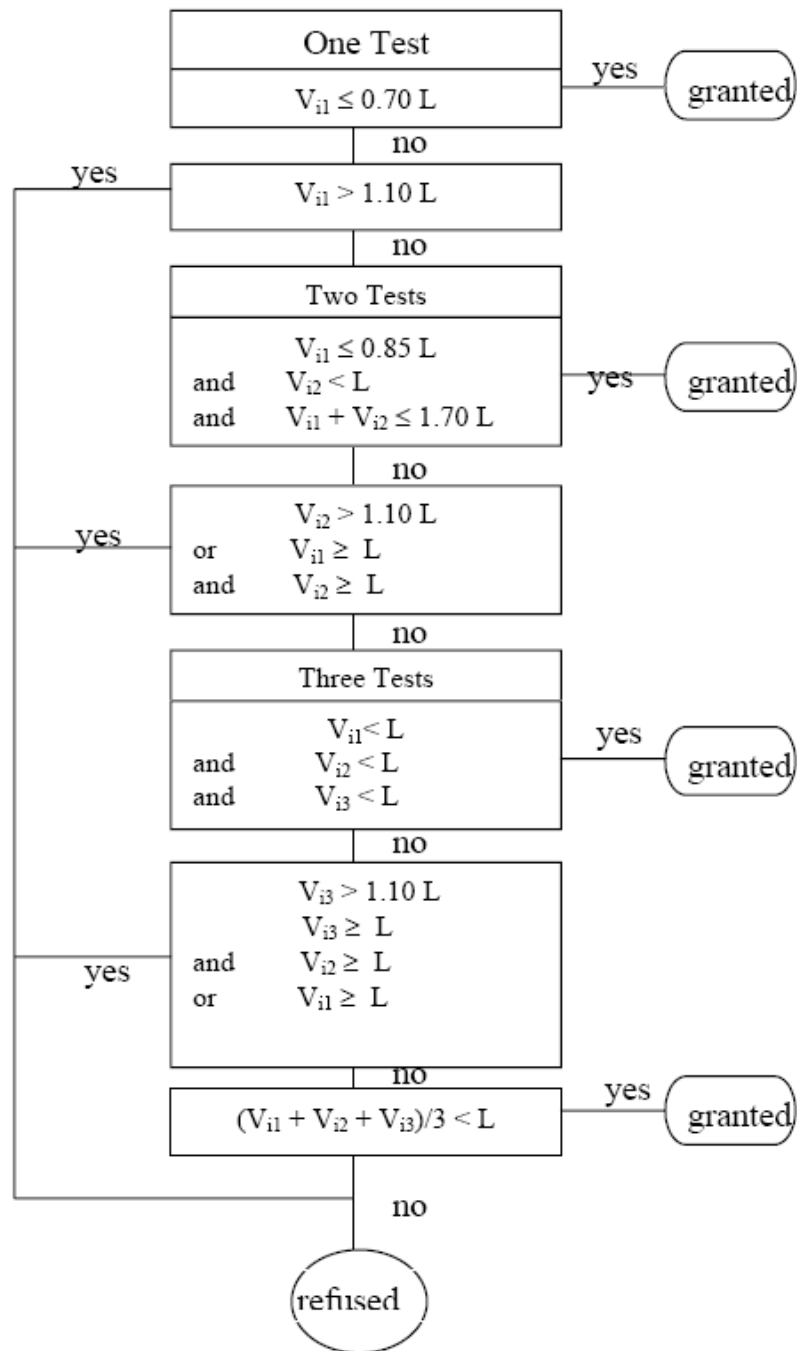
5.2.2.8. Nevertheless, for each of the pollutants or combination of pollutants one of the three results obtained may exceed by not more than 10% of the applicable limits prescribed for the vehicle concerned, provided the arithmetical mean of the three results is not exceeding the prescribed limit. Where the prescribed limits are exceeded for more than one pollutant or combination of pollutants, it shall be immaterial whether this occurs in the same test or in different tests.

5.2.2.9. The number of tests prescribed in Para 5.2.2.8 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 5.2.2.6 above.

- i. Only one test shall be performed if the result obtained for each pollutant or the sum of values for pollutants in case of the limit is so specified (e.g. HC+ NO<sub>x</sub>) is less than or equal to 0.7 L i.e.  $V_1 \leq 0.70$  L.
- ii. If the requirements of 5.2.2.9.1 are not satisfied, only two tests are performed, if for each pollutant or the sum of values for pollutants in case of the limit is so specified (e.g. HC + NO<sub>x</sub>), the following requirements are met.  $V_1 \leq 0.85$  L and  $V_1 + V_2 \leq 1.7$  L and  $V_2 \leq$  L. Fig.1 depicts the scheme.



Figure 1: Flow Sheet for the Type Approval Test as per Bharat Stage IV for 4 wheelers



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

5.2.3.1. This is applicable only for spark ignition engine vehicles.

5.2.3.2. The carbon monoxide and Hydrocarbons content by volume of the exhaust gases emitted with the engine idling must not exceed as per the limits mentioned in 4.1 of Part I of this document.

5.2.4. Type III test (verifying emission of crankcase gases).

5.2.4.1. This test must be carried out on all 4 wheeler vehicles referred to in Para 1 except those having compression ignition engines.

5.2.4.2. When tested in accordance with Chapter 10, the engine's crankcase ventilation system must not permit the emission of any of the crankcase gases into the atmosphere.

5.2.5. Type IV test (determination of evaporative emission).

5.2.5.1. This test must be carried out on all 4 wheeler gasoline vehicles.

5.2.5.2. When tested in accordance with Chapter 11, evaporative emission shall be less than 2 g/test.

5.2.6. Type V test (durability of anti-pollution devices): The requirement of durability must be complied on all vehicles referred to in Para 1 of this Chapter. This may be established by using the deterioration factor notified in CMVR or by carrying out the durability test. The test represents an ageing test of 80,000 km for four wheelers driven in accordance with the program described in chapter 12, on a test track, on the road or on a chassis dynamometer.

5.2.6.1 For all type of 4 wheelers a deterioration factor as notified in Notification is applicable.

OR

The vehicle manufacturer may opt for an ageing test of 80,000 km for 4 wheeler vehicles for evaluation deterioration factor as described in chapter 12.

5.2.6.2 At the request of the manufacturer, the testing agency may carry out the Type I test before Type V test has been completed using the deterioration factors given in Notification. On completion of Type V test, the test agency may then amend the type-approval

results recorded in the Notification with those measured in type V test.

5.2.6.3 Deterioration factor are determined using either procedure in chapter 12 or using the values in the notifications at the option of manufacturer. The factors are used to establish compliance with the requirements of 5.2.2.6 and 8.2.

## **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 Type I & Type II test**

7.1.1 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.

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

7.1.1.2 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.

7.1.1.3 If different body configurations are used with the same power plant and drive line and the change in the load equation due to changes in the coefficient of resistances that is within the limits that would be caused by the change of inertia as permitted by Clause 7.1.1 above the approval may be extended.

#### 7.1.2 Vehicle models with Different Overall Gear Ratios:

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

7.1.2.2 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 at engine speed of 1000 rev/min, V1 is the speed of the vehicle model type approved and V2 is the speed of the vehicle model for which extension of the approval is requested.

7.1.2.3 If for each gear ratio  $E \leq 8\%$ , the extension shall be granted without repeating the Type I Tests.

7.1.2.4 If for at least one gear ratio,  $E > 8\%$  and if for each gear ratio  $E \leq 13\%$  the Type I test must be repeated, but may be performed in laboratory chosen by the manufacturer subject to the approval of the test agency granting type approval. The report of the tests shall be submitted to the test agency by the manufacturer.

7.1.3 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.

7.1.4 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.

7.1.5 Vehicle model with different makes of emission related components:

7.1.5.1 the manufacturers shall inform the test agency The names of suppliers of items such as ignition coil, magneto, CB point, air filter, silencer, etc. mentioned above, that in addition to carried out the type approval, the names of new alternate suppliers for these items as and when they are being introduced.

7.1.5.2 At the time of first type approval or for a subsequent addition of a make for a particular part, work out the combinations of tests in such a way that each make of such parts are tested at least once,

**7.2 Evaporative Emissions (type IV test)**

7.2.1.1 Approval granted to a vehicle type equipped with a control system for evaporative emissions may be extended under the following conditions.

7.2.1.2 The basic principle of fuel/air metering (e.g. single point injection, carburetor) must be the same.

7.2.1.3 The shape of the fuel tank and the material of the fuel tank and liquid fuel hoses must be identical. The worst-case of family with regards to the cross-section and approximate hose length must be tested. Whether non-identical vapor/liquid separators are acceptable is decided by the technical service responsible for the type-approval tests. The fuel tank volume must be within a range of  $\pm 10\%$ . The setting of the tank relief valve must be identical.

7.2.1.4 The method of storage of the fuel vapor must be identical, i.e. trap form and volume, storage medium, air cleaner (if used for evaporative emission control), etc.

7.2.1.5 The carburetor bowl fuel volume must be within a 10 milliliter range.

7.2.1.6 The method of purging of the stored vapor must be identical (e.g., air flow, start point or purge volume over driving cycle).

7.2.1.7 The method of sealing and venting of the fuel metering system must be identical.]

#### 7.2.2 Further notes:

- i. different engine sizes are allowed;
- ii. different engine powers are allowed;
- iii. automatic and manual gearboxes, two and four wheel transmissions are allowed;
- iv. different body styles are allowed;
- v. different wheel and tyre sizes are allowed.

### 7.3 Durability of anti-pollution devices (Type V Test)

7.3.1 Approval granted to a vehicle type may be extended to different vehicle types, provided that the engine/pollution control system combination is identical to that of the vehicle already approved. To this end, those vehicle types whose parameters described below are identical or remain within the limit values prescribed are considered to belong to the same engine/pollution control system combination.

#### 7.3.2 Engine:

- number of cylinders,
- engine capacity ( $\pm 15\%$ ),
- configuration of the cylinder block,
- number of valves,
- fuel system,
- type of cooling system,
- combustion process,
- cylinder bore center to center dimensions

#### 7.3.3 Pollution control system:

- Catalytic Converters:
  - Number of catalytic converters and elements
  - Size and shape of catalytic converters (volume of monolith  $\pm 10\%$ ),
  - Type of catalytic activity (oxidizing, three-way),
  - Precious metal load (identical or higher),
  - Precious metal ratio ( $\pm 15\%$ )
  - Substrate (structure and material),
  - Cell density,
  - Type of casing for the catalytic converter(s),
  - Location of catalytic converters (position and dimension in the exhaust system that does not produce a temperature variation of more than 50 K at the inlet of the catalytic converter). This temperature variation shall be checked under stabilized conditions at a speed of 90 km/h for Four Wheelers, and the load setting of type I test.
- Air injection:

- With or without
- Type (pulsair, air pumps....)
- EGR:
  - With or without

7.3.4 Inertia category: the two inertia categories immediately above and any inertia category below.

7.3.5 The durability test may be achieved by using a vehicle, the body style, gear box (automatic or manual) and size of the wheels or tyres of which are different from those of the vehicle type for which the type approval is sought.

## **7.4 On-board diagnostics**

Approval granted to a vehicle type with respect to the OBD system may be extended to different vehicle types belonging to the same vehicle-OBD family as described in Chapter 13, Annex 3 or Chapter 14, Annex 2 as applicable. The engine emission control system must be identical to that of the vehicle already approved and comply with the description of the OBD engine family given in Chapter 13, Annex 3 or Chapter 14, Annex 2 as applicable, regardless of the following vehicle characteristics:

- engine accessories,
- tyres,
- equivalent inertia,
- cooling system,
- overall gear ratio,
- transmission type,
- type of bodywork.

## **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 administrative procedure for carrying out conformity of production is given in Part VI of this document. However, when the period between commencement of production of a new model and beginning of next rationalized COP period is less than two months, the same would be merged with the rationalized COP period.

8.2 If a type I test is to be carried out and a vehicle type-approval has one or several extensions, the tests will be carried out either on the vehicle described in the initial information package or on the vehicle described in the information package relating to the relevant extension.

8.3 Three vehicles are selected at random in the series and are tested as described in para 5.2.2 above. However, in case of vehicle model and its variants produced less than 250 in the half yearly period as mentioned in clause 11.1 of Part VI of this document sample size shall be one. The deterioration factors are used in the same way. The limit values are as specified in applicable notification.

8.4 Type I Test: Verifying the average emission of gaseous pollutants: For verifying the conformity of production in a Type I Test, the following procedure as per Option1 is adopted.

8.5 To verify the average tailpipe emissions of gaseous pollutants of low volume vehicles with Annual production less than 250 per 6 months, manufacture can choose from the Option 1 OR Option 2 as listed below:

### **8.6 Option 1**

8.6.1 The vehicle samples taken from the series, as described in 8.1 is subjected to the test described in Para 5.2.2 above. The results shall be multiplied by the deterioration factors used at the time of type approval and in the case of periodically regenerating systems the results shall also be multiplied by the  $K_i$  factors obtained by the procedure specified in Chapter 15 of Part XIV of this document at the time when type approval was granted. The result masses of gaseous emissions and in addition in case of vehicles equipped with compression ignition engines, the mass of particulates obtained in the test shall not exceed the applicable limits.

8.6.2 Procedure for Conformity of Production as per Bharat Stage IV for all M and N Category vehicles upto 3.5 tons GVW.

8.6.2.1 Conformity of production shall be verified as per Bharat Stage IV emission norms for 4 wheeler vehicles as given in Para 5.2.2.7 and with the procedure given below.

8.6.2.2 To verify the average tailpipe emissions of gaseous pollutants following procedure shall be adopted:

8.6.2.3 Minimum of three vehicles shall be selected randomly from the series with a sample lot size as defined in part VI of MoRTH/CMVR/TAP-115/116.

8.6.2.4 After selection by the authority, the manufacturer must not undertake any adjustments to the vehicles selected, except those permitted in Part VI.

8.6.2.5 All three randomly selected vehicles shall be tested for a Type - I test as per Para 5.2.2 of chapter 1 of this part.

8.6.2.6 Let  $X_{i1}$ ,  $X_{i2}$  &  $X_{i3}$  are the test results for the Sample No.1, 2 & 3.

8.6.2.7 If the natural Logarithms of the measurements in the series are  $X_1$ ,  $X_2$ ,  $X_3$  .....  $X_j$  and  $L_i$  is the natural logarithm of the limit value for the pollutant, then define:



$$d_i = X_i - L_i$$

$$\bar{d}_n = \frac{1}{n} \sum_{j=1}^n d_j$$

$$V_n^2 = \frac{1}{n} \sum_{j=1}^n (d_j - \bar{d}_n)^2$$

8.6.2.8 Table I of Chapter 1 of this part shows values of the pass ( $A_n$ ) and fail ( $B_n$ ) decision numbers against current sample number. The test statistic is the ratio  $\bar{d}_n / V_n$  and must be used to determine whether the series has passed or failed as follows:

- Pass the series, if  $\bar{d}_n / V_n \leq A_n$  for all the pollutants.
- Fail the series if  $\bar{d}_n / V_n \geq B_n$  for any one of the pollutants.
- Increase the sample size by one, if  $A_n < \bar{d}_n / V_n < B_n$  for any one of the pollutants. When a pass decision is reached for one pollutant, that decision will not be changed by any additional tests carried out to reach a decision for the other pollutants
- If no pass decision is reached for all the pollutants and no fail decision is reached for one pollutant, a test shall be carried out on another randomly selected sample till a pass or fail decision is arrived at.

8.6.2.9 Running in may be carried out at the request of the manufacturer either as per the manufacturers recommendation submitted during type approval or with a maximum of 3000 km for the vehicles equipped with a positive ignition engine and with a maximum of 15000 km for the vehicles equipped with a compression ignition engine.

8.6.2.10 Alternatively if the manufacturer wishes to run in the vehicles, ("x" km, where  $x \leq 3000$  km for vehicles equipped with a positive ignition engine and  $x \leq 15000$  km for vehicles equipped with a compression ignition engine), the procedure will be as follows:

- the pollutant emissions (type I) will be measured at zero and at "x" km on the first tested vehicle,
- the evolution coefficient of the emissions between zero and "x" km will be calculated for each of the pollutants:

$$\frac{\text{Emissions "x" km}}{\text{Emissions zero km}}$$

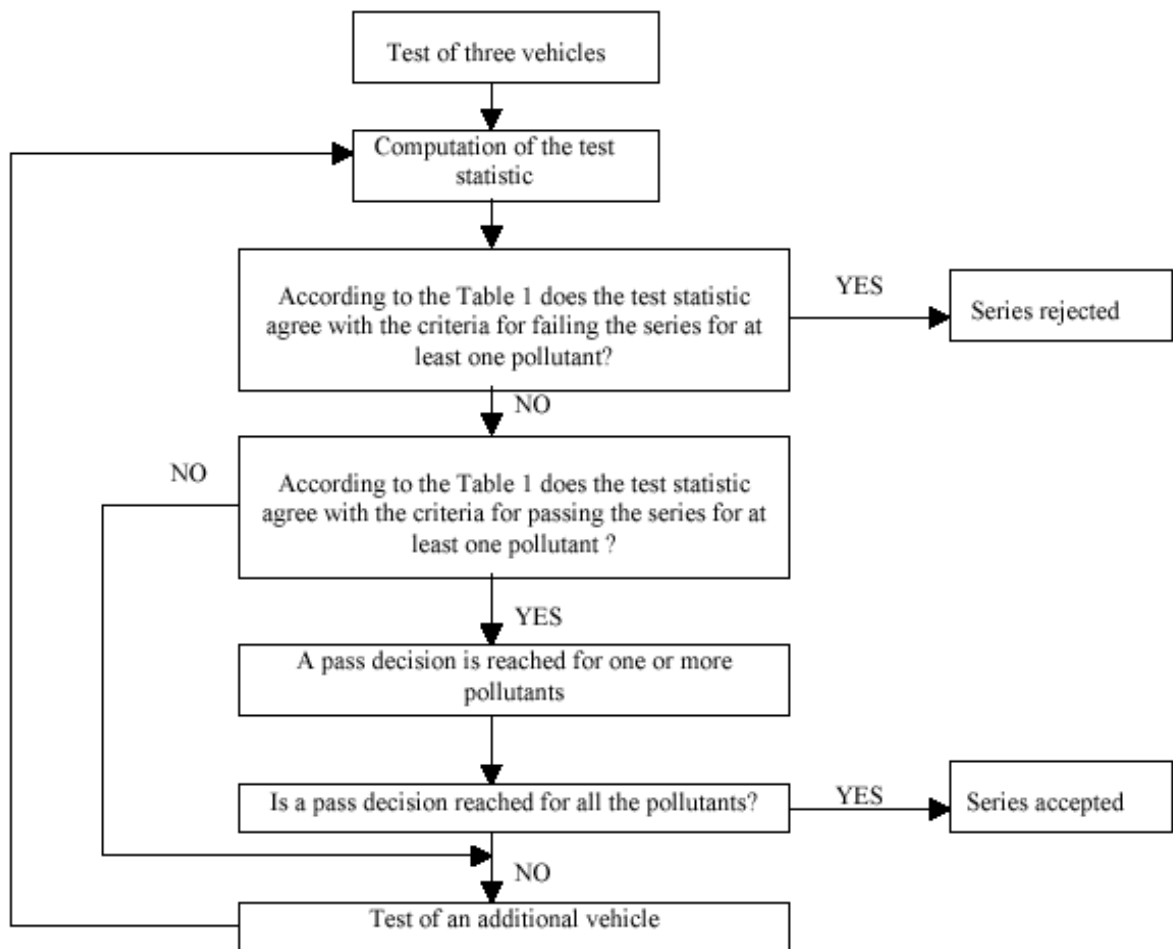
This may be less than 1,

- the other vehicles will not be run in, but their zero km emissions will be multiplied by the evolution coefficient.

In this case, the values to be taken will be:

- the values at "x" km for the first vehicle,
- the values at zero km multiplied by the evolution coefficient for the other vehicles.

8.6.2.11 All these tests shall be conducted with the reference fuel as specified in the applicable gazette notification. However, at the manufacturer's request, tests may be carried out with commercial fuel.



**Figure 2: Option 1 CoP Test Procedure as per Bharat Stage IV for 4 wheelers.**

**Table I: Applicable for CoP Procedure as per Bharat Stage IV for 4 wheelers.**

Sample size (n)	Pass decision threshold (A <sub>n</sub> )	Fail decision threshold (B <sub>n</sub> )
3	-0.80381	16.64743
4	-0.76339	7.68627
5	-0.72982	4.67136
6	-0.69962	3.25573
7	-0.67129	2.45431
8	-0.64406	1.94369
9	-0.61750	1.59105
10	-0.59135	1.33295
11	-0.56542	1.13566
12	-0.53960	0.97970
13	-0.51379	0.85307
14	-0.48791	0.74801
15	-0.46191	0.65928
16	-0.43573	0.58321
17	-0.40933	0.51718
18	-0.38266	0.45922
19	-0.35570	0.40788
20	-0.32840	0.36203
21	-0.30072	0.32078
22	-0.27263	0.28343
23	-0.24410	0.24943
24	-0.21509	0.21831
25	-0.18557	0.18970
26	-0.15550	0.16328
27	-0.12483	0.13880
28	-0.09354	0.11603
29	-0.06159	0.09480
30	-0.02892	0.07493
31	0.00449	0.05629
32	0.03876	0.03876

## 8.7 Option 2

- 8.7.1 The vehicle samples taken from the series, as described in 8.1 is subjected to the test described in Para 5.2.2 above. The results shall be multiplied by the deterioration factors used at the time of type approval and in the case of periodically regenerating systems the results shall also be multiplied by the  $K_i$  factors obtained by the procedure specified in Chapter 15 of Part XIV of this document at the time when type approval was granted. The result masses of gaseous emissions and in addition in case of vehicles equipped with compression ignition engines, the mass of particulates obtained in the test shall not exceed the applicable limits.
- 8.7.2 Procedure for Conformity of Production as per Bharat Stage IV for all M and N Category vehicles upto 3.5 tons GVW.
- 8.7.2.1 Conformity of production shall be verified as per Bharat Stage IV emission norms for 4 wheeler vehicles as given in Para 5.2.2.7 and with the procedure given below.
- 8.7.2.2 To verify the average tailpipe emissions of gaseous pollutants following procedure shall be adopted:
- 8.7.2.3 Minimum of three vehicles shall be selected randomly from the series with a sample lot size.
- 8.7.2.4 After selection by the authority, the manufacturer must not undertake any adjustments to the vehicles selected, except those permitted in Part VI. MoRTH/CMVR/TAP-115/116
- 8.7.2.5 First vehicle out of three randomly selected vehicles shall be tested for Type - I test as per MoRTH/CMVR/TAP-115/116 Para 5.2.2 of chapter 1.
- 8.7.2.6 Only one test ( $V_1$ ) shall be performed if the test results for all the pollutants meet 70 % of their respective limit values (i.e.  $V_1 \leq 0.7L$  &  $L$  being the COP Limit)
- 8.7.2.7 Only two tests shall be performed if the first test results for all the pollutants doesn't exceed 85% of their respective COP limit values (i.e.  $V_1 \leq 0.85L$ ) and at the same time one of these pollutant value exceeds 70% of the limit (i.e.  $V_1 > 0.7L$ ) In addition, to reach the pass decision for the series, combined results of  $V_1$  &  $V_2$  shall satisfy such requirement that :  $(V_1 + V_2) < 1.70L$  and  $V_2 \leq L$  for all the pollutants.
- 8.7.2.8 Third Type - I ( $V_3$ ) test shall be performed if the para 4.11 above doesn't satisfy and if the second test results for all pollutants are within the 110% of the prescribed COP limits, Series passes only if the arithmetical mean for all the pollutants for three type I tests doesn't exceed their respective limit value (i.e.  $(V_1 + V_2 + V_3)/3 \leq L$ )

8.7.2.9 If one of the three test results obtained for any one of the pollutants exceed 10% of their respective limit values the test shall be continued on Sample No. 2 & 3 as given in the Figure - 2 of chapter 1 of this part, as the provision for extended COP and shall be informed by the test agency to the nodal agency

8.7.2.10 These randomly selected sample No.2 & 3 shall be tested for only one Type - I test as per para 5.2.2. of Part 09, Chapter 1 of MoRTH/CMVR/TAP-115/116.

8.7.2.11 Let  $X_{i2}$  &  $X_{i3}$  are the test results for the Sample No.2 & 3 and  $X_{i1}$  is the test result of the Sample No.1 which is the arithmetical mean for the three type - I tests conducted on Sample No. 1

8.7.2.12 If the natural Logarithms of the measurements in the series are  $X_1, X_2, X_3, \dots, X_j$  and  $L_i$  is the natural logarithm of the limit value for the pollutant, then define :

$$d_j = X_j - L_i$$

$$\bar{d}_n = \frac{1}{n} \sum_{j=1}^n d_j$$

$$V_n^2 = \frac{1}{n} \sum_{j=1}^n (d_j - \bar{d}_n)^2$$

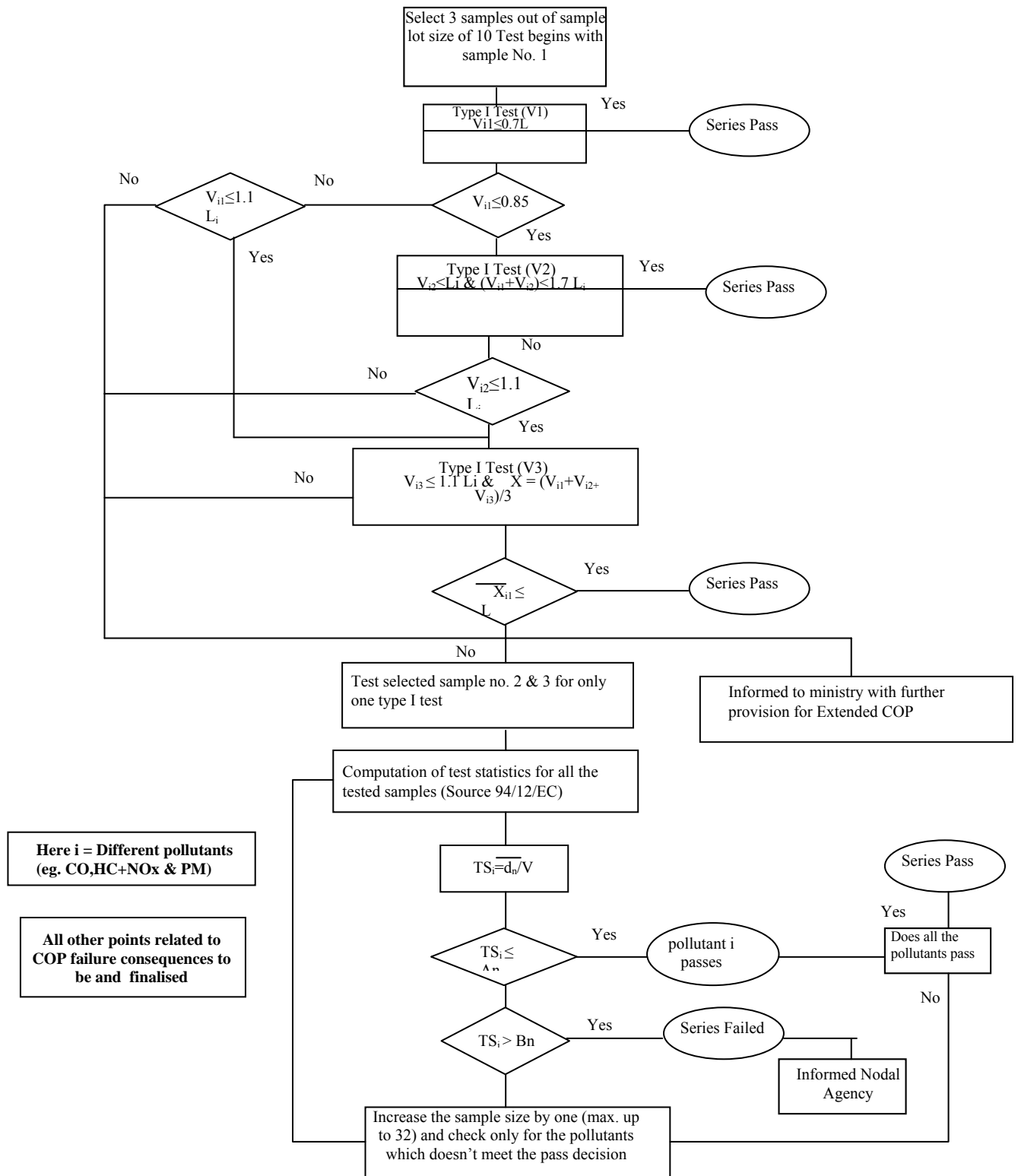
8.7.2.13 Table I of this part shows values of the pass ( $A_n$ ) and fail ( $B_n$ ) decision numbers against current sample number. The test statistic is the ratio  $\bar{d}_n / V_n$  and must be used to determine whether the series has passed or failed as follows :-

- Pass the series,  $\bar{d}_n / V_n \geq A_n$  for all the pollutants-
- Fail the series  $\bar{d}_n / V_n \geq B_n$  for any one of the pollutants.-
- Increase the sample size by one, if  $A_n < \bar{d}_n / V_n \leq B_n$  for any one of the pollutants.

8.7.2.14 When a pass decision is reached for one pollutant, that decision will not be changed by any additional tests carried out to reach a decision for the other pollutants.-

8.7.2.15 If no pass decision is reached for all the pollutants and no fail decision is reached for one pollutant, a test shall be carried out on another randomly selected sample till a pass or fail decision is arrived at.

- 8.8 All these tests shall be conducted with the reference fuel as specified in the applicable gazette notification. However, at the manufacturer's request, tests may be carried out with commercial fuel.
- 8.9 Type II Test: Carbon monoxide and Hydrocarbons emission at idling speed. When the vehicle taken from the series for the first 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 and hydrocarbon 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. These vehicles can be same as those selected for carrying out Type I test. Additional vehicles if required, shall be selected for carrying out for Type II test. At least 9 vehicles should meet the limit values specified in Para 5.2.3.2 above. Then the series is deemed to conform.
- 8.10 For type III test is to be carried out, it must be conducted on all vehicles selected for type I CoP test. (8.2.2.3). The conditions laid down in 5.2.4.2 must be complied with.
- 8.11 For type IV test is to be carried out, it must be conducted in accordance with section 7 of chapter 11.



**Figure 3**  
**OPTION II : COP Test Procedure as per Bharat Stage IV for 4-Wheelers**