Chapter 14

TEST PROCEDURE FOR ON-BOARD DIAGNOSTICS – II (OBD - II)

1. INTRODUCTION

This Chapter applies to the functional aspects of on-board diagnostic (OBD - II) system for the emission control of motor vehicles.

2. DEFINITIONS

For the purposes of this Chapter:

2.1. 'OBD' means an on-board diagnostic system for emission control, which must have the capability of identifying the likely area of malfunction by means of fault codes stored in computer memory.

2.2. 'Vehicle type' means a category of power-driven vehicles, which do not differ in such essential engine and OBD system characteristics as defined in Annexure 2.

2.3. 'Vehicle family' means a manufacturer's grouping of vehicles, which through their design, are expected to have similar exhaust emission and OBD system characteristics. Each engine of this family must have complied with the requirements of TAP 115/116 (Issue 4).

2.4. 'Emission control system' means the electronic engine management controller and any emission-related component in the exhaust or evaporative system, which supplies an input to or receives an output from this controller.

2.5. 'Malfunction indicator (MI)' means a visible or audible indicator that clearly informs the driver of the vehicle in the event of a malfunction of any emission-related component connected to the OBD system, or the OBD system itself.

2.6. "Malfunction" means the failure of an emission-related component or system that would result in emissions exceeding the limits in the applicable Gazette Notification under CMVR or if the OBD system is unable to fulfill the basic monitoring requirements of this Chapter.

2.7. 'Secondary air' refers to air introduced into the exhaust system by means of a pump or aspirator valve or other means that is intended to aid in the oxidation of HC and CO contained in the exhaust gas stream.

2.8. 'Engine misfire' means lack of combustion in the cylinder of a positive-ignition engine due to absence of spark, poor fuel metering, poor compression or any other cause. In terms of OBD monitoring it is that percentage of misfires out of a total

number of firing events (as declared by the manufacturer) that would result in emissions exceeding the limits given in the applicable Gazette Notification under CMVR or that percentage that could lead to an exhaust catalyst, or catalysts, overheating causing irreversible damage.

2.9. 'Type I test' means the driving cycle (Parts One and Two) used for emission approvals, as detailed in Chapter 3.

2.10. 'A driving cycle' consists of engine start-up, driving mode where a malfunction would be detected if present, and engine shut-off.

2.11. 'A warm-up cycle' means sufficient vehicle operation such that the coolant temperature has risen by a least 22 degrees K from engine starting and reaches a minimum temperature of 343 degrees K (70 degrees C).

2.12. 'Fuel trim' refers to feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments. These long-term adjustments compensate for vehicle differences and gradual changes that occur over time.

2.13. 'Calculated load value' refers to an indication of the current airflow divided by peak airflow, where peak airflow is corrected for altitude, if available. This definition provides a dimensionless number that is not engine specific and provides the service technician with an indication of the proportion of engine capacity that is being used (with wide open throttle as 100 %);

$$CLV = \frac{\text{Current airflow}}{\text{Peak airflow (at sea level)}} \times \frac{\text{Atmospheric pressure (at sea level)}}{\text{Barometric pressure}}$$

2.14. 'Permanent emission default mode' refers to a case where the engine management controller permanently switches to a setting that does not require an input from a failed component or system where such a failed component or system would result in an increase in emissions from the vehicle to a level above the limits given in the applicable Gazette Notification under CMVR.

2.15. 'Power take-off unit' means an engine-driven output provision for the purposes of powering auxiliary, vehicle mounted, and equipment.

2.16 Access' means the availability of all emission-related OBD data including all fault codes required for the inspection, diagnosis, servicing or repair of emissions-related parts of the vehicle, via the serial interface for the standard diagnostic connection (pursuant to Annexure 1, Para 6.5.3.5 of this Chapter).

2.17. 'Unrestricted' means

- access not dependent on an access code obtainable only from the manufacturer, or a similar device, or
- access allowing evaluation of the data produced without the need for any unique decoding information, unless that information itself is standardised.

2.18. 'Standardised' means that all data stream information, including all fault codes used, shall be produced only in accordance with industry standards which, by virtue of the fact that their format and their permitted options are clearly defined, provide for a maximum level of harmonisation in the motor vehicle industry, and whose use is expressly permitted in TAP 115/116.

2.19. "*Repair information*" means all information required for diagnosis, servicing, inspection, periodic monitoring or repair of the vehicle and which the manufacturers provide for their authorised dealers/repair shops. Where necessary, such information shall include service handbooks, technical manuals, diagnosis information (e.g. minimum and maximum theoretical values for measurements), wiring diagrams, the software calibration identification number applicable to a vehicle type, instructions for individual and special cases, information provided concerning tools and equipment, data record information and two-directional monitoring and test data. The manufacturer shall not be obliged to make available that information which is covered by intellectual property rights or constitutes specific know-how of manufacturers and/or OEM suppliers; in this case the necessary technical information shall not be improperly withheld.

2.20 "*Deficiency*" means, in respect of vehicle OBD systems, that up to two separate components or systems that are monitored contain temporary or permanent operating characteristics that impair the otherwise efficient OBD monitoring of those components or systems or do not meet all of the other detailed requirements for OBD. Vehicles may be type-approved, registered and sold with such deficiencies according to the requirements of Para 4 of this Chapter.

3. REQUIREMENTS AND TESTS

3.1. All vehicles shall be equipped with an OBD system so designed, constructed and installed in a vehicle as to enable it to identify types of deterioration or malfunction over the entire life of the vehicle. In achieving this objective the test agency shall accept that vehicles which have traveled distances in excess of the Type V durability distance, referred to in Para 3.3.1, may show some deterioration in OBD system performance such that the emission limits given in the applicable Gazette Notification under CMVR may be exceeded before the OBD system signals a failure to the driver of the vehicle.

3.1.1. Access to the OBD system required for the inspection, diagnosis, servicing or repair of the vehicle shall be unrestricted and standardised. All emission-related fault codes must be consistent with Para 6.5.3.4 of Annex 1 to this Chapter.

3.1.2. No later than three months after the manufacturer has provided any authorised dealer or repair shop with repair information, the manufacturer shall make that information (including all subsequent amendments and supplements) available upon reasonable and non-discriminatory payment and shall notify the approval authority accordingly.
In the event of failure to comply with these provisions the approval authority shall take appropriate measures to ensure that repair information is available, in accordance with the procedures laid down for type-approval.

3.2. The OBD system must be so designed, constructed and installed in a vehicle as to enable it to comply with the requirements of this Chapter during conditions of normal use.

3.2.1. Temporary disablement of the OBD system

3.2.1.1 A manufacturer may disable the OBD system if its ability to monitor is affected by low fuel levels. Disablement shall not occur when the fuel tank level is above 20 % of the nominal capacity of the fuel tank.

3.2.1.2 A manufacturer may disable the OBD system at ambient engine starting temperatures below 266 degrees K (-7 degrees C) or at elevations over 2,500 m above sea level provided the manufacturer submits data and/or an engineering evaluation which adequately demonstrate that monitoring would be unreliable when such conditions exist. A manufacturer may also request disablement of the OBD system at other ambient engine starting temperatures if he demonstrates to the test agency with data and/or an engineering evaluation that misdiagnosis would occur under such conditions.

3.2.1.3 For vehicles designed to accommodate the installation of power take-off units, disablement of affected monitoring systems is permitted provided disablement occurs only when the power take-off unit is active.

3.2.2. Engine misfire - vehicles equipped with positive-ignition engines

3.2.2.1 Manufacturers may adopt higher misfire percentage malfunction criteria than those declared to the authority, under specific engine speed and load conditions where it can be demonstrated to the authority that the detection of lower levels of misfire would be unreliable.

3.2.2.2 When a manufacturer can demonstrate to the authority that the detection of higher levels of misfire percentages is still not feasible, or that misfire cannot be

distinguished from other effects (e.g. rough roads, transmission shifts, after engine starting; etc.) the misfire monitoring system may be disabled when such conditions exist.

3.3. Description of tests

3.3.1. The OBD II tests are carried out on the vehicle used for the Type V durability test, given in Chapter 12, and using the test procedure in Annexure I to this Chapter. OBD II tests are carried out at the conclusion of the Type V durability testing. When no Type V durability testing is carried out, or at the request of the manufacturer, a suitably aged and representative vehicle may be used for these OBD II demonstration tests.

3.3.2. The OBD II system must indicate the failure of an emission-related component or system when that failure results in emissions exceeding the threshold limits given in the applicable Gazette Notification under CMVR.

3.3.3. Monitoring requirements for vehicles equipped with positive-ignition engines

In satisfying the requirements of Para 3.3.2 the OBD system must, at a minimum, monitor for:

3.3.3.1 Reduction in the efficiency of the catalytic converter with respect to the emissions of HC only. Manufactures may monitor the front catalyst alone or in combination with the next catalyst(s) downstream. Each monitored catalyst or catalyst combination shall be considered malfunctioning when the emissions exceed the HC threshold given in the applicable Gazette Notification under CMVR.

3.3.3.2 The presence of engine misfire in the engine operating region bounded by the following lines:

(a) a maximum speed of 4,500 min^{-1} or 1,000 min^{-1} greater than the highest speed occurring during a Type I test cycle, whichever is the lower;
(b) the positive torque line (i.e. engine load with the transmission in neutral);
(c) a line joining the following engine operating points: the positive torque line at 3,000 min^{-1} and a point on the maximum speed line defined in (a) above with the engine's manifold vacuum at 13.33 kPa lower than that at the positive torque line.

3.3.3.3 Oxygen sensor deterioration

3.3.3.4 If active on the selected fuel, other emission control system components or systems, or emission-related power train components or systems which are connected to a computer, the failure of which may result in tailpipe emissions exceeding the limits given in the applicable Gazette Notification under CMVR.

3.3.3.5 Unless otherwise monitored, any other emission-related power train component connected to a computer, including any relevant sensors to enable monitoring functions to be carried out, must be monitored for circuit continuity.

3.3.3.6 the electronic evaporative emission purge control, Fuel tank leakage, and fuel system must, at a minimum, be monitored for circuit continuity.

3.3.4. Monitoring requirements for vehicles equipped with compression-ignition engines In satisfying the requirements of Para 3.3.2 the OBD II system must monitor:

3.3.4.1 Where fitted, reduction in the efficiency of the catalytic converter;

3.3.4.2 Where fitted, the functionality and integrity of the particulate trap;

3.3.4.3 The fuel-injection system electronic fuel quantity and timing actuator(s) is/are monitored for circuit continuity and total functional failure;

3.3.4.4 Other emission control system components or systems, or emission-related power train components or systems, which are connected to a computer, the failure of which may result in tailpipe emissions exceeding the limits given in the applicable Gazette Notification under CMVR. Examples of such systems or components are those for monitoring and control of air mass-flow, air volumetric flow (and temperature), boost pressure and inlet manifold pressure (and relevant sensors to enable these functions to be carried out).

3.3.4.5 Unless otherwise monitored, any other emission-related powertrain component connected to a computer must be monitored for circuit continuity.

3.3.5 Manufacturers may demonstrate to the approval authority that certain components or systems need not be monitored if, in the event of their total failure or removal, emissions do not exceed the emission limits given in the official applicable Gazette Notification under CMVR.

3.4. A sequence of diagnostic checks for OBD II must be initiated at each engine start and completed at least once provided that the correct test conditions are met. The test conditions must be selected in such a way that they all occur under normal driving as represented by the Type I test.

3.5. Activation of malfunction indicator (MI)

3.5.1. The OBD system must incorporate a malfunction indicator readily perceivable to the vehicle operator. The MI must not be used for any other purpose except to indicate emergency start-up or limp-home routines to the driver. The MI must be visible in all reasonable lighting conditions. When activated, it must display a symbol in conformity with ISO 2575[(1)]. A vehicle must not be equipped with more than one general purpose MI for emission-related problems. Separate

specific purpose telltales (e.g. brake system, fasten seat belt, oil pressure, etc.) are permitted. The use of red for an MI is prohibited.

(1) International Standard ISO 2575-1982 (E), entitled 'Road vehicles – Symbols for controls indicators and tell tales', Symbol Number 4.36.

3.5.2. For strategies requiring more than two preconditioning cycles for MI activation, the manufacturer must provide data and/or an engineering evaluation, which adequately demonstrates that the monitoring system is equally effective and timely in detecting component deterioration. Strategies requiring on average more than 10 driving cycles for MI activation are not accepted. The MI must also activate whenever the engine control enters a permanent emission default mode of operation if the emission limits given in the applicable Gazette Notification under CMVR are exceeded or if the OBD system is unable to fulfill the basic monitoring requirements specified in Para 3.3.3 or Para 3.3.4 of this Chapter. The MI must operate in a distinct warning mode, e.g. a flashing light, under any period during which engine misfire occurs at a level likely to cause catalyst damage, as specified by the manufacturer. The MI shall activate when the vehicle's ignition is in the "key-on" position before engine starting or cranking and de-activate before engine starting after few seconds (or 'on' till engine is started) if no malfunction has previously been detected.

3.6. The OBD system must record fault code(s) indicating the status of the emission control system. Separate status codes must be used to identify correctly functioning emission control systems and those emission control systems, which need further vehicle operation to be fully evaluated.
If the MI is activated due to deterioration or malfunction or permanent emission default modes of operation, a fault code must be stored that identifies the type of malfunction. A fault code must also be stored in the cases referred to in Para 3.3.3.5 and Para 3.3.4.5 of this Chapter.

3.6.1. The distance traveled by the vehicle while the MI is activated must be available at any instant through the serial port on the standard link connector.

3.6.2. In the case of vehicles equipped with positive-ignition engines, misfiring cylinders need not be uniquely identified if a distinct single or multiple cylinder misfire fault code is stored.

3.7. Extinguishing the MI

3.7.1. If misfire at levels likely to cause catalyst damage (as specified by the manufacturer) is not present any more, or if the engine is operated after changes to speed and load conditions where the level of misfire will not cause catalyst damage, the MI may be switched back to the previous state of activation during the first driving cycle on which the misfire level was detected and may be switched to the normal activated mode on subsequent driving cycles. If the MI is

switched back to the previous state of activation, the corresponding fault codes and stored freeze-frame conditions may be erased.

3.7.2. For all other malfunctions, the MI may be de-activated after three subsequent sequential driving cycles during which the monitoring system responsible for activating the MI ceases to detect the malfunction and if no other malfunction has been identified that would independently activate the MI.

3.8. Erasing a fault code

3.8.1. The OBD system may erase a fault code and the distance traveled and freeze-frame information if the same fault is not re-registered in at least 40 engine warm-up cycles.

3.9. Bi-fuelled gas vehicles
In general, for bi-fuelled gas vehicles for each of the fuel types (petrol and NG/LPG) all the OBD requirements as for a mono-fuelled vehicle are applicable. To this end one of the following two options in paragraphs 3.9.1. or 3.9.2. or any combination thereof shall be used.

3.9.1. One OBD system for both fuel types.

3.9.1.1. The following procedures shall be executed for each diagnostic in a single OBD system for operation on petrol and on NG/LPG, either independent of the fuel currently in use or fuel type specific:
(a) activation of malfunction indicator (MI) (see paragraph 3.5. of this annex),
(b) fault code storage (see paragraph 3.6. of this annex),
(c) extinguishing the MI (see paragraph 3.7. of this annex),
(d) erasing a fault code (see paragraph 3.8. of this annex).
For components or systems to be monitored, either separate diagnostics for each fuel type can be used or a common diagnostic.

3.9.1.2. The OBD system can reside in either one or more computers.

Notwithstanding this requirement, the status code (described in Para 3.6 of this Chapter) shall indicate fully evaluated control systems for both fuel types (petrol and gas) when the control systems are fully evaluated for one of the fuel types

3.9.2. Two separate OBD systems, one for each fuel type.

3.9.2.1. The following procedures shall be executed independently of each other when the vehicle is operated on petrol or on NG/LPG:
(a) activation of malfunction indicator (MI) (see paragraph 3.5. of this annex),
(b) fault code storage (see paragraph 3.6. of this annex),
(c) extinguishing the MI (see paragraph 3.7. of this annex),
(d) erasing a fault code (see paragraph 3.8. of this annex).

3.9.2.2. The separate OBD systems can reside in either one or more computers.

3.9.3. Specific requirements regarding the transmission of diagnostic signals from bi-fuelled gas vehicles.

3.9.3.1. On a request from a diagnostic scan tool, the diagnostic signals shall be transmitted on one or more source addresses. The use of source addresses is described in ISO DIS 15031-5 "Road vehicles - communication between vehicles and external test equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services", dated 1 November 2001.

3.9.3.2. Identification of fuel specific information can be realized:

(a) by use of source addresses and/or
(b) by use of a fuel select switch and/or
(c) by use of fuel specific fault codes.

The following procedures shall be executed for each diagnostic in a single OBD system for operation on petrol and on NG/LPG, either independent of the fuel currently in use or fuel type specific:

(a) activation of malfunction indicator (MI) (see paragraph 3.5. of this annex),
(b) fault code storage (see paragraph 3.6. of this annex),
(c) extinguishing the MI (see paragraph 3.7. of this annex),
(d) erasing a fault code (see paragraph 3.8. of this annex).

For components or systems to be monitored, either separate diagnostics for each fuel type can be used or a common diagnostic.

3.9.4. Regarding the status code (as described in paragraph 3.6. of this annex), one of the following two options has to be used:

(a) the status code is fuel specific, i.e. use of two status codes, one for each fuel type;
(b) the status code shall indicate fully evaluated control systems for both fuel types (petrol and NG/LPG) when the control systems are fully evaluated for one of the fuel types.

If none of the diagnostics reporting readiness is fuel type specific, then only one status code has to be supported.

4. Requirements relating to the type-approval of on-board diagnostic systems

4.1. A manufacturer may request to the authority that an OBD system be accepted for type-approval even though the system contains one or more deficiencies such that the specific requirements of this Chapter are not fully met.

4.2. In considering the request, the authority shall determine whether compliance with the requirements of this Chapter is infeasible or unreasonable. The authority shall take into consideration data from the manufacturer that details such factors as, but

not limited to, technical feasibility, lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers, the extent to which the resultant OBD system will be effective in complying with the requirements of TAP 115 / 116 and that the manufacturer has demonstrated an acceptable level of effort toward compliance with the requirements of TAP 115 / 116.

4.2.1. The authority will not accept any deficiency request that includes the complete lack of a required diagnostic monitor.

4.2.2. The authority will not accept any deficiency request that does not respect the OBD threshold limits in the applicable Gazette Notification under CMVR.

4.3. In determining the identified order of deficiencies, deficiencies relating to Para 3.3.3.1, 3.3.3.2 and 3.3.3.3 of this Chapter for positive-ignition engines and Para 3.3.4.1, 3.3.4.2 and 3.3.4.3 of this Chapter for compression-ignition engines shall be identified first.

4.4. Prior to or at the time of type-approval, no deficiency shall be granted in respect of the requirements of Para 6.5, except Para 6.5.3.4 of Annexure 1 to this Chapter.

4.5. Deficiency period

4.5.1. A deficiency may be carried-over for a period of two years after the date of type-approval of the vehicle type unless it can be adequately demonstrated that substantial vehicle hardware modifications and additional lead-time beyond two years would be necessary to correct the deficiency. In such a case, the deficiency may be carried-over for a period not exceeding three years.

4.5.2. A manufacturer may request that the type-approval authority grant a deficiency retrospectively when such a deficiency is discovered after the original type-approval. In this case, the deficiency may be carried-over for a period of two years after the date of notification to the type-approval authority unless it can be adequately demonstrated that substantial vehicle hardware modifications and additional lead-time beyond two years would be necessary to correct the deficiency. In such a case, the deficiency may be carried-over for a period not exceeding three years.

5. ACCESS TO OBD INFORMATION

5.1. Applications for type-approval or amendment of a type-approval shall be accompanied by the relevant information concerning the vehicle OBD system. This relevant information shall enable manufacturers of replacement or retrofit components to make the parts they manufacture compatible with the vehicle OBD system with a view to fault-free operation assuring the vehicle user against malfunctions. Similarly, such relevant information shall enable the manufacturers

of diagnostic tools and test equipment to make tools and equipment that provide for effective and accurate diagnosis of vehicle emission control systems.

5.2. Upon request, the type-approval authorities shall make Annexure to the type-approval certificate containing the relevant information on the OBD system available to any interested components, diagnostic tools or test equipment manufacturer on a non-discriminatory basis.

5.2.1. If a type-approval authority receives a request from any interested components, diagnostic tools or test equipment manufacturer for information on the OBD system of a vehicle that has been type-approved as per TAP 115/116,

- the type-approval authority shall, within 30 days, request the manufacturer of the vehicle in question to make available the information required.
- the manufacturer shall submit this information to the type-approval authority within two months of the request,
- the type-approval authority shall transmit this information to the test agencies, which granted the original type-approval, shall attach this information to Annexure II to the vehicle type-approval information.

This requirement shall not invalidate any approval previously granted pursuant to TAP 115 / 116 nor prevent extensions to such approvals under the terms of the regulation under which they were originally granted.

5.2.2. Information can only be requested for replacement or service components that are subject to type-approval, or for components that form part of a system that is subject to type approval.

5.2.3. The request for information must identify the exact specification of the vehicle model for which the information is required. It must confirm that the information is required for the development of replacement or retrofit parts or components or diagnostic tools or test equipment.

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,

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

6.3 In case of 6.2 above, the testing agency shall extend the type approval covering the modified specification or the vehicle model shall be subjected to necessary tests as per the guidelines for extension of approval (clause 7). In case, the vehicle complies with the requirements, the test agency shall extend the type approval.

7. Guidelines for Extension of Approval of the vehicle for OBD.

7.1 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 Annex 2. 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 Annex 2, regardless of the following vehicle characteristics:

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

7.2 In a vehicle model, which is previously approved for OBD parameter, if there is any change in OBD parameter, then the testing for the changed OBD parameter only needs to be conducted as mutually agreed between the test agency and vehicle manufacturer if manufacturer can prove that changed OBD parameter don't have any interaction with other OBD parameters.

Annexure 1:

FUNCTIONAL ASPECTS OF ON-BOARD DIAGNOSTIC (OBD) SYSTEMS

1. INTRODUCTION

This Annexure describes the procedure of the test according to Para 5 of this Chapter. The procedure describes a method for checking the function of the on-board diagnostic (OBD) system installed on the vehicle by failure simulation of relevant systems in the engine management or emission control system. It also sets procedures for determining the durability of OBD systems.

The manufacturer must make available the defective components and/or electrical devices which would be used to simulate failures. When measured over the Type I test cycle, such defective components or devices must not cause the vehicle emissions to exceed the limits given in the applicable Gazette Notification under CMVR by more than 20 %.

When the vehicle is tested with the defective component or device fitted, the OBD system is approved if the MI is activated. The OBD system is also approved if the MI is activated below the OBD threshold limits given in the applicable Gazette Notification under CMVR.

2. DESCRIPTION OF TEST

2.1. The testing of OBD – II systems consists of the following phases:

- simulation of malfunction of a component of the engine management or emission control system,
- preconditioning of the vehicle with a simulated malfunction over preconditioning specified in Para 6.2.1 or Para 6.2.2.
- driving the vehicle with a simulated malfunction over the Type I test cycle and measuring the emissions of the vehicle,
- determining whether the OBD system reacts to the simulated malfunction and indicates malfunction in an appropriate manner to the vehicle driver.

2.2. Alternatively, at the request of the manufacturer, malfunction of one or more components may be electronically simulated according to the requirements of Para 6.

2.3. Manufacturers may request that monitoring take place outside the Type I test cycle if it can be demonstrated to the authority that monitoring during conditions encountered during the Type I test cycle would impose restrictive monitoring conditions when the vehicle is used in service.

3. TEST VEHICLE AND FUEL

3.1. Vehicle

The test vehicle shall meet the requirements of Para 3.1 of Chapter 3.

3.2. Fuel

The reference fuel shall be as described in the applicable Gazette Notification under CMVR shall be used.

4. TEST TEMPERATURE AND PRESSURE

4.1. The test temperature and pressure must meet the requirements of the Type I test as described in Chapter 3.

5. TEST EQUIPMENT

5.1. Chassis dynamometer

The chassis dynamometer must meet the requirements of Chapter 3.

6. OBD – II TEST PROCEDURE

6.1. The operating cycle on the chassis dynamometer must meet the requirements of Chapter 3.

6.2. Vehicle preconditioning

6.2.1. According to the engine type and after introduction of one of the failure modes given in Para 6.3, the vehicle must be preconditioned by driving at least two consecutive Type I tests (Parts One and Two). For compression-ignition engine vehicles an additional preconditioning of two Part Two cycles is permitted.

6.2.2. At the request of the manufacturer, alternative preconditioning methods may be used.

6.3. Failure modes to be tested

6.3.1. Positive-ignition engine vehicles:

6.3.1.1 Replacement of the catalyst with a deteriorated or defective catalyst or electronic simulation of such a failure.

6.3.1.2 Engine misfire conditions according to the conditions for misfire monitoring given in Para 3.3.3.2 of this chapter.

6.3.1.3 Replacement of the oxygen sensor with a deteriorated or defective oxygen sensor or electronic simulation of such a failure.

6.3.1.4 Electrical disconnection of any other emission-related component connected to a power-train management computer (if active on the selected fuel type).

6.3.1.5 Electrical disconnection of the electronic evaporative purge control device, (if equipped and if active on the selected fuel type) Fuel tank leakage, and fuel system. For this specific failure mode, the Type I test need not be performed.

6.3.2. Compression-ignition engine vehicles:

6.3.2.1 Where fitted, replacement of the catalyst with a deteriorated or defective catalyst or electronic simulation of such a failure.

6.3.2.2 Where fitted, total removal of the particulate trap or, where sensors are an integral part of the trap, a defective trap assembly.

6.3.2.3 Electrical disconnection of any fuelling system electronic fuel quantity and timing actuator.

6.3.2.4 Electrical disconnection of any other emission-related component connected to a power train management computer.

6.3.2.5 In meeting the requirements of 6.3.2.3 and 6.3.2.4, and with the agreement between the test agency, the manufacturer must take appropriate steps to demonstrate that the OBD system will indicate a fault when disconnection occurs.

6.4. OBD system test

6.4.1. Vehicles fitted with positive-ignition engines:

6.4.1.1 After vehicle preconditioning according to 6.2, the test vehicle is driven over a Type I test (Parts One and Two). The MI must activate before the end of this test under any of the conditions given in 6.4.1.2 to 6.4.1.5. The technical service may substitute those conditions by others in accordance with 6.4.1.6. However, the total number of failures simulated must not exceed 4 for the purpose of type-approval.
In the case of testing a bi-fuel gas vehicle, both fuel types shall be used within the maximum of four (4) simulated failures at the discretion of the test agency.

6.4.1.2 Replacement of a catalyst with a deteriorated or defective catalyst or electronic simulation of a deteriorated or defective catalyst that results in emissions exceeding the HC limit given in the applicable Gazette Notification under CMVR.

6.4.1.3 An induced misfire condition according to the conditions for misfire monitoring given in Para 3.3.3.2 of this chapter that results in emissions exceeding any of the limits given in the applicable Gazette Notification under CMVR.

6.4.1.4 Replacement of an oxygen sensor with a deteriorated or defective oxygen sensor or electronic simulation of a deteriorated or defective oxygen sensor that results in emissions exceeding any of the limits given in the applicable Gazette Notification under CMVR.

6.4.1.5 Electrical disconnection of the electronic evaporative purge control device (if equipped and if active on the selected fuel type).

6.4.1.6 Electrical disconnection of any other emission-related power train component connected to a computer that results in emissions exceeding any of the limits given in the applicable Gazette Notification under CMVR (if active on the selected fuel type).

6.4.2. Vehicles fitted with compression-ignition engines:

6.4.2.1 After vehicle preconditioning according to 6.2, the test vehicle is driven over a Type I test (Parts One and Two). The MI must activate before the end of this test under any of the conditions given in 6.4.2.2 to 6.4.2.5. The technical service may substitute those conditions by others in accordance with 6.4.2.5. However, the total number of failures simulated must not exceed four for the purposes of type approval.

6.4.2.2 Where fitted, replacement of a catalyst with a deteriorated or defective catalyst or electronic simulation of a deteriorated or defective catalyst that results in emissions exceeding limits given in the applicable Gazette Notification under CMVR.

6.4.2.3 Where fitted, total removal of the particulate trap or replacement of the particulate trap with a defective particulate trap meeting the conditions of 6.3.2.2 that results in emissions exceeding the limits given in the applicable Gazette Notification under CMVR.

6.4.2.4 With reference to 6.3.2.5, disconnection of any fuelling system electronic fuel quantity and timing actuator that results in emissions exceeding any of the limits given in the applicable Gazette Notification under CMVR.

6.4.2.5 With reference to 6.3.2.5, disconnection of any other emission-related power train component connected to a computer that results in emissions exceeding any of the limits given in the applicable Gazette Notification under CMVR.

6.5. Diagnostic signals

6.5.1.1 Upon determination of the first malfunction of any component or system, 'freeze-frame' engine conditions present at the time must be stored in computer memory.

Should a subsequent fuel system or misfire malfunction occur, any previously stored freeze-frame conditions must be replaced by the fuel system or misfire conditions (whichever occurs first). Stored engine conditions must include, but are not limited to calculated load value, engine speed, fuel trim value(s) (if available), fuel pressure (if available), vehicle speed (if available), coolant temperature, intake manifold pressure (if available), closed - or open - loop operation (if available) and the fault code which caused the data to be stored. The manufacturer must choose the most appropriate set of conditions facilitating effective repairs for freeze-frame storage.

Only one frame of data is required. Manufacturers may choose to store additional frames provided that at least the required frame can be read by a generic scan tool meeting the specifications of 6.5.3.2 and 6.5.3.3. If the fault code causing the conditions to be stored is erased in accordance with Para 3.7 of this Chapter, the stored engine conditions may also be erased.

6.5.1.2 If available, the following signals in addition to the required freeze-frame information must be made available on demand through the serial port on the standardized data link connector, if the information is available to the on-board computer or can be determined using information available to the on-board computer: diagnostic trouble codes, engine coolant temperature, fuel control system status (closed-loop, open-loop, other), fuel trim, ignition timing advance, intake air temperature, manifold air pressure, air flow rate, engine speed, throttle position sensor output value, secondary air status (upstream, downstream or atmosphere), calculated load value, vehicle speed and fuel pressure.

The signals must be provided in standard units based on the specifications given in 6.5.3. Actual signals must be clearly identified separately from default value or limp-home signals.

6.5.1.3 For all emission control systems for which specific on-board evaluation tests are conducted (catalyst, oxygen sensor, etc.), except misfire detection, fuel system monitoring and comprehensive component monitoring, the results of the most recent test performed by the vehicle and the limits to which the system is compared must be made available through the serial data port on the standardized data link connector according to the specifications given in 6.5.3. For the monitored components and systems excepted above, a pass/fail indication for the most recent test results must be available through the data link connector.

6.5.1.4 The OBD requirements to which the vehicle is certified (i.e. this Chapter or the alternative requirements specified in Para 5 of Chapter I) and the major emission control systems monitored by the OBD system consistent with 6.5.3.3 must be available through the serial data port on the standardized data link connector according to the specifications given in 6.5.3.

6.5.1.5 Vehicles entering into service, the software calibration identification number shall be made available through the serial port on the standardised data link connector.

The software calibration identification number shall be provided in a standardised format.

6.5.2. The emission control diagnostic system is not required to evaluate components during malfunction if such evaluation would result in a risk to safety or component failure.

6.5.3. The emission control diagnostic system must provide for standardised and unrestricted access and conform with the following ISO standards and/or SAE specification.

6.5.3.1 One of the following standards with the restrictions as described must be used as the on-board to off-board communications link:
ISO 9141 - 2: 1994 (amended 1996) "Road Vehicles - Diagnostic Systems - Part 2: CARB requirements for interchange of digital information";
SAE J1850: March 1998 "Class B Data Communication Network Interface". Emission-related messages must use the cyclic redundancy check and the three-byte header and not use interbyte separation or checksums;
ISO 14230 - Part 4 "Road Vehicles - Keyword protocol 2000 for diagnostic systems - Part 4: Requirements for emissions-related systems";
ISO DIS 15765-4 "Road vehicles - Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emissions-related systems", dated 1 November 2001.

6.5.3.2 Test equipment and diagnostic tools needed to communicate with OBD systems must meet or exceed the functional specification given in ISO DIS 15031-4 "Road vehicles Communication between vehicle and external test equipment for emissions-related diagnostics - Part 4: External test equipment", dated 1 November 2001.

6.5.3.3 Basic diagnostic data, (as specified in 6.5.1) and bi-directional control information must be provided using the format and units described in ISO DIS 15031-5 "Road vehicles - Communication between vehicle and external test equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services", dated 1 November 2001, and must be available using a diagnostic tool meeting the requirements of ISO DIS 15031-4.
The vehicle manufacturer shall provide to a national standardisation body the details of any emission-related diagnostic data, e.g. PID's, OBD monitor Id's, Test Id's not specified in ISO DIS 15031-5 but related to TAP 115 / 116.

6.5.3.4 When a fault is registered, the manufacturer must identify the fault using an appropriate fault code consistent with those given in Section 6.3. of ISO DIS 15031-6 "Road vehicles - Communication between vehicle and external test equipment for emissions-related diagnostics - Part 6: Diagnostic trouble code definitions", relating to "emission related system diagnostic trouble codes". If such identification is not possible, the manufacturer may use diagnostic trouble

codes according to Sections 5.3 and 5.6 of ISO DIS 15031-6. The fault codes must be fully accessible by standardised diagnostic equipment complying with the provisions of section 6.5.3.2.

The vehicle manufacturer shall provide to a national standardisation body the details of any emission-related diagnostic data, e.g. PID's, OBD monitor Id's, Test Id's not specified in ISO DIS 15031-5 but related to TAP 115 / 116.

6.5.3.5 The connection interface between the vehicle and the diagnostic tester must be standardized and must meet all the requirements of ISO DIS 15031-3 "Road vehicles – Communication between vehicle and external test equipment for emissions-related diagnostics - Part 3: Diagnostic connector and related electrical circuits: specification and use", dated 1 November 2001. The installation position must be subject to agreement of the approval authority such that it is readily accessible by service personnel but protected from accidental damage during normal conditions of use.

6.5.3.6 The manufacturer shall also make accessible, where appropriate on payment, the technical information required for the repair or maintenance of motor vehicles unless that information is covered by an intellectual property right or constitutes essential, secret know how which is identified in an appropriate form; in such case, the necessary technical information shall not be withheld improperly.

Entitled to such information is any person engaged in commercially servicing or repairing, road side rescuing, inspecting or testing of vehicles or in the manufacturing or selling replacement or retro-fit components, diagnostic tools and test equipment.

Annexure 2

ESSENTIAL CHARACTERISTICS OF THE VEHICLE FAMILY

1. PARAMETERS DEFINING THE OBD FAMILY

The OBD family may be defined by basic design parameters, which must be common to vehicles within the family. In some cases there may be interaction of parameters. These effects must also be taken into consideration to ensure that only vehicles with similar exhaust emission characteristics are included within an OBD family.

2. To this end, those vehicle types whose parameters described below are identical are considered to belong to the same engine-emission control/OBD system combination.

Engine:

- combustion process (i.e. positive-ignition, compression-ignition, two-stroke, four-stroke),
- method of engine fuelling (i.e. carburetor or fuel injection).
- fuel type (i.e petrol, diesel, NG, LPG, bi-fuel petrol/NG, bi-fuel petrol/LPG

Emission control system:

- type of catalytic converter (i.e. oxidation, three-way, heated catalyst, other),
- type of particulate trap,
- secondary air injection (i.e. with or without),
- exhaust gas recirculation (i.e. with or without)

OBD parts and functioning:

- the methods of OBD functional monitoring, malfunction detection and malfunction indication to the vehicle driver.

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