Annex J (Normative Annex)
Onboard Diagnostic (OBD) System

J.1 Outline introduction

This Annex aims to install onboard diagnostic system (abbreviated as OBD system) on vehicle as per the stipulations of this Standard to monitor actual emission from power-driven vehicle through establishment of malfunction diagnostic criteria and other relevant requirements.

OBD system shall monitor the operating status of emission systems during actual in-use of vehicle through onboard computer and shall be capable of detecting malfunctions of emission systems, illuminating malfunction indicator (MIL) to notify the vehicle driver of malfunctions, and storing fault codes to identify the detected malfunctions.

OBD system shall ensure effective control of emission from in-use power-driven vehicle through monitoring of performance of emission system.

J.2 Terms and definitions

For the purpose of this Annex, the following terms and definitions are used:

J.2.1 OBD family

A group of vehicles of manufacturer, which feature similar emission characteristics and OBD characteristics in term of vehicle design, and each type of engine of the family shall meet requirements of this Standard.

J.2.2 OBD

"OBD" is a type of onboard diagnostic system that is used for monitoring of emission control system. In case of fault of emission-related components, monitoring of OBD system shall display occurrence of fault, store relevant fault code in onboard computer and illuminate malfunction indicator (MIL), so that vehicle driver can identify fault code through a criteria diagnostic system.

J.2.3 Monitoring system

Refers to a part of OBD system, it is a diagnostic system or a monitoring method that is used for monitoring fault of emission-related component or system.

J.2.4 Malfunction

Refers to failure of emission-related component or system, which will cause pollutant exceeding the appropriate OBD threshold value, if failure of OBD system to meet basic diagnostic requirements of this Annex is also referred to as malfunction.

J.2.5 MIL

A visible indicator, MIL can clearly inform driver of occurrence of fault of vehicle emission control system in case of fault of any emission-related components in OBD system or fault of OBD system itself.

J.2.6 Diagnostic system

Refers to a part of the OBD system, can enable vehicle driver or maintenance personnel to inquire the stored fault code through diagnostic connector connected with vehicle engine control unit and meet relevant setting requirements.

J.2.7 Response rate

For exhaust sensor, response rate refers to the delay from the instant when sensor contacts with exhaust of different components to the instant when its signal reflects the exhaust of different components. For oxygen sensor, response rate is refers to the time delay from the instant when oxygen sensor contacts with

exhaust shifting from condition that is richer/thinner than theoretical air-fuel ratio to condition that is thinner/richer than theoretical air-fuel ratio until the instant when its signal indicates thin/rich condition.

J.2.8 Secondary air

Refers to air introduced to exhaust system by means of pump or suction valve or other methods, which is used to help in the oxidation of THC and CO in exhaust gas.

J.2.9 Driving cycle

Consists of engine start, operation and stop state, including the process of engine stop up to the next engine start. For vehicles that adopt engine STOP-START control strategies, the manufacturer may define driving cycle separately.

J.2.10 Engine start

Refers to that engine speed up to no less than the normal warm-up idle speed 150rpm (normal warm-up idle speed refers to forward gear situations for vehicles equipped with automatic transmission). For hybrid electric vehicles or for engines featuring multiple start device or strategies (for example, integrated starter and generators), subject to environmental compliance supervision competent authority approval, the manufacturer may use different engine start definitions (for example, ignition key at "on" position). Definition of "engine start" approved by environmental compliance supervision competent authority shall be equivalent to definition of engine start for conventional vehicle.

J.2.11 Warm-up cycle

Refers to sufficiently operate vehicle, so that engine coolant temperature is at least 22°C more than the temperature upon start and at least reaches 71°C. (For diesel engine, at least reaches 60°C). Manufacturer may define alternate warm-up cycle in accordance with the criteria in J.3.2.5.2 (B) (iii) a-c.

J.2.12 Cold start

Upon engine start, engine coolant temperature (or equivalent temperature) shall not exceed 35°C and not exceed 7°C ambient temperature.

J.2.13 Fuel trim

Refers to feedback adjustment to the basic fuel supply procedure, short-term fuel trim refers to dynamic or instantaneous adjustment. Long-term fuel trim refers to more gradual adjustment to fuel supply calibration procedure than short-term fuel trim, long-term fuel trim is used for compensation of difference between batch production of vehicles and gradual change of vehicle occurred with time.

J.2.14 Auxiliary emission control device (AECD)

AECD means any devices which are used to measure temperature, vehicle speed, engine RPM, transmission, intake manifold vacuum, or any other parameters for the purpose of activating, modulating, delaying, or deactivating the operation of any part of the emission control system.

J.2.15 Emission increasing auxiliary emission control device (EI-AECD)

Refers to approved AECD that reduces the effectiveness of emission control system under conditions which may be encountered in normal vehicle operation and use; and the need for AECD is justified only for the sake to protect vehicle from damage or accident. If an AECD does not sense, measure or calculate any parameter or command or trigger any action, calculation procedure or alternate strategy, the AECD shall not be considered as EI-AECD. An AECD that is activated solely due to any of the following

conditions shall not be considered an EI-AECD: (1) operation of the vehicle in conditions above 2,440m in altitude; (2) ambient temperature; (3) is not activated during warm-up process and one same driving cycle after warm-up; (4) malfunction is detected by OBD system (storage of a fault code by the OBD system); (5) operation of an OBD monitoring; (6) implementation of low frequency regeneration.

J.2.16 Calculated load value (CLV)

In accordance with the definitions in SAE J1979, for gasoline engine, the calculated load value represents the current air intake flow rate divided by the maximum air intake flow rate under the rotation speed, the current air intake flow rate shall be corrected as per altitude and temperature; for diesel engine, it refers to the ratio of engine output torque to the maximum output torque at the engine speed. No matter for gasoline engine or diesel engine, it is allowed to replace air intake volume by torque.

J.2.17 Permanent emission default mode

Engine ECU shifts to a permanent setup state, under the state, ECU no longer receives input signal from failed components or failed system, because these failed components or systems will cause increase of pollutant emitted from vehicle and exceedance of OBD threshold value.

J.2.18 Power take-off Unit (PTO)

Power Take-off Unit that is driven by engine and provides power to auxiliary equipment of vehicle.

J.2.19 Base fuel schedule

Refers to fuel injection system calibration data schedule written into power-train control module or PROM during production or update through offline equipment, prior to learned onboard correction of fuel injection.

J.2.20 Confirmed fault code

Refers to the diagnostic fault code stored when OBD system has confirmed that a malfunction exists (for example, the fault code stored typically on the 2nd driving cycle in which the malfunction is detected) in accordance with requirements specified in J.4, J.5 and J.6.4.4.

J.2.21 Permanent fault code

Refers to fault code lit by the current malfunction indicator light(MIL), which is saved in non-volatile random access memory (NVRAM), and could not be erased by external tool.

J.2.22 Continuously

A term used for expression of monitoring conditions such as circuit continuity, lack of continuity, malfunction and out-of-range reasonable value, etc. Continuously refers to that monitoring is always under enabled status, and signal sampling frequency for monitoring is not less than 2Hz unless alternate enable conditions allowed in J.4 and J.5. If for control purpose, input component of onboard computer adopts lower sampling frequency, then evaluation is always performed for each time of sampling of monitoring signal.

J.2.23 Deactivate

During full life of vehicle, turn-off, disconnection or deactivation realized through software programming or other methods.

J.2.24 Diagnostic or emission critical powertrain control unit

Diagnostic or emission critical powertrain control unit includes engine and transmission control unit and any other onboard electronic powertrain control unit containing software that meets the following conditions:

(1) Has primary control over any of the monitors required by J.4.1-J.4.13, J.4.15, J.5.1-J.5.13 and J.5.15 excluding electric circuit and out-of-range value malfunction.

(2) Has primary control over the rationality diagnostics or functional inspection for

exceed 4 input components or 2 output components required to be monitored by J.4.14 and J.5.14.

For purposes of criteria (1) and (2) above, primary control over a monitor refers to that control unit executes the following tasks: (a) determine whether enabling conditions are met; (b) execute all or partial calculation

used to determine whether it is acceptable (for example: comparison between measured value or calculated value and malfunction threshold value); or (c) make decision or handle regarding whether it is acceptable (for example: confirmation of malfunction detection or illumination of MIL lamp and storage of fault code). Furthermore, for purposes of criteria (2) (a) above, all glow plugs in an engine shall be considered "one" component in lieu of each glow plug being considered a separate component.

J.2.25 Fault memory

Used for fault information stored in onboard computer, including fault code, engine conditions and MIL status information.

J.2.26 Functional check

For output component/system, functional check refers to confirmation of reasonable response of component/system to command of onboard computer.

J.2.27 Keep-alive memory (KAM)

KAM is defined as a type of memory that retains its storage contents as long as power is continuously supplied to onboard control unit. When engine is turned off, KAM shall not be erased; but if power supply of onboard control unit is disconnected (for example, disconnection of vehicle battery and removal of fuse of control unit), storage contents of KAM may be erased. Under certain circumstances, partial KAM contents may be erased during reset of KAM using the scan tool.

J.2.28 Key on, engine off position

The position where key is on but engine does not start. Ignition key is in the engine run position (ON), rather than starting position (START) or accessory position (ACC), but the engine is not running or propulsion system is not enabled.

J.2.29 Non-volatile random access memory (NVRAM)

Refers to a type of memory that retains the stored contents even if power supply of onboard control unit is disabled (for example, disconnection of vehicle battery and removal of fuse of control unit). Non-volatile performance of NVRAM is typically realized through the use of a back-up battery for onboard computer or through the use of an electrically erasable and programmable read-only memory chip.

J.2.30 Normal production

A certain time node after the start of normal production corresponding to the time when manufacturer has produced 2% of expected output volume of vehicle of identical calibration, which meet requirements in Annex N.

J.2.31 Pending fault code

Diagnostic fault code stored upon initial detection of malfunction before MIL illuminates in accordance with the requirements of J.4 and J.5.

J.2.32 Misfire

Misfire means lack of combustion event in the cylinder due to reasons such as ignition, fuel metering, poor compression, or any other cause, here, misfire does not include lack of combustion events in fuel shut-off cylinders due to default fuel shut-off strategies.

J.2.33 Percentage of misfire

In accordance with clauses J.4.3.2 and J.5.3.2, the percentage of number of misfires
occurred in the certain specified time interval to total ignition times.

J.2.34 Propulsion system active

Refers to the following status of vehicle: powertrain of vehicle (for example, engine and motor) is activated by driver (for example, after turn-on of ignition switch of conventional vehicle, or after pressing of power

supply button of hybrid electric vehicle, or after remote startup activation), so that vehicle is ready for use at any time (for example, before running, vehicle is ready for startup, ready for shifting from "parking" to "running"; heating, ventilation and air conditioning are turned on to control air condition in vehicle). "Powertrain activation status" excludes the action other than those caused by driver (for example, vehicle system is awakened and implements OBD monitor or off-vehicle charging, and does not include remote startup activation that will not cause engine start (for example: remote startup activation is for the sake of air conditioning in vehicle, regardless of air conditioning demand or air conditioning operation time, before further action of driver, engine will not start up).

J.2.35 Rationality fault diagnostic

For input component, rationality fault diagnostic refers to verification of accuracy of input signal in scope of normal operation, and when compared to other available information.

J.2.36 Redline engine speed

The maximum engine speed when system cuts off the fuel supply or the recommended the maximum engine speed displayed on tachometer.

J.2.37 Access

Access of all emission-related OBD data through serial interface used for criteria diagnostic connection (see J.6). The data includes all fault codes during component inspection, diagnostic, maintenance or repair related to vehicle emission.

J.2.38 Unrestricted

- Access that can be performed without relying on access code or similar equipment acquired from manufacturer, or;
- If the accessed information is non-criteriaized, assessment access can be performed for the generated data without special decoding information.

J.2.39 Standardised

All data stream including all fault codes used shall conform to the requirements of the automotive industry standards, as format of these criterias and allowable options have been clearly defined, and have been harmonized in automotive industry as much as possible, therefore, this Standard clearly permits use of them.

J.2.40 Repair information

All information that is required for diagnostic, maintenance, inspection, regular monitor or repair of vehicle and is provided by manufacturer to authorized dealer/repair factory. The information shall include repair manual, technical guidance, diagnostic information (such as theoretical minimum and maximum value used for measurement), roadmap, calibration software identification number applicable for a certain vehicle model, description of exceptional and special circumstances, data related to tools and equipment, data record information and two-way monitor and test data. Manufacturer is entitled with the right to refuse providing information under protection of intellectual property right, or special technical know-how of manufacturer and (or) OEM supplier, but shall not improperly conceal necessary technical information.

J.2.41 Deficiency

In OBD system, one or more independent components or systems are monitored, its operating characteristics will temporarily or permanently weaken OBD system's effective monitor of other components or systems, or make it impossible to meet all requirements of OBD system one by one. ~~In accordance with stipulations of J.7.1, environmental compliance supervision competent authority may approve vehicle with this type of defect.~~

J.2.42 Smart device

"Smart device" refers to powertrain electronic components or systems that use micro-processor or micro-controller but cannot be incorporated into category of critical diagnostic or emission electronic powertrain control unit. Devices used to control transmission or battery pack cannot be incorporated into the range of this definition. Any external components or systems that are connected with smart device shall not be deemed as part of smart device unless otherwise specified below:

(1) It is a sub-component integrated into functions of smart device;

(2) It is permanently connected with smart device through conductive wire or disposable connector; and

(3) Smart device and sub-component are deemed as one integrated component during design, manufacturer, installation and application (application step issued by each manufacturer).

J.2.43 Safety only component/system

"Safety only component/system" refers to component or system that is designed and applied on vehicle to prevent or reduce personal injury upon occupant, pedestrian or repair personnel. For example, traction control system, ABS system, hybrid high-voltage enclosure system and lane deviation control system.

J.2.44 Emission neutral default action

Emission neutral default action refers to compensation control operation or default operation mode that is in compliance with the following conditions:

(1) Under any foreseeable real driving conditions, will not cause measurable emission increase;

(2) Will not cause monitoring frequency of OBD system that is lower than requirement or inaccurate monitoring;

(3) Continuous activation of compensation control operation or default operation mode. If it takes over 30s of emission neutral diagnostic under the most severe condition to detect relevant malfunction and enable emission neutral default action to completely reach emission neutral condition (calculated from start of engine or activation of under-monitor system or component in the driving cycle), then it shall remain to be active in the next driving cycle until compliance with the following conditions: (a) the diagnostic activating the operation or the mode has been performed and diagnostic results show that malfunction no longer exists; or (b) elimination of malfunction by external diagnostic equipment;

(4) Where emission neutral diagnostic activating emission neutral default action detects malfunction, OBD system shall detect any malfunction that can prevent activation of compensation control operation or default operation mode and illuminate MIL.

J.2.45 Emission neutral diagnostic

Emission neutral diagnostic refers to monitoring strategy for monitors that are required in J.4.14 and J.5.14 and its monitoring strategy meets the following criteria:

(1) In case of detection of malfunction that can cause increase of emission or decrease of OBD system performance, it is possible to activate diagnostics of emission neutral default action;

(2) Diagnostics are located in diagnostic or emission critical powertrain control unit or control unit meeting level C and level D criteria in ISO 26262-5 (2011-11-15), unless

manufacturer can demonstrate to the environmental compliance supervision competent authority that the control unit where diagnostics are located cannot be tampered on in-use vehicle after sales.

J.2.46 Fueled engine operation

Refers to operation condition of internal combustion engine used in hybrid electric vehicle.

J.2.47 Similar condition

Used in J.4.3, J.4.6, J.5.3 and J.5.4, "similar condition" means engine operating conditions required to be stored pursuant to J.4.3.4.5, J.4.6.4.5, J.5.3.4.2 (C) and J.5.4.4.2 (E): engine speed within ±375rpm, engine load within ±20% and engine warm-up status (such as cold start or warm-up start) upon detection of malfunction. The environmental compliance supervision competent authority can define the other similar conditions based on equivalent timeliness and reliability in detecting similar engine operation.

J.3 General requirements and test

It specifies general requirements for OBD system of light-duty vehicle in J.3. See specific monitoring requirements for gasoline vehicle and diesel vehicle OBD system as per J.4 and J.5 respectively.

J.3.1 OBD system

J.3.1.1 If a malfunction specified in J.4 and J.5 occurs in vehicle, OBD system shall promptly detect these malfunctions, and store pending fault code or confirmed fault code in memory of onboard computer, and illuminate MIL lamp as per requirements.

J.3.1.2 OBD system shall be configured with criteriaized diagnostic interface as specified in J.6 of this Standard, so as to read the stored fault codes.

J.3.1.3 Design of OBD system shall meet the followings: When maintenance is not required in accordance with special regulations, OBD system shall operate normally for the full life of the vehicle; during the full life of the vehicle, OBD system shall not be programmed or set by other predesigned mode to deactivate regardless of use time and mileage.

J.3.1.4 Engine operating parameters in computer program shall not be changeable without the use of special tools and procedures (for example, soldered or enclosed computer components or sealed (or soldered) computer enclosure). Manufacturers may apply for exemption from the above provisions for some lines that do not require protection. The environmental compliance supervision competent authority approval shall be based on current performance of chips, overall performance of the vehicle and sales volume upon application.

J.3.2 Data related to OBD

J.3.2.1 Manufacturer shall submit the data specified in Annex A.4.2.10.2.7. Manufacturer may apply to the competent authority to submit one set of documentation to cover vehicle type of one same OBD family (as per definition of Appendix JB).

J.3.2.2 With approval of environmental compliance supervision competent authority, documentation requirements may be omitted or modified if the information required would be redundant or unnecessarily burdensome to generate.

J.3.2.3 To the extent possible, the type approval documentation shall use terms, abbreviations, and acronyms in SAE J1930.

J.3.2 MIL and fault code

J.3.2.1 MIL

J.3.2.1.1 MIL shall be located on instrument panel at driver's side, and shall be clearly visible under various light ray conditions in vehicle and shall be of amber color when being illuminated. Requirements of ISO 2575 F01 shall be met.

J.3.2.1.2 The MIL shall illuminate in the key "On" position and engine "Off" to confirm that all functions of MIL are normal. MIL shall continuously illuminate for at least 15s during the previously mentioned functional check. During the functional check process of MIL, data stream value for MIL status shall indicate "commanded off" (such as J.6.4.2) unless the MIL has been set "on" for a detected fault. Functional check of MIL is not required if vehicle returns to key "On" position and engine off after the initial engine operation of

each driving cycle, for example, accidental engine stall or engine stall caused due to reason other than command.

J.3.2.1.3 In the key "On", engine "Off" position of vehicle, manufacturer may indicate readiness status of MIL in accordance with stipulations on criteria format (J.6.4.1.3).

J.3.2.1.4 It is prohibited to use MIL for other purposes other than those specified in this Standard.

J.3.2.2 MIL Illumination and storage fault code

J.3.2.2.1 In case of detection of malfunction, OBD system shall store a pending fault code within 10s and indicate the malfunction that may exist.

J.3.2.2.2 After storage of pending fault code, if the identified malfunction is detected once again before end of the next driving cycle of diagnostics, MIL lamp shall illuminate continuously, and a confirmed fault code shall be stored within 10s. Meanwhile, pending fault code shall be stored continuously as per the requirements of J.6.4.4.5; if no malfunction is detected once again before end of the next driving cycle of diagnostics (i.e. no discovery of the above mentioned malfunction in the entire driving cycle), the corresponding pending fault code set as per J.3.2.2.1 shall be erased prior to the end of the driving cycle.

J.3.2.2.3 With the exception of the circumstances given in J.3.2.6, whenever powertrain enters a default fault mode or limp mode which may influence emission or OBD system performance, or in the event of occurrence of malfunction of onboard computer that influences performance of OBD system, OBD system shall illuminate MIL within 10s, and store a pending fault code and a confirmed fault code.

(A) If the default mode or limp mode of operation is repairable (for example, diagnostic strategy or control strategy causing the default mode or limp operation mode can run normally in the next drive cycle and confirm the presence of conditions triggering the default mode or limp operation mode), OBD system is not required to illuminate the MIL and store confirmed fault code upon the first time when the default or limp mode of operation appears, it is allowed to illuminate the MIL and store confirmed fault code until the default mode or limp operation mode triggering condition occurs again before the end of the next driving cycle.

(B) MIL illumination and fault code storage are not required for engine overtemperature default strategies that are only initiated after the temperature gauge indicates a temperature in the red zone, or after an overtemperature indicator is illuminated, or due to the verified occurrence of severe operating conditions (e.g., trailer towing up a grade).

J.3.2.2.4 If the instrument panel receives and/or is processing instructions or commands from other "key diagnostic or emission electronic powertrain control unit" to illuminate the MIL lamp, but a malfunction occurs (for example, communication is lost) such that the instrument panel is no longer able to receive the MIL illumination command, instrument panel shall default to a MIL on state. Storage of a fault code is not required in OBD system under this circumstance.

J.3.2.2.5 Before end of an ignition cycle, OBD system shall store the confirmed fault codes that are currently causing MIL to be illuminated in NVRAM as permanent fault codes (as per the stipulations of J.6.4.4.6).

J.3.2.2.6 Subject to environmental compliance supervision competent authority's approval, vehicle manufacturer may use alternative statistics-based strategy on MIL illumination and fault code storage. If manufacturer provides data/engineering evaluation to demonstrate that the alternative strategy can evaluate system performance in a manner that is equally effective and timely, environmental compliance supervision competent authority shall grant approval to the alternate strategy. With the exception of the special circumstance of the evaporative emission control system mentioned in J.4, it is not allowed to use the alternative strategy that requires more than 6 driving cycles for determining whether to illuminate MIL.

J.3.2.2.7 A manufacturer shall store and erase "freeze frame" conditions (as defined in section J.6.4.3) appearing at the time a malfunction is detected. A manufacturer shall store and erase freeze frame at the same time of storage and erasure of a pending or confirmed fault codes in accordance with the stipulations of J.3.2.2. With the exception of misfire and fuel system malfunction of gasoline engine and diesel engine described in J.4.3.4.3, J.4.6.4.4, J.5.3.4.2 (B) and J.5.4.4.2 (D), the freeze frame existing in system at present shall not be replaced by freeze frame of new fault code.

J.3.2.3 Extinguishment of MIL

Except the malfunctions related to misfire of gasoline engine, evaporative system of gasoline engine, fuel system of gasoline engine, exhaustion of reductant of diesel engine, misfire of diesel engine and fuel system of diesel engine in J.4.3.4.6, J.4.4.4.2, J.4.6.4.6, J.5.3.4.2 (D) and J.5.4.4.2 (F), after the MIL has been illuminated for occurrence of malfunction, MIL may be extinguished if in at least three sequential driving cycles, the OBD monitoring system no longer requires illumination of MIL and malfunction previously causing illumination of MIL disappears, and no other malfunction has been detected that requires to independently illuminate the MIL.

J.3.2.4 Erasure of confirmed fault code

If malfunction identical with previously confirmed fault code has not been again detected in at least 40 engine warm-up cycles, and the MIL is presently not illuminated for that malfunction, then OBD system may erase the corresponding confirmed fault code no earlier than end of the 40th warm-up cycle and no later than the end of the 41st warm-up cycle.

J.3.2.5 Erasure of permanent fault code

Under the following conditions, OBD system shall erase a permanent fault code:

J.3.2.5.1 If OBD system has been instructed to illuminate MIL, OBD system can erase the permanent fault code only if OBD system determines that malfunction corresponding the permanent fault code no longer occurs and also does not require to continuously illuminate MIL as per the requirements of J.3.2.3. Permanent fault code shall be erased at the same time when MIL is extinguished, or no later than the start of the first driving cycle in which MIL is extinguished.

J.3.2.5.2 If all fault information in the onboard computer other than the permanent fault code has been cleared (such as through the use of a scan tool or power disconnect, etc.), and OBD system is not illuminating MIL:

(A) Except the situations specified in J.3.2.5.2 (C), if the malfunction monitor that has caused storage of a permanent fault code is subject to the minimum IUPR requirements of section J.3.3.2 (such as catalytic convertor monitor and input component rationality diagnostics in comprehensive assembly monitor, etc.), the OBD shall erase the permanent fault code at the end of a driving cycle in which the malfunction has not been detected within the driving cycle in which one or multiple malfunction monitor has been performed.

(B) If the malfunction monitor that has caused storage of a permanent fault code is not subject to the minimum IUPR requirements of section J.3.3.2 (such as gasoline engine misfire monitor, fuel system monitor, comprehensive component circuit continuity monitor and etc.), OBD system shall erase the permanent fault code at

the end of the driving cycle if a driving cycle meets the following conditions:

(i) During the driving cycle, the fault monitor has been performed for one or more times, and the inspection results show that the malfunction is not present;

(ii) Malfunction monitoring detects no malfunction existing after the most recent driving cycle meeting the stipulations in J.3.2.5.2 (B)(i), and;

(iii) In a driving cycle which meets the following conditions (can be driving cycle that is different from the driving cycle in J.3.2.5.2 (B)(i));

a. Except as specified in the following J.3.2.5.2 (B)(iii)e, the accumulated operational time after engine start shall reach at least 600s;

b. Accumulated operational time of which vehicle speed is not less than 40km/h shall reach at least 300s;

c. Continuous vehicle operation at idle (accelerator pedal released by driver and vehicle speed less than 1.6km/h, or engine speed is not more than normal warmed-up idle speed 200rpm, for vehicles equipped with an automatic transmission, normal warm-up idle speed refers to forward gear situations) for not less than 30s, and

d. No malfunction is detected;

e. For hybrid electric vehicle, regarding the requirements in J.3.2.5.2 (B)(iii)a, manufacturer can use "cumulative time of propulsion system activation" in lieu of the cumulative operation time after engine start.

(iv) If monitors require to use "similar conditions" to store or erase pending or confirmed fault codes, it is not required to consider the "similar conditions" prior to erasure of the permanent fault code.

(C) For monitoring specified in J.3.2.5.2 (A), it is allowed to use the criteria specified in J.3.2.5.2 (B) besides the criteria in J.3.2.5.2 (A) for erasing the permanent fault code.

J.3.2.6 Exceptions to MIL and fault code requirements

J.3.2.6.1 If vehicle enters a default mode that may affect emissions or the performance of the OBD, vehicle manufacturer may request environmental compliance supervision competent authority approval to be exempted from the requirements for MIL illumination and fault code storage, vehicle manufacturer shall provide the following data/engineering evaluation demonstrating one of the following:

(A) (1) The default mode can cause a prominent indication status (for example, restrict vehicle at idling condition), driver will definitely response and repair the malfunction; (2) The default mode is not generated by components required to be monitored in J.4 and J.5 of this Standard; (3) and triggering of the default mode is not to protect the parts required to be monitored in J.4 and J.5; or

(B) The default mode is AECD activated under conditions approved by environmental compliance supervision competent authority.

J.3.2.6.2 For malfunction detected by emission neutral diagnostic, it is allowed to apply for no MIL illumination.

J.3.3 Monitoring condition

J.3.3 specifies general requirements on monitoring conditions of OBD system, J.4 and J.5 specify specific requirements on OBD monitoring conditions.

J.3.3.1 All vehicles subject to this Standard shall meet the following requirements on monitoring conditions:

J.3.3.1.1 In accordance with the stipulations of J.4 and J.5, manufacturer shall define monitoring conditions for detection of malfunctions specified in J.4 and J.5 and submit to environmental compliance supervision competent authority for approval. If the manufacturer has submitted data and/or other engineering evaluation documents demonstrating that the monitoring conditions defined by manufacturer meet the following requirements, the environmental compliance supervision competent authority shall grant approval: shall technically ensure robustness of malfunction detection (for example, avoid false indications of malfunction and false passes); monitoring condition design shall ensure monitoring when vehicle operates and is used normally on urban road; and shall ensure normal monitoring in WLTC test cycle.

J.3.3.1.2 For each driving cycle which meets monitoring conditions, monitoring shall run once at least.

J.3.3.1.3 Subject to environmental compliance supervision competent authority approval, manufacturers may define monitoring conditions other than the WLTC cycle (as per the stipulations of J.3.3.1.1). In reviewing, the environmental compliance supervision competent authority shall consider the following issues: the degree of restriction of WLTC cycle conditions upon in-use vehicle monitoring; the technical necessity for monitoring conditions other than the WLTC cycle; data or engineering evaluation submitted by the manufacturer which demonstrate that the component/system does not normally function or monitoring is not feasible in WLTC cycle; manufacturer demonstrates that monitoring conditions can meet the requirements on minimum IUPR.

J.3.3.2 As specified in details in J.4 and J.5, manufacturer shall define the monitoring conditions as per the criteria in J.3.3.2.1-J.3.3.2.3.

J.3.3.2.1 Besides compliance with stipulations of J.3.3.1, manufacturer shall ensure that the monitoring conditions defined by it can ensure in-use vehicle to meet the minimum IUPR requirements.

Minimum IUPR required in this Standard is as follows:

(A) For monitoring of secondary air system, positive crankcase ventilation system, gasoline particulate filter (GPF) cold start and cold start emission reduction strategy adopting the denominator increment rule specified in J.3.4.3.2 (D) and (E), engine cooling system and monitoring related to rationality diagnostics and functional diagnostics of input/output components of comprehensive component monitoring, the minimum IUPR is 0.100;

(B) For monitoring of hybrid electric vehicle, all monitoring for which it is necessary to define monitoring conditions as per the requirements of J.3.3.2, the minimum IUPR is 0.100;

(C) For monitoring of evaporative system:

(i) For monitoring of the malfunctions (i.e. purge flow) defined in J.4.4.2.2 (A), the minimum IUPR is 0.336;

(ii) For monitoring of the malfunctions (i.e. 1mm leak detection) defined in J.4.4.2.2 (B), the minimum IUPR is 0.260;

(iii) For monitoring of the malfunctions (i.e. 0.5mm leak detection) specified in J.4.4.2.2 (C) and the malfunctions (i.e. high load purge pipeline diagnostics) defined in J.4.4.2.2 (D), the minimum IUPR is 0.100.

(D) For catalytic convertor, oxygen sensor, EGR, VVT system and all other monitorings that are specified in J.4 and J.5 and the test conditions shall be defined in accordance with the requirements of J.3.3.2, the minimum IUPR is 0.336.

J.3.3.2.2 In addition to the requirements in J.3.3.2.1, manufacturers shall use algorithms in the OBD system software to individually track and report IUPR of the following monitors (if any) in the criteriaized format specified in J.3.5:

a. Catalytic converter (J.4.1.3 and J.5.1.3);

b. Front oxygen sensor/exhaust sensor (J.4.7.3.1 (A) and J.5.5.3.1 (A));

c. Evaporative system (J.4.4.3.1);

d. EGR system (J.4.8.3.1) and VVT system (J.4.12.3, J.5.6.3.1 (A), J.5.6.3.2, J.5.6.3.4 and J.5.13.3);

e. Secondary air system (J.4.5.3);

f. Particulate filter (J.5.9.3);

g. NOx adsorber (J.5.8.3.1) and NOx catalytic converter (J.5.2.3.1);

h. Rear oxygen sensor (J.4.7.3.2 (A));

i. Boost pressure control system (J.5.7.3.2 and J.5.7.3.3).

The OBD system is not required to track and report IUPR for monitors other than those specified above.

J.3.3.2.3 Manufacturers shall not use the calculated ratio (or any parameters derive thereof) or any other parameters for indication of monitor frequency as a monitoring condition for any monitoring (for example, using a low ratio to enable more frequent monitoring through modification of diagnostic priority or modification of other monitoring conditions, or using a high ratio to enable less frequent monitoring).

J.3.4 Definition of In-Use Performance Ratio (IUPR)

J.3.4.1 For monitor items required to meet the minimum IUPR specified in J.3.3.2.1, IUPR shall be calculated by adopting the following stipulations on numerator, denominator and ratio.

J.3.4.2 Numerator count

J.3.4.2.1 Definition: The numerator count is the number of times a vehicle has been operated such that all conditions necessary for a specific monitor to detect a malfunction have been encountered.

J.3.4.2.2 Incrementing of the numerator count

(A) Except as specified in following J.3.4.2.2 (E) and (F), the numerator count can only be incremented by an integer of 1, and can be incremented for one time at most per driving cycle.

(B) The numerator count can only be incremented by 1 if and only if the following criteria conditions are satisfied in a driving cycle, and the numerator count shall be incremented within 10s:

(i) If all monitoring conditions necessary for the monitor of the specific component to detect a malfunction and store a pending fault code have been satisfied, including enabling criterion, presence or absence of related fault codes, sufficient length of monitoring time, and diagnostic executive priority stipulations (such as malfunction diagnostic A must execute prior to fault B, etc.). Therefore, it is not sufficient to determine compliance with criteria for incrementing the monitor numerator counter as per satisfaction of all the conditions necessary to determine pass;

(ii) For monitors that require multiple stages or events in a single driving cycle to detect a malfunction, then all monitoring conditions necessary to complete these phases or events shall be satisfied;

(iii) For monitors that require intrusive operation of components to detect a malfunction, a manufacturer shall request environmental compliance supervision competent authority approval of the strategy used to determine the following circumstances: if a malfunction had appeared, the monitor would have detected the malfunction. Upon approval of the request, environmental

compliance supervision competent authority shall take account of: whether the strategy is equivalent to actual intrusive operation and whether the strategy is equivalent in term of determination of satisfaction of intrusive operation occurrence conditions.

(iv) In addition to the requirements specified in J.3.4.2.2 (B)(i)-(iii), the secondary air system monitor numerator count shall be incremented if and only if the above determination criteria in (B) have been satisfied under the secondary air system under normal operation conditions: because of secondary air system, monitoring shall be performed during "normal operation" in accordance with stipulations of J.4.5.2.2. Monitoring during intrusive operation of the secondary air system in the same driving cycle solely for the purpose of monitoring may not be sufficient to meet this criteria.

(C) If a monitoring results are obtained in a "gray zone" or "non-detection zone" (for example, results that indicate neither a passing nor a malfunctioning) or in a "non-decision zone" (for example, for monitoring related to count, monitoring can increment or decrement count values until a pass or fail criteria condition is reached by count value, the manufacturer shall submit a program for appropriate incrementing of the numerator count to the environmental compliance supervision competent authority for review. In reviewing process, the environmental compliance supervision competent authority shall based on data and/or engineering evaluation submitted by the manufacturer. These data and/or engineering evaluation

results shall demonstrate the possible frequency of results in the "non-detection zone", the ability of the monitoring to accurately determine a malfunction when an actual malfunction had been present. The environmental compliance supervision competent authority shall not approve the program that allows the numerator count to be incremented when the monitor indicates a result in the "non-decision zone" or prior to count reaching criteria.

(D) For monitoring that run or complete diagnosis during engine off operation, the numerator count shall be incremented within 10s after the monitoring has completed diagnosis or incremented during the 10s after engine starts on the subsequent driving cycle.

(E) Except as specified in J.3.4.2.2 (F) for exponentially weighted moving averages, manufacturers shall be in accordance with stipulations of J.3.2.2.6, where alternative statistical MIL illumination protocols are used, shall submit a program for increment the numerator count to the environmental compliance supervision competent authority for review and approval. If the manufacturer provides supporting data and engineering evaluation for the program; the equivalence of the manufacturer's program to program specified in J.3.4.2.2; the environmental compliance supervision competent authority shall grant approval on the basis of equivalence of the two in determining whether the minimum IUPR specified in J.3.3.2.1 can be satisfied.

(F) If manufacturers use exponentially weighted moving average (EWMA) as alternative protocol of MIL illumination in accordance with the stipulations of J.3.2.2.6, shall increment the numerator count value as per following stipulations:

(i) Following a reset or erasure of the EWMA result, the numerator count shall not be incremented before the specified number of decisions necessary for MIL illumination has been satisfied;

(ii) After compliance with the decision number in J.3.4.2.2 (F)(i) above, the numerator count, when incremented, shall be incremented by 1 and shall not be incremented more than once in one same driving cycle. Incrementing of the numerator count shall be in compliance with the stipulations of J.3.4.2.2 (B), (C) and (D).

J.3.4.3 Denominator count

J.3.4.3.1 Definition: Definition of denominator count is based on the number of times a vehicle has been operated in accordance with definition in J.3.4.3.2.

J.3.4.3.2 Incrementing of denominator count

(A) The denominator count shall be incremented by an integer of 1 when incremented. The denominator count shall not be incremented more than once per driving cycle.

(B) Except as specified in J.3.4.3.2 (H), (J) and (K), the denominator count for each monitoring shall be incremented within 10s if and only if the following criteria are satisfied in one driving cycle:

(i) Accumulated operational timeafter engine start is more than or equal to 600s under the condition of an altitude of less than 2,440m and at an ambient temperature of more than or equal to -7°C;

(ii) Except as specified in J.3.4.3.2 (B) (iv) below, cumulative operation time at vehicle speed more than or equal to 40km/h is more than or equal to 300s while at an elevation of less than 2,400m above sea level and at an ambient temperature of more than or equal to -7°C;

(iii) Continuous vehicle operation at idle (for example, accelerator pedal released by driver and vehicle speed less than or equal to 1.6km/h or engine speed is not more than the normal engine warmed-up idle speed for 200rpm, normal warm-up idle speed refers to forward gear situations for vehicles equipped with an automatic transmission) for more than or equal to 30s while at an altitude of less than 2,440m and at an ambient temperature of more than or equal to -7°C.

(iv) As alternative of conditions (i)-(iii) mentioned above, for non hybrid vehicle, vehicle manufacturer may increment each denominator count by 1 within 10s if the stipulations of J.3.4.3.2 (K)(i)-(iv) are satisfied in one separated driving cycle.

(C) In addition to the requirements of J.3.4.3.2 (B), the secondary air system monitor denominator count shall be incremented if and only if commanded "on" operation of the secondary air system cumulatively continues for a time more than or equal to 10s. In order to determine this commanded "on" time during monitoring process, OBD system shall not count the running time that is only in order to detect intrusive operation of secondary air system.

(D) In addition to the conditions mentioned in J.3.4.3.2 (D)(iv) and J.3.4.3.2 (L), evaporative system monitor (with the exception of high load purge pipeline diagnostics), integrated component monitoring's input component temperature sensor rationality diagnosis (e.g., intake air temperature sensor, hybrid components temperature sensor and etc.) and the denominator count for rationality diagnostics of engine cooling system input component shall be incremented, if and only if:

(i) The requirements specified in J.3.4.3.2 (B) are met;

(ii) Accumulated operational time after engine start is more than or equal to 600s while at an ambient temperature of more than or equal to 4°C but less than or equal to 35°C;

(iii) During cold start of engine, coolant temperature is more than or equal to 4°C but is less than or equal to 35°C, and does not exceed the ambient temperature of 7 °C.

(iv) For OVC-HEV vehicle, manufacturer shall adopt the conditions of J.3.4.3.2 (L) for replacement of conditions of J.3.4.3.2 (D)(i)-(iii) to determine whether to increment denominator count of evaporative system monitoring.

(E) In addition to the requirements of J.3.4.3.2 (B), the denominator count for the following monitors shall be incremented if and only if the component or strategy is commanded "on" for a time more than or equal to 10s:

(i) Heated catalytic converter (J.4.2);

(ii) Cold start emission reduction strategy (J.4.11 and J.5.12);

(iii) Components or systems that operate only at engine start-up, and components or systems (e.g., glow plugs and intake air heaters, etc.) that are subject to monitoring requirements for other emission control device or emission source (J.4.15 and J.5.15) and output parts (J.4.14 and J.5.14) in comprehensive parts.

When determining the commanded "on" duration time, OBD system shall not count operation time during intrusive operation solely for the purpose of monitoring in the same driving cycle.

(F) In addition to the requirements of J.3.4.3.2 (B) above, the component is commanded to run (such as "on", "open", "closed" and "locked", etc.) for more than or equal to 2 times during one driving cycle and every time duration is more than 2s, or for a cumulative time more than or equal to 10s, the denominator count for monitoring of the following components (except those operated only at engine start-up and subject to the requirements of J.3.4.3.2 (E)) shall be incremented by 1:

(i) VVT and its control system (J.4.12 and J.5.13);

(ii) Output component of comprehensive component (J.4.14 and J.5.14) (such as turbocharger waste valve, variable length air intake manifold, hydraulic torque converter lock-up solenoids and etc., idling speed control system, idling fuel control system and etc.);

(iii) PM sensor heater (J.5.5.2.4 (A));

(iv) Particulate filter active/passive injection system (J.5.9.2.5).

For monitoring of PM sensor heater, manufacturer may adopt the criteria specified in J.3.4.3.2 (F) and J.3.4.3.2 (B).

(G) For the following monitoring, the denominator count shall be incremented by 1 during a driving cycle in which the following two conditions are met:

(1) The requirements of J.3.4.3.2 (B) have been met on at least one driving cycle after the denominator count was lastly incremented;

(2) The cumulative operation mileage of vehicle after the denominator count was lastly incremented has exceed 800km:

(i) Diesel engine NMHC catalytic convertor (J.5.1.2.2);

(iii) Performance and carrier loss of DPF (J.5.9.2.1 and J.5.9.2.4).

(H) For monitors of the following components, the manufacturer may apply to environmental compliance supervision competent authority for approval to use alternative criteria for incrementing the denominator count other than the criteria set forth in J.3.4.3.2 (B) for incrementing the denominator count. The environmental compliance supervision competent authority shall determine whether to grant approval to the criteria in accordance with the conformity of the submitted alternative method in measuring the frequency of monitor relative to vehicle operation frequency with the results measured in accordance with the method in J.3.4.3.2 (B).

(i) Other emission control or emission source devices (J.4.15 and J.5.15);

(ii) Integrated component monitoring's input component that requires extended monitoring (J.4.14 and J.5.14) (for example, fuel level sensor rationality);

(iii) Cycle regeneration frequency of particulate filter (J.5.9.2.2);

(iv) Monitoring of particulate sensor diagnostic capability (J.5.5.2.2 (D)).

(I) Except as required in J.3.4.3.2 (B), the denominator count for the following monitoring shall be incremented by 1 if and only if a regeneration is commanded for a time more than or equal to 10s:

(i) Incomplete regeneration of particulate filter (J.5.9.2.3).

(J) For vehicles that adopt alternative engine start hardware or strategies (for example, vehicle features STOP-START system but does not belong to hybrid electric vehicle), the manufacturer may request environmental compliance supervision competent authority approval to adopt alternative criteria other than that specified in J.3.4.3.2 (B) above for incrementing the denominator count. The environmental compliance supervision competent authority shall not approve the application for alternative criteria that only adopt engine shut off under idle/vehicle stop conditions. If the alternative criteria relative to measurement results of vehicle operation frequency is equivalent to measurement results of the number of traditional vehicle operations measured in accordance with the stipulations in J.3.4.3.2 (B), environmental compliance supervision competent authority shall grant approval to the alternative criteria.

(K) For hybrid electric vehicles, criteria for incrementing the denominator count in J.3.4.3.2 (B) above is not adopted, the denominator count for each monitor shall be incremented by 1 within 10s if and only if the following requirements are satisfied in one driving cycle:

(i) Accumulated operational time of power propulsion system is more than or equal to 600s when altitude is less than 2,440m and ambient temperature is more than or equal to -7°C;

(ii) Cumulative operating time of which vehicle speed is more than or equal to 40km/h is more than or equal to 300s at an altitude of less than 2,440m and at an ambient temperature of more than or equal to -7°C;

(iii) Under the condition of an altitude of less than 2,440m and at an ambient temperature of more than or equal to -7°C, continuous vehicle idling time is more than or equal to 30s (for example, accelerator pedal released by driver and vehicle speed less than or equal to 1.6km/h or engine speed is not more than the normal engine warmed-up idle speed for 200rpm, normal warm-up idle speed refers to forward gear situations for vehicles equipped with an automatic transmission); and
(iv) Cumulative operating time of fuel engine is more than or equal to 10s when altitude is less than 2,440m and ambient temperature is more than or equal to -7°C.
(L) For OVC-HEV vehicle
Evaporation system monitor (with the exception of high load purge pipeline diagnostics), integrated component monitoring's input component temperature sensor rationality diagnosis (e.g., intake air temperature sensor, hybrid components temperature sensor and etc.) and engine cooling system input component rationality diagnosis, except as specified in J.3.4.3.2 (K)(i)-(iv) above, its denominator count shall be incremented, if and only if:
(a) Cumulative activation time of propulsion system is more than or equal to 600s when ambient temperature is more than or equal to 4°C and less than or equal to 35°C;
(b) Engine coolant temperature at the instant of propulsion system activation start is more than or equal to 4°C and less than or equal to 35°C; and
(c) Before propulsion system is activated, duration time during which vehicle is uninterruptedly under condition of propulsion system inactive is more than or equal to 6h.
(M) Except the requirements in J.3.4.3.2 (B) above (for hybrid electric vehicles, except
the requirements in J.3.4.3.2 (K) above), denominator count of high load purge pipeline diagnostics of evaporation system shall be incremented, if and only if:
(i) Accumulated operational time after the start of the engine is more than or equal to 600s when altitude is less than 2,440m and ambient temperature is more than or equal to 4°C (for hybrid electric vehicles, accumulated operational time after engine start shall be replaced with accumulated operational time of powertrain system activation);
(ii) High load purge condition occurs for 2 times or more than 2 times in one driving cycle and each time exceeds 2s or accumulative time is more than or equal to 10s, whichever comes earlier;
(iii) The above mentioned high load purge condition refers to circumstance where engine manifold pressure is more than atmospheric pressure by more than 7kpa.

J.3.4.4 Stipulations on ratio

J.3.4.4.1 Definition: the ratio refers to the numerator count divided by the denominator count.
J.3.4.5 Interruption of numerator count and denominator count
J.3.4.5.1 When detecting the malfunction that may disable the monitoring subject to requirements of J.3.3.2.1 (refers to that a pending fault code or confirmed fault code is stored), OBD system shall stop incrementing of the numerator count and denominator count for each monitor that is disabled within 10s. When the malfunction no longer appears (refers to that the pending code is erased through self-clearing or through a scan tool), incrementing of numerator count and denominator count shall resume within 10s.
J.3.4.5.2 If the operation of PTO may disable monitor subject to requirements in J.3.3.2.1, then OBD system shall stop the incrementing of the numerator counter and denominator counter for each disabled monitor within 10s after start of PTO. After the PTO operation ends, incrementing of numerator count and denominator count shall resume within 10s.

J.3.4.5.3 OBD system shall stop incrementing of the numerator count and denominator count of all monitors within 10s in case of detection of a malfunction of any component used to determine whether the criteria (refers to vehicle speed, ambient temperature, altitude, idling operation, engine cold start or engine operation time) in J.3.4.3.2 (B)-(D) are satisfied has occurred (refers to that a pending fault code or confirmed fault code has been stored). Incrementing of the numerator count and denominator count shall be resumed within 10s when the malfunction no longer appears (for example, pending fault code is erased through self-clearing or by a scan tool).

J.3.5 Standardised requirements of monitor performance tracking and reporting

J.3.5.1 For monitoring of IUPR to be tracked and reported as required in J.3.3.2.2, relevant data shall be tracked and reported in accordance with the requirements of J.3.4, J.3.5 and J.6.5. OBD system shall respectively report numerator count and denominator count of following component IUPR.

J.3.5.1.1 For gasoline vehicle, OBD system shall respectively monitor numerator count and denominator count of each component as follows: Catalytic convertor (report respectively for each group), front oxygen sensor (report respectively for each group), evaporative system 1mm (0.5mm) leakage inspection, EGR/VVT system, secondary air system and rear oxygen sensor (report respectively for each group). OBD system shall report general denominator count and ignition cycle count as per the criteria format specified in J.3.5.5, J.3.5.6 and J.6.5 at the same time.

J.3.5.1.2 For diesel vehicle, OBD system shall respectively monitor numerator count and denominator count of each component as follows: Catalytic converter of NMHC and NOx catalytic converter, diesel engine fuel system and exhaust gas sensor, EGR/VVT and boost pressure control system, a NOx adsorber, particulate filter. OBD system shall report general denominator count and ignition cycle count as per the criteria format

specified in J.3.5.5, J.3.5.6 and J.6.5 at the same time.

J.3.5.2 Numerator count

J.3.5.2.1 OBD system shall respectively report numerator count for each of the components listed in J.3.5.1.

J.3.5.2.2 For components or systems with multiple monitors that are required to be reported in J.4 and J.5, for example, oxygen sensor may have multiple monitors for monitoring of sensor response or other characteristics parameters, OBD system shall individually track numerator count and denominator count for each monitor and report only the numerator count and denominator count for the specific monitor that has the minimum IUPR. If two or more monitors have identical IUPRs, the numerator count and denominator count of monitor of the maximum denominator count shall be reported.

J.3.5.2.3 Numerator count shall be reported in accordance with the stipulations in J.6.5.2.1.

J.3.5.3 Denominator count

J.3.5.3.1 The OBD system shall respectively report of the denominator count of each component listed in J.3.5.1.

J.3.5.3.2 Denominator count shall be reported in accordance with the stipulations of J.6.5.2.1.

J.3.5.4 Ratio

J.3.5.4.1 In accordance with the provisions of J.3.5.2.2, in order to determine numerator count and denominator count to be reported, the ratio of numerator count to denominator count shall be calculated in accordance with the stipulations in J.6.5.2.2.

J.3.5.5 Ignition cycle count

J.3.5.5.1 Definition:

(A) Ignition cycle count refers to record of the number of ignition cycles a vehicle has experienced as defined in J.3.5.5.2 (B) and J.3.5.5.2 (C).
(B) In addition to the requirements of J.3.5.5.1 (C), OBD system shall report ignition cycle count in accordance with stipulations of J.3.5.5.2 (B). As an alternative method, OBD system may report 2-ignition cycle count, one is in compliance with the definition in J.3.5.5.2 (B), the other is in compliance with the definition in J.3.5.5.2 (C).
(C) For plug-in hybrid electric vehicle, OBD system shall respectively report 2-ignition cycle count defined in J.3.5.5.2 (B) and (C).
(D) The ignition cycle count shall be reported in accordance with the stipulations of J.6.5.2.1.
J.3.5.5.2 Incrementing of ignition cycle count
(A) The count of ignition cycles shall be incremented by an integer of 1 when being incremented. The count of ignition cycles can be incremented for one time at most per driving cycle.
(B) The count of ignition cycles shall be incremented within 10s if and only if the following criteria are met:
(i) In addition to requirements in J.3.5.5.2 (B)(ii), the vehicle meets the engine start definition for over (2±1) s;
(ii) For hybrid electric vehicle, the vehicle meets the propulsion system activation definition for over (2±1) s.
(C) In addition to the ignition cycle count described in J.3.5.5.2 (B), secondary ignition cycle count shall be tracked and reported for OVC-HEV vehicle, and shall be incremented within 10s if and only if vehicle meets fueled engine operation definition for over (2±1) s.
(D) It is required to stop further incrementing of the ignition cycle count OBD system in within 10s if a malfunction of any component used to determine if the criteria specified in J.3.5.5.2 (B) and (C) (such as engine speed and operating time) are satisfied has occurred and pending fault code has been stored. Incrementing of the ignition cycle count shall not be terminated under any other conditions. It is required to resume incrementing of the ignition cycle count within 10s when the malfunction no longer appears (for example, pending fault code is erased through self-clearing or by a scan tool).

J.3.5.6 General denominator count

J.3.5.6.1 Definition:
(A) The general denominator count refers to record the number of times a vehicle has been operated as per definition in J.3.5.6.2 (B).
(B) The general denominator count shall be reported in accordance with the stipulations in J.6.5.2.1.
J.3.5.6.2 Incrementing of general denominator count
(A) When being incremented, the general denominator count shall be incremented by an integer of 1 per time. The general denominator count can be incremented for one time at most per driving cycle.
(B) The general denominator count shall be incremented within 10s if and only if the criteria defined in J.3.4.3.2 (B) (for hybrid electric vehicle: J.3.4.3.2 (K)) are satisfied in one driving cycle:
(C) It is required to stop further incrementing of the general denominator count in OBD system within 10s if a malfunction of any component used to determine if the criteria in J.3.4.3.2 (B) (for example, vehicle speed, ambient temperature, altitude, idle operation and time of operation) are satisfied has occurred and pending fault code has been stored. The general denominator count may not be disabled from incrementing for any other conditions (for example, the malfunction criteria in J.3.4.5.1 and J.3.4.5.2 may not cause disablement of incrementing of general denominator count). Incrementing of the general denominator count shall resume within 10s when the malfunction no longer appears (for example, pending fault code erased through self-clearing or by a scan tool).

J.3.6 Requirements of determining applicable vehicle

J.3.6.1 Substitute fuel vehicle shall meet the requirements regarding vehicle equipped with positive-ignition engine in Annex J.

J.3.6.2 For configuration of component/system required by malfunction in J.4 and J.5, requirements in Annex J shall be met.

J.3.7 OBD test requirements

In order to implement OBD verification test, inspection of COP and in-use compliance, manufacturer shall provide test equipments (such as malfunction simulators and critical aging sample, etc) required to complete OBD test in accordance with requirements of the environmental compliance supervision competent authority, and ensure its validity. "Test equipment" shall include but not limited to: critical and aging catalytic converters and simulation equipments used to misfire malfunction, oxygen sensor malfunction, fuel system malfunction, VVT system malfunction, and cold start emission reduction strategy malfunction.

J.3.8 OBD threshold

J.3.8.1 On vehicle used for Type V durability test as provided in Annex G, adopt the test procedure of Appendix JA for OBD system verification test. Test shall be performed

upon end of Type V durability test; or as required by manufacturer, it is allowed to use appropriately aged (equivalent to 160,000km) and representative vehicle.

J.3.8.2 Before failure of an emission-related component or system causes exceedance of threshold values specified in Table J.1, OBD system shall indicate the failure.

Table J.1 OBD threshold value

	Test mass (TM) (kg)	Carbon monoxide (CO) (g/km)		Non-methane hydrocarbon + Nitrogen oxide (NMHC+NOx)) (g/km)	Particulate matter (PM) (g/km)
Vehicle of category I	-	All	1.900	0.260	0.012
Vehicle of category II	I	TM≤1,305	1.900	0.260	0.012
	II	1,305<TM≤1,760	3.400	0.335	0.012
	III	1,760<TM	4.300	0.390	0.012

J.4 Requirements for gasoline vehicle/motor vehicle equipped with positive-ignition engines

J.4.1 Monitoring of catalytic convertor

J.4.1.1 Requirement

OBD system shall monitor whether conversion capability of catalytic convertor system is at normal level.

J.4.1.2 Malfunction criteria

J.4.1.2.1 Before deterioration of catalytic convertor could result in NMHC+NOx emissions of vehicle exceeding the OBD threshold, OBD system shall detect a malfunction of catalytic convertor.

J.4.1.2.2 The following catalytic convertor systems shall be used to establish malfunction criteria in J.4.1.2.1:

(A) The manufacturer shall use a catalytic convertor system deteriorated to the malfunction criteria, which shall represent real world catalytic convertor system deterioration under normal and malfunctioning operating conditions.
(B) Except as described in J.4.1.2.2 (C), the malfunction criteria shall be established by adopting all monitored and unmonitored (downstream of the sensor for catalytic convertor monitoring) catalytic convertor deteriorated to the malfunction criteria's catalytic convertor system at the same time.
(C) For vehicles featuring fuel shutoff protection measure under misfire conditions (see section J.4.3.4.1 (D)), the malfunction criteria shall be established by using a catalytic convertor system with all monitored catalytic converters simultaneously deteriorated to the malfunction criteria while unmonitored catalytic converters deteriorated to durability mileage.

J.4.1.3 Monitoring conditions

Manufacturers shall define the monitoring conditions for malfunctions in J.4.1.2 in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.4.1.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.1.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.4.1.4 MIL illumination and storage fault code

J.4.1.4.1 Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.4.1.4.2 The monitoring method for the adoptive catalytic converter (system) shall be capable of detecting the following circumstances: catalytic converter has not been replaced with effective catalytic converter but fault code has been cleared (except OBD system self-clearing).

J.4.2 Monitoring of heated catalytic convertor

J.4.2.1 Requirement

J.4.2.1.1 OBD system shall monitor all heated catalytic converter systems for whether normal heating function is available.

J.4.2.1.2 Catalytic conversion capability of heated catalytic convertors shall be monitored in accordance with the requirements of J.4.1.

J.4.2.2 Malfunction criteria

J.4.2.2.1 OBD system shall detect a heated catalytic converter system malfunction when the catalytic converter does not reach its designated heating temperature within a specified time period after engine starting. When the manufacturer determines the time specified above, manufacturer shall ensure that vehicle emissions do not exceed the OBD threshold value before the OBD system detects a malfunction in the heated catalytic converter system.

J.4.2.2.2 Manufacturers may apply to use other alternate strategy for monitoring heated catalytic convertor. The environmental compliance supervision competent authority shall grant approval on the basis that the alternate strategy features equivalent reliability and timeliness in detection of heated catalytic convertor malfunctions.

J.4.2.3 Monitoring conditions

Manufacturers shall define the monitoring conditions for malfunctions in J.4.2.2 in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR).

J.4.2.4 MIL illumination and storage fault code

Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.4.3 Misfire monitoring

J.4.3.1 Requirement

J.4.3.1.1 OBD system shall monitor misfire malfunction of engine.

J.4.3.1.2 OBD system shall identify the cylinder that is experiencing misfire. Manufacturers may apply to environmental compliance supervision competent authority for approval to: only store a general misfire fault code instead of misfire fault code of a specific cylinder under certain specific operating conditions. If data and/or engineering evaluation submitted by manufacturer can demonstrate that: the misfiring cylinder cannot be reliably identified under the specific operation conditions proposed by manufacturer, the environmental compliance supervision competent authority shall approve the application.

J.4.3.1.3 Except the following circumstances permitted, if more than one cylinder is misfiring, a separate fault code shall be stored to indicate that multiple cylinders are misfiring. When identifying multiple cylinders misfire, the OBD system is not required to distinguish each of the misfiring cylinders individually through separate fault codes. If more than 90% of the detected misfires occur in a cylinder, it is necessary to store the appropriate fault code indicating the specific misfiring cylinder in lieu of only storage of the multiple cylinders misfire fault code. However, if misfire of two or more cylinders exceed 10% of detected misfires, then a multiple cylinders fault code must be stored.

J.4.3.2 Malfunction criteria

OBD system shall detect a misfire malfunction under the following circumstances:

J.4.3.2.1 For all vehciels, misfire causing catalytic converter failure

(A) Manufacturer shall determine the percentage of misfire that would cause catalytic converter damage by adjustment in 200 revolution cycles for each engine speed and load condition that would cause catalytic converter damage temperature. The manufacturer shall submit documentation to support the percentage of misfire required in AB.2.5. If under a certain engine speed and load condition, the percentage of misfire is less than 5%, the manufacturer may take 5% as the malfunction criteria.

(B) If environmental compliance supervision competent authority agrees, manufacturer may adopt inspection cycle more than 200 revolution for inspection before the first time of occurrence of the percentage of misfire that would cause catalytic convertor damage mentioned in J.4.3.4.1 (A). The environmental compliance supervision competent authority shall grant approval to relevant request if data and/or engineering evaluation submitted by manufacturer can demonstrate that: catalytic converter failure would not occur due to extremely high temperatures within the above mentioned rotation speed testing cycle.

(C) OBD system shall detect misfire malfunction if the engine appears more than the percentage of misfire established in J.4.3.2.1 (A). Under the situations of multiple cylinders misfire, if total percentage of misfire is more than or equal to 50%, OBD system shall only be required to detect misfire malfunctions causing single component failure.

(D) For purposes of establishing the temperature at which catalytic converter failure occurs as required in J.4.3.2.1 (A), manufacturers shall not define catalytic converter failure at a temperature more severe than the following temperature condition: under the temperature, the catalytic converter system could be operated for 10h consecutive and still meet the emission limit of durability mileage specified in emission regulation.

J.4.3.2.2 Misfire causing emissions to exceed the OBD threshold value

(A) Except plug-in hybrid electric vehicle specified in J.4.3.2.3 below, manufacturer shall determine the percentage of misfire as per 1,000 revolution of monitoring cycle that would cause emissions to exceed OBD monitoring threshold value. Set the relevant malfunction of percentage of misfire from the beginning of the test, at complete engine cycle intervals, across randomly selected cylinders, set misfire event as per identical interval to determine percentage of misfire until pollutant emission of emission durability demonstration vehicle exceeds percentage of misfire of OBD threshold value. If the actual percentage of misfire is determined to be less than 1%, the manufacturer may set the malfunction criteria as 1%.

(B) Subject to environmental compliance supervision competent authority approval, manufacturer can adopt other operation monitoring cycle. Under the precondition that manufacturer has proved that the strategy can detect misfire equivalently, timely and effectively, environmental compliance supervision competent authority may grant approval.

(C) If percentage of misfire exceeds the percentage of misfire mentioned in J.4.3.2.2 (A) regardless of the pattern of misfire events (such as random, constant and continuous, etc.), OBD system shall detect a malfunction. If percentage of misfire caused due to multi-cylinders engine misfire is more than or equal to 50%, OBD system shall only be required to detect misfire malfunctions that are caused by a single component failure.

J.4.3.2.3 Misfire of plug-in hybrid electric vehicle

(A) Manufacturer shall detect misfire malfunction of which percentage of misfire is more than 2%, and shall evaluate percentage of misfire as per cycle of 1,000 revolution;

(B) Manufacturer may apply to modify the percentage of misfire in J.4.3.2.3 (A) provided that the percentage of misfire will not cause emission of vehicle to exceed relevant OBD threshold value.

(C) Manufacturer may select to replace the percentage of misfire required in J.4.3.2.3 by the percentage of misfire specified in J.4.3.2.2.

(D) If percentage of misfire caused due to multi-cylinders engine misfire is more than or equal to 50%, OBD system shall only be required to detect misfire malfunctions that are caused by a single component failure.

J.4.3.3 Monitoring conditions

J.4.3.3.1 Vehicle manufacturer shall continuously monitor for misfire under the following conditions:

(A) Except the situations mentioned in J.4.3.3.6, OBD system shall start monitoring of misfire starting from the 2nd revolution after engine start but shall perform misfire determination no later than the 1,000th revolution.

(B) During the engine start (refers to rotation speed rise and rotation speed drop), during the process when engine speed reaches the desired idle engine speed, under positive torque conditions.

(C) Under all positive torque engine speeds and load conditions within the range above the positive torque curve and connecting line between the two operating points as follows. The two operating points refer to: an engine speed of 3,000rpm with the load at the positive torque curve; and the engine speed is at rotation speed redline, with the engine's manifold vacuum at 13.33kPa less than that at the positive torque curve.

J.4.3.3.2 If an OBD system cannot detect all misfire patterns under engine speed and load conditions as required in J.4.3.3.1, vehicle manufacturer might apply to environmental compliance supervision competent authority for approval to accept the system. In evaluating the manufacturer's application, the environmental compliance supervision competent authority shall consider the following factors: the magnitude of the region in which misfire detection is limited, the probability of detection of misfire in the limited region, the frequency with which vehicle actually operates in the said region, the patterns of misfire for which misfire detection is difficult, and demonstration that the misfire monitoring technology adopted

is inherently capable of detecting misfire under required conditions (for example, compliance can be achieved on other engines). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and symmetrical cylinder (cylinders firing at the same crankshaft angle) continuous misfire.

J.4.3.3.3 Manufacturer may submit application to environmental compliance supervision competent authority, during the first 1,000 revolution after engine start, if the strategy of reducing torque is adopted in cold start emission control (for example, spark retard strategies), can reduce the monitoring ability of the control system on misfire. If the manufacturer can demonstrate that the probability of misfire detection is not less than 75% under the lowest torque condition for operating continuously at idle (park/neutral idle) when the engine is started at 10-30°C and that the technology cannot reliably detect a higher percentage of the misfire events under the above conditions, the environmental compliance supervision competent authority shall approve the above mentioned application.

J.4.3.3.4 A manufacturer may apply to environmental compliance supervision competent authority for approval to disable misfire monitoring or adopt an alternative malfunction evaluation criterion when misfire event cannot be distinguished from other factors.

(A) Regarding the following circumstances, if it can be confirmed that documents provided by manufacturer can prove that: the interval of stop of monitor or use of an alternative malfunction criterion are necessary method adopted technically to avoid false detection, the environmental compliance supervision competent authority may approve the application to stop monitor or adopt an alternative malfunction criterion.

(i) Rough road;

(ii) Fuel cut;

(iii) Gear changes for manual transmission vehicles;

(iv) Traction force control or other vehicle stability control activation, such as antilock braking or other engine torque modifications to enhance vehicle stability.

(v) Diagnostics during maintenance of vehicle or adoption of external control for vehicle components during test process at assembling factory, or activation of intrusive operation.

(vi) Intrusive evaporative system or EGR diagnostics that can significantly affect engine stability (refers to that while the purge valve is opened during establishment of vacuum for fuel evaporative system leak check, but cannot be interrupted while the purge valve is closed and the fuel evaporative system is sealed; while an EGR diagnostic causes the EGR valve to be intrusively cycled on and off during positive torque conditions), or:

(vii) If change of engine speed, load or torque caused due to throttle movement change is higher than the worst case of WLTC cycle test.

(B) The environmental compliance supervision competent authority shall approve a manufacturer's request in accordance with J.4.16.3, J.4.16.4 and J.4.16.6 to disable misfire monitoring when fuel level is less than 15% of the capacity of the fuel tank, when PTO units are active, or while engine coolant temperature is less than -7°C. The environmental compliance supervision competent authority shall also approve manufacturer's request to disable misfire monitor before coolant temperature rises to 21°C after engine starts at temperature less than -7°C.

(C) In general, the environmental compliance supervision competent authority shall not approve to disable misfire monitor for following conditions: normal air conditioning compressor on and off process, automatic transmission vehicle gear shifts (except for shifts under condition of wide open throttle operation), change

process from idle to off-idle, normal engine speed and load changes that occur during the engine speed rise and return process (refers to rotation speed rise and rotation speed drop) after engine starting in case of no driver operation, or excessively rapid acceleration (except for actual acceleration that exceeds the acceleration at wide open throttle while the vehicle is not in neutral gear due to slipping of clutch).

(D) If the manufacturer can demonstrate that application for disabled fault diagnostic or use of an alternate malfunction criterion is based on use of the best available computer and monitoring technology and application for disabled diagnostic is only for an unusual or unforeseen circumstance, the environmental compliance supervision competent authority shall approve the application.

J.4.3.3.5 For engines with more than 8 cylinders that cannot meet the requirements of J.4.3.3.1, a manufacturer may apply to environmental compliance supervision competent authority to use alternative misfire monitoring conditions. The environmental compliance supervision competent authority shall approve the above application if data/engineering evaluation submitted by manufacturer demonstrate that: effective misfire detection cannot be achieved throughout the required operating region when adopting proven monitoring technology (for example, compliance with criteria requirements on other engines) and misfire is detected to the fullest extent permitted by the technology. However, the environmental compliance supervision competent authority shall not grant the above mentioned application if the misfire detection system is unable to monitor misfire under all positive torque operating conditions in emission test cycle.

J.4.3.3.6 Where engine shutdown strategy is adopted and engine can be enabled to continue running without restart of engine by driver (for example, adopt the control strategy to turn off engine during idling of hybrid electric vehicle), a manufacturer may apply to environmental compliance supervision competent authority to use the following misfire monitoring conditions: under the monitoring condition, start fuel supply after engine

starts and after each time of resume of fuel supply, it is required to monitor misfire. The environmental compliance supervision competent authority shall determine whether to approve application on the basis of equivalence between the monitoring condition and the condition specified in J.4.3.3.1 (A). For hybrid electric vehicles, after each time of resume of fuel supply, OBD system shall start monitoring of misfire from the 2nd revolution after start of engine.

J.4.3.4 MIL illumination and storage fault code

J.4.3.4.1 Misfire causing catalytic convertor failure. Where percentage of misfire mentioned in J.4.3.2.1 is detected, it is necessary to determine whether MIL shall be illuminated and fault code shall be stored as per the following criteria:

(A) Pending fault code

(i) A pending fault code shall be stored immediately if, during a single driving cycle, the percentage of misfire is exceeded three times when operating in the positive torque condition encountered during an WLTC emission cycle or is exceeded on a single occasion when operating at any operating point in the positive torque region defined in J.4.3.3.1;

(ii) After a pending fault code is stored as specified in details in section J.4.3.4.1 (A)(i), the MIL shall blink ceaselessly once per second while misfire is occurring during the driving cycle.

a. The MIL may be extinguished when misfire is not occurring during the driving cycle.

b. At the time when a misfire malfunction occurs, if the MIL is already illuminated for a malfunction other than misfire, the MIL shall blink ceaselessly as specified in J.4.3.4.1 (A)(ii). If misfiring no longer occurs, the MIL shall stop blinking but may remain illuminated due to existence of other malfunction.

(B) Confirmed fault code

(i) If a pending fault code is stored for exceeding the percentage of misfire given in J.4.3.2.1, in the following two cases, OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in J.4.3.2.1 is again exceeded:

(a) The driving cycle immediately following the storage of the pending fault code, regardless of the conditions in the driving cycle;

(b) The next driving cycle in which the conditions (J.2.46) are similar to the cycle when the pending fault code was stored.

(ii) If a pending fault code is stored for exceeding the percentage of misfire listed in J.4.3.2.2 in a previous drive cycle, OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in J.4.3.2.1 is detected during the cycle regardless of the conditions.

(iii) After storage of a confirmed fault code, the MIL shall blink as per the type specified in J.4.3.4.1 (A)(ii) as long as misfire is occurring, and the MIL shall remain continuously illuminated if the misfiring ceases.

(C) Erasure of pending fault code

Pending fault code can be erased in the next driving cycle if the conditions similar to that causing storage of pending fault code have been detected once again without any exceedance of the specified percentage of misfire. The pending fault code may also be erased if similar driving conditions do not occur during 80 successive driving cycles after the driving cycle of initial detection of malfunction.

(D) Exemption requirements for vehicles with fuel shutoff and default fuel control function

(i) Notwithstanding the provisions in J.4.3.4.1 (A) and J.4.3.4.1 (B), if fuel shutoff and default fuel control mode of vehicle is to prevent over fuel injection during catalytic convertor failure misfire conditions, the MIL needs not blink. On the contrary, in accordance with the requirements in J.4.3.4.1 (B) (iii) on continuous illumination, the MIL shall illuminate continuously upon detection of misfire provided that the fuel shutoff and default control mode shall be activated as soon as misfire is detected. Fuel shutoff and default fuel control mode may be deactivated only if it is allowed to inject fuel outside of the misfire range.

(ii) Vehicle manufacturer may also periodically (but shall be not more than once per 30s) deactivate fuel shutoff and default fuel control mode to determine whether the specified percentage of misfire for catalytic convertor failure is always being exceeded. Normal fuel and fuel control mode may be resumed if percentage of misfire no longer exceeds the specified percentage of misfire causing catalytic convertor failure.

(E) During extreme catalytic convertor failure misfire conditions (for example, catalytic convertor failure misfire occurring at all engine speeds and loads), manufacturers may apply to the environmental compliance supervision competent authority to: adopt strategies that continuously illuminate the MIL in lieu of blinking the MIL. The environmental compliance supervision competent authority shall grant approval to the above request if the manufacturer has demonstrated that the manufacturer adopts the above mentioned strategy only when catalytic convertor failure misfire cannot be avoided during reasonable driving conditions or the manufacturer has demonstrated that: the strategy will minimize catalytic convertor damage under above mentioned conditions (for example, at low engine speeds and loads).

J.4.3.4.2 If OBD system detects percentage of misfire to exceed the OBD threshold defined in J.4.3.2.2, MIL illumination and fault code storage shall be in compliance with the following criteria:

(A) A pending fault code shall be stored before the 4 times detection of the fault if exceedance of the percentage of misfire specified in J.4.3.2.2 is detected during one driving cycle.
(B) If a pending fault code has been stored, in the following two cases, OBD system shall illuminate the MIL and store a confirmed fault code within 10s if percentage of misfire exceeds the percentage of misfire specified in J.4.3.2.2 for 4 times: (i) The driving cycle immediately following the storage of the pending fault code, regardless of the conditions in the driving cycle; (ii) The next driving cycle in which the conditions (J.2.46) are similar to the cycle when the pending fault code was stored. Meanwhile, in accordance with stipulations of J.6.4.4.5, the stored pending fault code shall be continuously reserved.
(C) The pending fault code may be erased at the end of the driving cycle if in the next driving cycle, operating conditions similar to that causing storage of pending fault code have occurred without detection of any exceedance of the specified percentage of misfire. The pending fault code may also be erased if similar driving conditions do not occur during 80 successive driving cycles after the driving cycle of initial detection of malfunction.
J.4.3.4.3 For plug-in hybrid electric vehicle, upon detection of the percentage of misfire specified in J.4.3.2.3 (A), the following criteria shall apply for MIL illumination and fault code storage.
(A) A pending fault code shall be stored immediately if exceedance of the percentage of misfire specified is detected during one driving cycle;
(B) If a pending fault code has been stored, in the following two cases, OBD system shall illuminate the MIL and store a confirmed fault code if percentage of misfire
again exceeds the percentage of misfire specified in J.4.3.2.3 A): (a) The driving cycle immediately following the storage of the pending fault code, regardless of the conditions in the driving cycle; (b) The next driving cycle in which the conditions (J.2.46) are similar to the cycle when the pending fault code was stored. At this point, the stored pending fault code shall be continuously reserved. Meanwhile, in accordance with stipulations of J.6.4.4.5, the stored pending fault code shall be continuously reserved.
(C) The pending fault code may be erased at the end of the driving cycle, if in the next driving cycle, operating conditions similar to that causing storage of pending fault code have occurred without detection of any exceedance of the specified percentage of misfire. The pending fault code may also be erased if similar driving conditions do not occur during 80 successive driving cycles after the driving cycle of initial detection of malfunction.
J.4.3.4.4 Storage of freeze frame conditions
(A) OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with confirming fault code.
(B) When the misfire fault code is stored, if freeze frames are stored for a malfunction other than misfire and fuel system malfunction (see J.4.6), the stored freeze frame shall be replaced with freeze frame conditions related to the misfire malfunction.
J.4.3.4.5 Store misfire conditions to determine similar operating condition
In case of detection of misfire fault defined in J.4.3.4.1 or J.4.3.4.2, manufacturer shall store the following engine conditions: engine speed, load, and warm-up status upon occurrence of the first misfire event that resulted in the storage of the pending fault code.
J.4.3.4.6 Extinguishment of the MIL. The MIL may be extinguished after 3 sequential driving cycles in which similar conditions causing storage of misfire fault code have occurred but without detection of any exceedance of the specified percentage of misfire.

J.4.4 Evaporative system monitoring

J.4.4.1 Requirement

OBD system shall monitor purge flow from the evaporative system and shall monitor the integrity of the entire evaporation system other than the pipeline and joint between carbon canister valve and air intake manifold, and prevent fuel vapor from leaking into atmosphere. Individual components of the fuel evaporative system (such as valves and sensors, etc.) shall be monitored in accordance with the comprehensive components requirements in J.4.14 (such as circuit continuity, out-of-range values, rationality and proper functional response, etc.). For those vehicles on which installation of fuel evaporative emission control system is not required, it is not required to monitor evaporative system.

For substitutive fuel vehicle related to fuel evaporative emission, the manufacturer shall submit monitoring plan to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer demonstrate that monitoring program has effectiveness and reliability equivalent to the monitoring program that meets the requirements of J.4.4 on gasoline vehicle.

J.4.4.2 Malfunction criteria

J.4.4.2.1 In J.4.4, "orifice" refers to an O'Keefe Controls Co. precision metal type B orifice with several National Pipe Thread Taper connections, diameter of the several National Pipe Thread Taper connections has specific dimension, for example, part of number B-40-SS refers to a stainless steel of 1mm diameter orifice.

J.4.4.2.2 OBD system shall detect an evaporative system malfunction for the following conditions:

(A) No purge flow from the fuel evaporative system to the engine (refers to enclosed area of engine air intake system) can be detected by OBD system;

(B) The complete evaporative system contains one leak or multiple leaks that are more than or equal to a leak caused by a 1mm diameter orifice;

(C) If manufacturer requests, requirements on leak that is more than or equal to a leak caused by a 0.5mm diameter orifice can replace the leak standard in J.4.4.2.2 (B);

(D) For high load purge pipeline on supercharging engine vehicle (for example, canister evaporative system purge pipeline under the condition that intake manifold pressure is larger than ambient pressure), if there is no purge flow from evaporative system to engine, OBD system shall detect a malfunction.

J.4.4.2.3 On vehicles with fuel tank capacity more than 75L, vehicle manufacturer may apply to the environmental compliance supervision competent authority to revise the leakage orifice size specified in J.4.4.2.2 (B)/(C) if the most reliable monitoring method available cannot reliably detect leak volume specified. The environmental compliance supervision competent authority shall approve the above application on the basis that the data and/or engineering evaluation submitted by manufacturer demonstrate the necessity of the application.

J.4.4.2.4 On the basis of data/engineering evaluation submitted by manufacturer, the environmental compliance supervision competent authority shall grant approval to application of manufacturer to increase the orifice size specified in J.4.4.2.2 (B)/(C), so as to prevent OBD system from wrong determination of situation that cannot cause evaporative emission to exceed 1.5 times of threshold.

J.4.4.2.5 For J.4.4.2.2 (A) or J.4.4.2.2 (D):

(A) In addition to the requirements in J.4.4.2.5 (A)(i), J.4.4.2.5 (A)(ii) and J.4.4.2.5 (B), for vehicles that utilize more than one purge flow path (for example, a turbocharged engine with a low load purge pipeline and a high load purge pipeline), OBD system shall verify whether the requirements of J.4.4.2.2 (A) are met (for example, purge flow to the engine) for all purge flow paths.

(i) In addition to the requirements for high load purge pipeline specified in J.4.4.2.5 (A)(ii), if a manufacturer can demonstrate that: blockage, leakage, or disconnection of one of the purge flow paths cannot cause a measurable emission increase during any reasonable actual driving conditions, monitoring of that purge path is not required.

(ii) For a turbocharged engine with a low load purge pipeline and a high load purge pipeline, for which requirements of J.4.4.2.2 (D) apply, if manufacturer can demonstrate that in WLTC cycle, purge flow rate of high load purge pipeline accounts for less than 10% of total purge flow rate flowing to engine, it is not required to monitor high load purge pipeline.

(B) Manufacturer may apply for monitoring strategy that cannot detect all pipeline disconnection, damage, blockage or other malfunction affecting requirements of J.4.4.2.2 (D). The environmental compliance supervision competent authority shall approve the application upon determining that the manufacturer has provided data/engineering evaluation that demonstrate: the degree of restriction upon purge channel is small in relation to complete monitoring requirements (for example, blockage of high load purge pipeline can be detected, but disconnection or damage cannot be detected, or the entire purge pipeline can be basically monitored with the exception of disconnection or damage of partial pipeline 25.4mm behind venturi); existing verified monitoring technology (for example, monitoring technology that can meet requirements on other engine) cannot fully realize monitoring of high load purge pipeline; design of high load purge pipeline can avoid deterioration of unmonitored portion (for example, damage, disconnection and blockage).

J.4.4.2.6 On vehicle with multiple fuel tanks, carbon canisters/purge valves, if the most reliable monitoring method cannot fully detect leak of the magnitudes specified, manufacturer

may apply to consider as per multiple "complete fuel evaporation systems" when determining malfunction criteria of J.4.4.2.2 (B) or (C). The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation provided by manufacturer can demonstrate the need for the request and there is no common pipeline or passage for different "complete fuel evaporation control systems" on vehicle. Each "complete fuel evaporation system" shall fully meet requirements of J.4.4.2.2 (B) or (C).

J.4.4.3 Monitoring conditions

J.4.4.3.1 Manufacturer shall define the monitoring conditions for malfunctions defined in J.4.4.2 in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report in-use monitor performance ratio of malfunction monitor items defined in J.4.4.2 (B) or (C) in accordance with the stipulations of J.3.3.2.2. For tracking and reporting of in-use monitor performance ratio, all monitor items defined in J.4.4.2 (B) or (C) shall be tracked individually but reported as a single set of values as per requirements of J.3.5.2.2.

J.4.4.3.2 Manufacturer may disable or prohibit evaporative system monitoring when the fuel tank level is more than 85% of nominal tank capacity or during refueling.

J.4.4.3.3 Manufacturers may apply to monitor the evaporative system only on driving cycles determined by the manufacturer to be cold starts to ensure reliable monitoring. The competent authority shall not approve such requirement: it is not allowed to deem the start as cold starts solely on the basis that ambient temperature exceeds (for example, indicates a higher temperature) coolant temperature at engine start. The environmental compliance supervision competent authority shall approve the above request once it is determined that data/engineering evaluation submitted by the manufacturer demonstrate that: a reliable check can only be made on driving cycles when the cold start criteria are satisfied.

J.4.4.3.4 Manufacturer may temporarily disable the fuel evaporative purge system during evaporative system leak check.

J.4.4.4 MIL illumination and storage fault code

J.4.4.4.1 Except as specified below for fuel tank cap leaks and alternative strategy of statistical MIL illumination, see general requirements for MIL illumination and storage fault code as per J.3.2.

J.4.4.4.2 If OBD system is capable of identifying that a system leak is being caused by a missing or improperly fastened fuel tank cap:

(A) It is not required to illuminate the MIL or store a fault code if the vehicle is equipped with other malfunction indicator lights for notifying the vehicle driver about occurrence of the above malfunction. The alternative indicator light shall be of sufficient illumination and location shall be readily visible to vehicle driver under all lighting conditions.

(B) If the vehicle is not equipped with a alternative indicator and the MIL illuminates, the MIL may be extinguished and the corresponding fault codes erased once OBD system has verified that the fuel tank cap has been securely fastened and the MIL has not been illuminated for any other type of malfunction.

(C) The environmental compliance supervision competent authority may approve other strategies that provide equivalent assurance that: vehicle driver will be notified of a missing or improperly secured fuel cap and that corrective action will be undertaken.

J.4.4.4.3 Notwithstanding the requirements in J.3.2.2.6, manufacturers may still apply to use alternative statistical MIL illumination and fault code storage strategy that averagely requires 12 driving cycles at most for the monitoring specified in J.4.4.2.2 (B) or (C). In accordance with the requirements in J.3.2.2.6, if data/engineering evaluation provided by manufacturer can demonstrate that the most reliable monitoring method feasible at

present cannot reliably detect leak malfunction of the specified size without the additional driving cycles and that the monitoring system will still meet the monitoring conditions requirements specified in J.3.3.1 and J.3.3.2, environmental compliance supervision competent authority shall grant approval to the above mentioned application.

J.4.5 Secondary air system monitoring

J.4.5.1 Requirement

For vehicles equipped with any type of secondary air system, OBD system shall monitor whether the secondary air system operates normally, including all air switching valves, meanwhile, all electronic components (such as actuators, valves and sensors, etc.) in the secondary air system shall be monitored in accordance with the comprehensive component requirements in J.4.14.

J.4.5.2 Malfunction criteria

J.4.5.2.1 For purpose of J.4.5,

(A) "Air flow" is defined as the air flow per unit time delivered by the secondary air system to the exhaust system. For vehicles configured with secondary air systems with multiple air flow paths/distribution points, the air flow to each sub-channel (for example, a group of cylinders that share a common exhaust manifold, catalytic convertor, and control sensor) shall be monitored in accordance with the malfunction criteria in J.4.5.2.2 unless complete blocking between secondary air delivery system and a certain sub-channel does not cause increase in emission results.

(B) "Normal operation" is defined as the operating condition where secondary air injection system is activated during engine warm-up or catalytic convertor heating after engine startup, excluding the

operating condition where secondary air system is activated by intrusive operation solely for the purpose of monitoring.

J.4.5.2.2 For all light-duty vehicles

(A) OBD system shall detect a secondary air system malfunction prior to a decrease of air flow from the design flow that would cause a vehicle's emissions to exceed the OBD threshold value when the secondary air system is operating normally.

(B) Manufacturers may apply to environmental compliance supervision competent authority to modify malfunction criteria: When the secondary air system is operating normally, detect a malfunction when no secondary air flow is detected in lieu of the malfunction criteria specified in J.4.5.2.2 (A). If aging or deterioration of the secondary air system is unlikely, and data and/or engineering evaluation submitted by the manufacturer demonstrate that: the materials used for the secondary air system (such as air hoses, tubing, valves, and connectors, etc.) are inherently resistant to disconnection, corrosion, or other deterioration, environmental compliance supervision competent authority shall grant approval to the above mentioned application.

(C) If no aging or deterioration of the secondary air injection system would result in emissions exceeding OBD threshold value, when the secondary air system is operating normally, OBD system shall also detect malfunction when no air flow is detected.

J.4.5.3 Monitoring conditions

Manufacturer shall define the monitoring conditions in accordance with the stipulations in J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report in-use monitor performance ratio of malfunction monitor items defined in J.4.5.2 in accordance with the stipulations of J.3.3.2.2. For tracking and reporting of in-use monitor performance ratio, all monitor items defined in J.4.5.2 shall be tracked individually but reported as a single set of values as per requirements of J.3.5.2.2.

J.4.5.4 MIL illumination and storage fault code

See general requirements for MIL illumination and fault code storage as per J.3.2.

J.4.6 Fuel system monitoring

J.4.6.1 Requirement

OBD system shall monitor the fuel system to ensure that vehicle emission meets requirements of criteria.

J.4.6.2 Malfunction criteria

J.4.6.2.1 When any of the following issues happen, OBD system shall detect a malfunction of the fuel system:

(A) The fuel supply system is unable to ensure that vehicle emission do not exceed OBD threshold value; or

(B) Based on rear oxygen (or exhaust) sensor, feedback control is unable to ensure that vehicle emission do not exceed OBD threshold value.

J.4.6.2.2 Except the situations specified in following J.4.6.2.3, if the vehicle is equipped with adaptive feedback control system, OBD system shall detect a malfunction when the adaptive feedback control has reached maximum adjustment range allowed by the manufacturer.

J.4.6.2.3 If the vehicle is equipped with feedback control that is based on a rear oxygen sensor (or equivalence sensor), OBD system is not required to detect a malfunction of the fuel system solely when the feedback control system has reached the maximum adjustment range allowed by the manufacturer. However, if malfunction or failure causes emission to exceed the malfunction criteria in J.4.6.2.1 (B), OBD system is required to detect malfunction.

J.4.6.2.4 OBD system shall detect a malfunction whenever the fuel control system fails to enter closed-loop control (if any) within specified time interval.

J.4.6.2.5 For vehicles that use engine shutdown strategy and do not require vehicle driver to restart engine for continuing driving (for example, hybrid electric vehicle featuring STOP-START function stops engine under vehicle idling operating condition), if the fuel control system fails to enter closed-loop control within a specified time interval after engine restart, OBD system shall detect a malfunction.

J.4.6.2.6 If manufacturer demonstrates that all input factors influencing close-loop control of fuel system have corresponding parameter or parts diagnose, and these diagnoses are equivalent to requirements of J.4.6.2.4 and J.4.6.2.5 in term of effectiveness and timeliness, then it is allowed to replace the requirements of J.4.6.2.4 and J.4.6.2.5 by the above mentioned diagnose.

J.4.6.3 Monitoring conditions

J.4.6.3.1 Except the circumstance specified in J.4.6.3.4, malfunction of fuel system shall be monitored continuously, OBD system shall continuously monitor J.4.6.2.1 (A), J.4.6.2.1 (B) and J.4.6.2.2 (refers to fuel supply system, rear oxygen feedback control and self-adaptive feedback control).

J.4.6.3.2 Manufacturers shall define the monitoring conditions for malfunctions required in J.4.6.2.4 in accordance with the requirements of J.3.3.1.

J.4.6.3.3 Manufacturer shall define the malfunction monitoring conditions required in J.4.6.2.5 as per the requirements of J.3.3.1, with the exception of the followings: monitor shall occur when monitoring conditions are met each time during driving cycle, rather than monitoring once per driving cycle as required in section J.3.3.1.2.

J.4.6.3.4 in order to ensure robust detection of malfunctions to avoid false indications and false passes of malfunctions, if it is technically required to disable continuous monitoring

under certain conditions, manufacturers may apply to disable continuous monitoring of fuel system. Provided that data/engineering evaluation submitted by manufacturer demonstrates that a normal system cannot be distinguished clearly from a malfunctioning system and that the time interval of monitor disablement is limited to technical demand, the environmental compliance supervision competent authority shall grant approval.

J.4.6.4 MIL illumination and storage fault code

For malfunction of fuel system, requirements of illumination of MIL and storage of fault code shall be in compliance with the stipulations of following sections J.4.6.4.1-J.4.6.4.6.

J.4.6.4.1 A pending fault code shall be stored immediately if fuel system exceeds the malfunction criteria specified in J.4.6.2.

J.4.6.4.2 If a pending fault code has been stored, when the malfunction is again detected under the following two circumstances, OBD system shall immediately illuminate the MIL and store a confirmed fault code, and confirmed fault code is stored, it is necessary to keep the previous pending fault code:

(a) The driving cycle immediately following the storage of the pending fault code, regardless of the conditions in the driving cycle;

(b) The next driving cycle in which the conditions (J.2.46) are similar to the cycle when the pending fault code was stored.

J.4.6.4.3 The pending fault code can be erased at the end of the next driving cycle if similar conditions where pending fault code is stored do not occur and exceedance of fuel system malfunction criteria do not occur in the operating cycle. The pending fault code may also be erased if similar conditions do not occur again during the 80 consecutive driving cycles after the initial detection of a malfunction.

J.4.6.4.4 Storage of freeze frame conditions

(A) OBD system shall store and erase freeze frame state in conjunction with storing and erasing pending fault code or in conjunction with confirmed fault code.

(B) If freeze frames are currently stored for a malfunction other than misfire (J.4.3) or fuel system malfunction, then when fault code of fuel system is stored, the stored freeze frame state shall be replaced with freeze frame of the fuel system malfunction.

J.4.6.4.5 Store fuel system status to determine similar operating condition

(A) In case of detection of a fuel system malfunction defined in J.4.6.2, OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.

(B) If fuel system uses feedback control that is based on a rear oxygen (or equivalent) sensor, the manufacturer may apply to use an alternative definition of "similar conditions". If the data/engineering evaluation provided by manufacturer demonstrates that: the alternate definition provides effective robust detection of fuel system faults that are related to engine speed, load/warm-up status, the competent authority shall approve the above mentioned application, the environmental compliance supervision competent authority shall grant approval.

J.4.6.4.6 Extinguishment of the MIL

The MIL may be extinguished after 3 sequential driving cycles in which similar operating conditions causing storage of fuel system fault code have occurred but without detection of fuel system malfunction.

J.4.7 Exhaust gas sensor monitoring

J.4.7.1 Requirement

J.4.7.1.1 OBD system shall monitor malfunctions of front oxygen sensors (for fuel control sensors, conventional switching sensors/wide range or universal range sensors) for contents including the output voltage, response rate, and any other parameter which can affect emissions.

J.4.7.1.2 OBD system shall also monitor malfunctions of all rear oxygen sensors (those used for fuel trim control or as monitoring device), monitor its output voltage, activity and response rate.

J.4.7.1.3 For vehicles equipped with heated oxygen sensors, OBD system shall monitor its heater performance.

J.4.7.1.4 For other types of sensor (such as HC sensor and NOx sensor, etc), manufacturer shall submit monitor plan to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that: the submitted monitoring plan is as reliable and effective as the required sensors under J.4.7.

J.4.7.2 Malfunction criteria

J.4.7.2.1 Front oxygen sensor:

(A) OBD system shall detect a malfunction prior to emissions exceeding OBD threshold value caused due to any failure or deterioration of the oxygen sensor voltage, response rate, amplitude, or other characteristic parameters (including characteristic drift or bias corrected by rear oxygen sensors). For response rate, OBD system is only required to monitor systemic fault (such as, fault influencing simultaneously response rate from lean to rich and response rate form rich to lean).

(B) OBD system shall detect malfunctions of the oxygen sensor caused by disconnection of circuit or out-of-range values.

(C) OBD system shall detect a malfunction of the oxygen sensor when an oxygen sensor failure or deterioration causes the fuel system to fail to enter closed-loop operation or the fuel system to disable using oxygen sensor as a feedback input signal (for example, use of default value or open loop operation) within manufacturer specified time interval.

(D) OBD system shall detect a malfunction of oxygen sensor when the sensor's output voltage, amplitude, activity, or other characteristic parameters are no longer sufficient to meet requirements on OBD system monitoring (for example, catalytic convertor monitoring).

J.4.7.2.2 Rear oxygen sensor:

(A) OBD system shall detect a malfunction before a vehicle's emissions exceed the OBD threshold due to any failure or deterioration of the oxygen sensor's output voltage, response rate, amplitude, or other characteristic parameters.

(B) OBD system shall detect malfunctions of the oxygen sensor caused by disconnection of circuit.

(C) Sensor performance diagnostics for other monitors.

(i) OBD system shall detect a malfunction of the oxygen sensor when the sensor's output voltage, amplitude, activity, or other parameters are no longer "sufficient" to meet performance requirements for other monitoring purposes (for example, catalytic convertor monitoring). For this requirement, "sufficient" refers to the capability of the worst performing acceptable sensor to detect the best performing unacceptable other monitored system or component (for example, catalytic convertor).

(ii) For systems in which it is not technically feasible to satisfy the requirements of J.4.7.2.2 (C)(i) completely, OBD system shall at least detect a slow rich-lean response malfunction during a fuel shut-off (for example, deceleration fuel shut-off). The rich-lean response check shall monitor the two parts of following contents: 1. The sensor response time from a rich mixture condition (for example, 0.7V) prior to the start of fuel shut-off to a lean mixture condition (for example, 0.1V) during expected fuel shut-off conditions; 2. The sensor intermediate signal conversion time (for example, conversion time from 0.55V to 0.3V). If the manufacturer can demonstrate that other monitoring strategy has equivalent effectiveness, environmental compliance supervision competent authority shall grant approval.

(D) OBD system shall detect malfunctions of unreasonable output values of the oxygen sensor.

J.4.7.2.3 Sensor heaters

(A) When the current or voltage drop in the heater circuit exceeds the manufacturer's specified requirements on high mileage performance index, OBD system shall detect a malfunction of the heater performance. If environmental compliance supervision competent authority determines that data/engineering evaluation submitted by manufacturer can demonstrate that: adoption of other malfunction criteria has equivalent monitoring effectiveness and timeliness for detection of heater malfunction, other malfunction criteria can be used for monitoring catalytic convertor malfunction.

(B) OBD system shall detect malfunctions of the heater circuit, including open circuit or short circuit malfunctions.

J.4.7.3 Monitoring conditions

J.4.7.3.1 Front oxygen sensor

(A) Manufacturer shall define the monitoring conditions for malfunctions in J.4.7.2.1 (A) and (D) (for example, normal response rate) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.4.7.2.1 (A) and (D) in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.7.2.1 (A) and (D) shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

(B) Except as specified in J.4.7.3.1 (C), continuous monitoring for malfunctions in J.4.7.2.1 (B) and (C) (i.e. circuit continuity, out-of-range, and open-loop malfunctions) shall be performed.
(C) A manufacturer may apply to disable continuous oxygen sensor monitoring when an oxygen sensor malfunction cannot be distinguished from other effects (for example, disable monitoring of less than lower limit value of the voltage of the oxygen sensor during fuel shut-off conditions). The environmental compliance supervision competent authority shall approve the application upon determining that test data/engineering evaluation submitted by manufacturer can demonstrate that: a normal sensor cannot be distinguished from a malfunction sensor and that the disablement interval is necessary for avoiding false detection.
J.4.7.3.2 Rear oxygen sensor
(A) Manufacturer shall define the monitoring conditions for malfunctions in J.4.7.2.2 (A) and (C) (for example, appropriate activity of sensor) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.4.7.2.2 (A) and (C) in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.7.2.2 (A) and (C) shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
(B) Except as specified in J.4.7.3.2 (C) below, continuous monitoring of malfunctions in J.4.7.2.2 (B) and (D) (i.e. circuit continuity, out-of-range, and open-loop malfunctions) shall be performed.
(C) A manufacturer may apply to disable continuous oxygen sensor monitoring when an oxygen sensor malfunction cannot be distinguished from other effects (for example, disable monitoring of less than lower limit value of the voltage of the oxygen sensor during fuel shut-off conditions). The environmental compliance supervision competent authority shall approve the application upon determining that test data/engineering evaluation submitted by manufacturer can demonstrate that: a normal sensor cannot be distinguished from a malfunction sensor and that the disablement interval is necessary for avoiding false detection.
J.4.7.3.3 Sensor heater
Manufacturer shall define the monitoring conditions for malfunction in J.4.7.2.3 (A) (for example, heater performance of sensor) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). For malfunction of J.4.7.2.3 (B) (for example: electric circuit malfunction), it is necessary to perform continuous monitoring.

J.4.7.4 MIL illumination and storage fault code

MIL shall be illuminated and fault code shall be stored as per the requirements specified in J.3.2.

J.4.8 Exhaust gas recirculation (EGR) system monitoring

J.4.8.1 Requirement

For vehicles equipped with EGR system, OBD system shall monitor extremely low flow and extremely high flow malfunctions, etc. The individual components (such as actuators, valves and sensors, etc) in the EGR shall be monitored in accordance with the comprehensive component requirements in J.4.14.

J.4.8.2 Malfunction criteria

J.4.8.2.1 OBD system shall detect a malfunction prior to change of EGR flow over or below the manufacturer's specified flow that would cause a vehicle's emissions to exceed relevant OBD monitor threshold value.
J.4.8.2.2 If no failure or deterioration of the EGR system could result in a vehicle's emissions exceeding OBD threshold value, but when EGR system reaches its control limit value, it is still impossible to increase flow

rate to the target flow rate or for EGR system without feedback control, no EGR flow rate is detected when EGR flow rate is required, OBD system shall also detect a malfunction.

J.4.8.3 Monitoring conditions

J.4.8.3.1 Manufacturer shall define the monitoring conditions for malfunctions specified in J.4.8.2 in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.4.8.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.8.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.4.8.3.2 Manufacturers may request competent authority approval to disable the EGR system monitoring under some special conditions (for example, when low temperature freezing may affect performance of the system). The environmental compliance supervision competent authority shall grant approval if data/engineering evaluation submitted by manufacturer can demonstrate that monitoring under these conditions is not reliable.

J.4.8.4 MIL illumination and storage fault code

MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.4.9 Positive crankcase ventilation (PCV) system monitoring

J.4.9.1 Requirement

For vehicle equipped with PCV system, manufacturer shall monitor PCV system to ensure system integrity. Vehicles without crankcase emission control requirements shall be exempted from monitoring of the PCV system.

J.4.9.2 Malfunction criteria

J.4.9.2.1 For the purposes of J.4.9, "PCV system" includes all types of crankcase ventilation system, including positive pressure ventilation system. "PCV valve" includes all valves or orifices used to control crankcase ventilation flow. For any additional pipeline and hose of PCV system, if they used to equalize crankcase pressure or to provide ventilation between various areas of the engine (for example, crankcase and valve chamber cover, or air intake system of natural suction engine using dry type of oil sump), these pipelines and hoses are considered part of the PCV system "between the crankcase and the PCV valve", malfunction diagnosis shall be in accordance with the provisions of J.4.9.2.2 and J.4.9.2.3.

J.4.9.2.2 Except as specified in J.4.9.2.3, OBD system shall detect a malfunction if a disconnection occurs between crankcase and PCV valve or between the PCV valve and the intake manifold.

J.4.9.2.3 If PCV valve is fastened directly to the crankcase in a manner which makes it significantly more difficult to remove the PCV valve from the crankcase than disconnect the line between the PCV valve and the intake manifold (taking aging effects into consideration), the environmental compliance supervision competent authority shall exempt the manufacturer from detection of disconnection fault between the crankcase and the PCV valve.

J.4.9.2.4 For system that utilizes rigid pipe connection between the PCV valve and the crankcase, manufacturer may request competent authority approval not to monitor connection between the crankcase and the PCV valve. The environmental compliance supervision competent authority shall grant approval on the basis that manufacturer submits data/engineering evaluation demonstrating that the connection between the PCV valve and the crankcase meets the following conditions: (i) it is possible to avoid deterioration or accidental disconnection; (ii) it is significantly more difficult to disconnect the connection between the valve and crankcase than disconnecting the connection between the PCV valve and air intake manifold; and (iii) there will be no disconnection during manufacturer's repair procedures if

the repair work does not involve PCV system, the environmental compliance supervision competent authority y shall approve the application.

J.4.9.2.5 If there is disconnection fault between the PCV valve and the intake manifold, the following circumstances will occur, manufacturers are not required to inspect the circumstances: 1) causes the vehicle to stall immediately during idle operation; 2) disconnection between the PCV valve and the intake manifold is unlikely to occur because PCV system is integral to the air intake system (for example, adoption of mechanical passages rather than tubing or hoses for connection).

J.4.9.3 Monitoring conditions

Manufacturer shall monitor the malfunctions specified in J.4.9.2 in accordance with the stipulations (for example, minimum diagnostic frequency requirements) of J.3.3.1 and J.3.3.2 (for example, minimum IUPR requirements).

J.4.9.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2. The stored fault code need not specifically indicate that a certain malfunction belongs to the PCV system malfunction (for example, a fault code for idle speed control or fuel system monitoring can be used) if the manufacturer can demonstrate that additional monitoring hardware would be sufficient to detect that a malfunction belongs to the PCV system malfunction, and the manufacturer has malfunction diagnostic and repair procedures to check the integrity of the PCV system.

J.4.10 Engine cooling system monitoring

J.4.10.1 Requirement

J.4.10.1.1 OBD system shall monitor whether operation status of thermostat is normal for vehicle installed with thermostat.

J.4.10.1.2 OBD system shall monitor the engine coolant temperature (ECT) sensor for circuit continuity, out-of-range values and data rationality faults.

J.4.10.1.3 For engine that does not use thermostat for controlling coolant temperature (for example, electronic water pump is used), manufacturer shall submit alternative monitor program to environmental compliance supervision competent authority, environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that the alternative monitor program is as reliable and effective as the requirements of J.4.10 on thermostat monitoring, environmental compliance supervision competent authority shall grant approval.

J.4.10.1.4 If vehicle is not based on cooling system and coolant temperature sensor (for example, use oil temperature and cylinder head temperature) for representation of engine temperature for emission control (for example, modification of ignition time and fuel injection time or fuel injection volume). Manufacturer shall submit alternative monitor program to environmental compliance supervision competent authority, if data/engineering evaluation submitted by manufacturer can demonstrate that the alternative program is as reliable and effective as the requirements of J.4.10 on cooling system monitoring, environmental compliance supervision competent authority shall grant approval.

J.4.10.2 Malfunction criteria

J.4.10.2.1 Thermostat

(A) OBD system shall detect a malfunction within a specified time interval or equivalent calculation time (to be approved by environmental compliance supervision competent authority) after starting the engine in case of malfunction of thermostat under one of the following circumstances:

(i) The coolant temperature can not reach the highest temperature required by OBD system to perform other monitors;
(ii) The coolant temperature does not reach a warmed-up temperature, definition of warmed-up temperature is within deviation range of 11ºC from the manufacturer's thermostat regulating temperature. Manufacturer can apply for the use of lower temperature to determine the malfunction. The manufacturer is required to demonstrate that the fuel, spark timing/other coolant temperature-based modifications to the engine control strategies would not cause an emission increase of OBD threshold value, environmental compliance supervision competent authority shall grant approval.
(B) The manufacturer shall provide sufficient data/engineering evaluation to indicate "provisions of the time after engine start" or "equivalent time calculated value" mentioned in J.4.10.2.1 (A).
(C) The manufacturer may apply for the use of alternative malfunction criteria / monitoring conditions (see J.4.10.3). These alternative malfunction criteria and monitoring conditions shall be related to temperature at engine start. The environmental compliance supervision competent authority shall grant approval, if the manufacturer has submitted data to demonstrate that under the condition of the normal work of the thermostat, coolant temperature does not reach the specified temperatures in the malfunction criteria within the prescribed time, that the monitoring system is capable of meeting the specified malfunction criteria at engine start temperatures greater than 10ºC, and that the effectiveness of the monitoring system is equivalent to monitoring systems that fully meet the monitoring requirements at a lower temperature.
(D) Subject to approval of environmental compliance supervision competent authority, manufacturers may be exempted from the monitoring requirements in J.4.10.2.1 (A) and (B) provided that the manufacturer has demonstrated that a malfunctioning thermostat neither causes a measurable increase in emissions during any reasonable driving condition nor causes any disablement of normal operation of other monitors.
J.4.10.2.2 Coolant temperature (ECT) sensor
(A) Circuit continuity. OBD system shall detect a malfunction if open circuit or out-of-range value occurs.
(B) The time to achieve temperature required by closed-loop control
(i) OBD system shall detect a malfunction if the ECT sensor does not achieve the stabilized minimum temperature which is needed for the fuel control system to perform closed-loop operation (temperature required by closed-loop control) within specified time interval (approved by environmental compliance supervision competent authority) after starting the engine.
(ii) The above mentioned time interval shall be related to coolant temperature and intake air temperature upon engine startup and may not exceed the following stipulations except as specified in J.4.10.2.2 (B)(iii):
Where engine start temperature is less than 8ºC below close-loop enable temperature, time interval shall not exceed 2min; where engine temperatures is 8ºC-19ºC below close-loop enable temperature within specified time, time interval shall not exceed 5min.
(iii) The environmental compliance supervision competent authority shall grant approval if the data/engineering evaluation submitted by the manufacturer prove that the vehicle under normal conditions require longer warm-up period.
(iv) If engine control system does not utilize ECT signal to enable closed loop fuel control, subject to permission from the environmental compliance supervision competent authority, vehicle manufacturer is not required to monitor as per the stipulations of J.4.10.2.2 (B).
(C) Malfunction of stuck in range below lower limit of the highest enable temperature
To use all available information to the maximum extent feasible, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature below the lower limit of the highest enable

temperature required by the OBD system, making it impossible for OBD system to enable other diagnostics (e.g., an OBD that requires ECT to be more than 60°C for starting diagnostic, when the ECT sensor inappropriately indicates a temperature less than 60°C, OBD system shall detect a malfunction). For temperature range monitored in J.4.10.2.1 or J.4.10.2.2 (B), manufacturers are exempted from the monitor requirement for the temperature region in J.4.10.2.2 (C).

(D) Malfunction of stuck in range below lower limit of the lowest enable temperature

(i) OBD system shall use available information to the maximum extent, if the ECT sensor inappropriately indicates a temperature above the upper limit of the lowest temperature causing impossibility of OBD system to perform other diagnostics, OBD system shall detect malfunctions (for example, if an OBD system requires temperature to less than 32°C to perform a diagnostic monitor, then OBD system shall detect malfunctions when ECT sensor inappropriately indicates a temperature more than 32°C).

(ii) It is allowed to be exempted from monitor requirement for temperature regions in J.4.10.2.1, J.4.10.2.2 (B) or J.4.10.2.2 (C) if vehicle OBD system detects ECT sensor malfunctions specified in J.4.10.2.2 (D) (ECT sensor or thermostat malfunctions) and the MIL is illuminated as per J.3.2.2.3 (for example, over-temperature protection strategies) for default.

(iii) For vehicles that have a temperature indication (not a warning light) on the instrument panel and where instrument temperature and OBD system utilize one same ECT sensor, manufacturers are exempted from the monitor requirements of J.4.10.2.2 (D) on instrument temperature red zone.

J.4.10.3 Monitoring conditions

J.4.10.3.1 Thermostat

(A) Manufacturers shall define the monitoring conditions for malfunctions specified in J.4.10.2.1 (A) in accordance with the stipulations of J.3.3.1. Except as specified in J.4.10.3.1 (C)-(E), monitoring for malfunctions specified in J.4.10.2.1 (A) shall be conducted once per driving cycle in which the ECT sensor indicates, at engine start, a temperature lower than the temperature specified in the malfunction criteria in J.4.10.2.1 (A).

(B) Manufacturers may disable malfunction monitoring for thermostat at ambient temperatures less than -7°C.

(C) Manufacturers may apply to environmental compliance supervision competent authority to disable or prohibit thermostat monitoring in case of potential false diagnostic (such as vehicle operation at idle for more than 50% of the warm-up time or in case of heating operation of engine block, etc.). Regarding the circumstance where monitoring of the driving cycle is disabled solely due to high ECT temperature during engine start, manufacturer may disable monitoring if ECT temperature at engine start is more than 20°C below malfunction criteria temperature in J.4.10.2.1 (A) in driving cycle (for example: malfunction criteria temperature value is 71°C, and start ECT temperature is more than 51°C, then it is allowed to disable monitoring).

(D) Notwithstanding the stipulations in J.4.10.2.1 (D), manufacturer may apply to start malfunction monitoring where ECT temperature at engine start is less than 20°C below thermostat malfunction temperature in driving cycle (for example, if thermostat malfunction temperature is 75°C, vehicle manufacturer may request for approval to start OBD monitoring where ECT temperature is between 55-75°C during engine start).

(E) For the purpose of this section, monitoring condition that can be encountered during the emission test cycle in J.3.3.1.1 refers to on-road driving as per the emission test cycle rather than driving on a chassis dynamometer.

J.4.10.3.2 ECT sensor

(A) In addition to the following circumstances in J.4.10.3.2 (E), monitoring for malfunctions specified in J.4.10.2.2 (A) (for example, circuit continuity and out-of-range value) shall be conducted continuously.

(B) Manufacturers shall monitor the monitoring conditions for malfunctions specified in J.4.10.2.2 (B) in accordance with definition of J.3.3.1. Additionally, except as specified in J.4.10.3.2 (D), monitoring for malfunctions in J.4.10.2.2 (B) shall be conducted once per driving cycle in which the ECT sensor indicates a temperature lower than the closed loop enabled temperature at engine start (i.e. engine start temperature is greater than the ECT sensor range lower limit and less than the closed loop enabled temperature).

(C) Manufacturers shall monitor the malfunctions specified in J.4.10.2.2 (C) and (D) in accordance with stipulations of IUPR of J.3.3.1 and J.3.3.2.

(D) Manufacturers may disable or delay the time to reach closed loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnostic (for example, vehicle operation at idle for more than 50%-75% of the warm-up time).

(E) A manufacturer may apply to disable continuous ECT sensor monitoring when an ECT sensor malfunction cannot be distinguished from other effects. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

J.4.10.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.4.11 Cold start emission reduction strategy monitoring

J.4.11.1 Requirement

J.4.11.1.1 If a vehicle adopts a specific emission control strategy to reduce cold start emissions, OBD system shall monitor whether the under-control components/parts function properly (for example, increased engine idle speed and retarded spark timing) while engine uses the control strategy to realize relevant operation of the strategy. Secondary air system shall be monitored as per the stipulations of J.4.5.

J.4.11.1.2 If components/parts required to be monitored in the cold start emission reduction strategy specified in J.4.11 are required to be monitored in other sections (for example, idling speed control), manufacturer may use different malfunction diagnostic strategy to distinguish malfunction identified as per J.4.11 from malfunction identified as per other criteria (for example, distinguish malfunctions that are related to cold start emission reduction strategy from malfunctions that are not related to cold start).

J.4.11.2 Malfunction criteria

J.4.11.2.1 OBD system shall detect a malfunction if the following occurs in vehicle:

(A) Any failure or deterioration of the cold start emission reduction control strategy would cause a vehicle's emissions to exceed the OBD threshold value. At this moment, OBD system shall monitor comprehensive effect of all components/parts (for example, measuring air flow and calculating heat value acquired by the exhaust) or the individual components/parts (for example, engine speed is increased, the spark timing).

(B) In case of no failure or deterioration of components or parts related to engine cold start emission reduction strategy could result in a vehicle's emissions exceeding relevant OBD threshold, the component shall be monitored for proper functional response in accordance with the malfunction criteria in J.4.14.2.

For components/parts involving spark timing (for example: retarded spark timing), OBD system may monitor final commanded spark timing in lieu of monitoring of the actual spark timing.

J.4.11.3 Monitoring conditions

Manufacturer shall define the monitoring conditions for malfunctions specified in J.4.11.2 in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR).

J.4.11.4 MIL illumination and storage fault code

MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.4.12 VVT system monitoring

J.4.12.1 Requirement

For the purpose of this section, VVT system generally refers to variable valve timing control system (VVT) and variable valve lift control system (VVL).

If VVT system is used on vehicles, OBD system shall monitor control target errors and slow response malfunctions. Manufacturer shall perform comprehensive malfunction mode and failure analysis for hydraulic system and mechanical system (for example: partial or total blockage of hydraulic passage, broken return spring and failure of position control pin to enter expected position of valve mechanism at a certain VVT position), so as to identify target errors and slow response malfunctions of system. The individual electronic components (such as actuators, valves and sensors, etc.) in the VVT system shall be monitored in accordance with the comprehensive components monitoring requirements in J.4.14.

J.4.12.2 Malfunction criteria

J.4.12.2.1 Target error: OBD system shall monitor VVT system for capability to reach valve timing required by system and capability to control crankshaft angle and valve lift, prior to above failure causing emission to exceed the OBD threshold value, OBD system shall detect a malfunction. If the system operates as per a non-continuous state (for example, two-stage valve driving mechanism), it is not required to detect malfunction before emission exceeds OBD threshold value, but it is required to detect all malfunctions exceeding OBD threshold value.

J.4.12.2.2 Slow response: OBD system shall monitor whether valve timing capability of VVT system meets system requirements within specified time, and shall detect malfunction prior to emissions exceeds OBD threshold value. If the system operates as per a non-continuous state, it is not required to detect malfunction before emission exceeds OBD threshold value, but it is required to detect all malfunctions exceeding OBD threshold value.

J.4.12.2.3 Where no failure or deterioration of the VVT system could result in emissions exceeding OBD threshold value, OBD shall monitor the electronic components of VVT system for response in accordance with the malfunction criteria in J.4.14.2.

J.4.12.3 Monitoring conditions

Manufacturer shall define the monitoring conditions for malfunctions in J.4.12.2 in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.4.12.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.12.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.4.12.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.4.13 Gasoline Particulate Filter (GPF) monitoring

J.4.13.1 Requirement

OBD system shall monitor the particulate filter equipped on vehicles for proper operation. For separated electronic component (for example: pressure sensor for monitoring), it is necessary to monitor as per the requirements of J.4.14 on comprehensive component monitoring.

J.4.13.2 Malfunction criteria

J.4.13.2.1 Filtering performance

(A) OBD system shall detect a malfunction prior to a decrease in the filtering performance of the particulate filter that would cause a PM emissions to exceed the OBD threshold value.

(B) If no failure or deterioration of the particulate filter performance could result in a vehicle's PM emissions exceeding the OBD threshold value, OBD system shall detect a malfunction when the particulate filter carrier is completely destroyed, removed or missing.

J.4.13.2.2 Catalytic type of particulate filter, in addition to the requirements specified in J.4.13.2.1, shall as a part of catalytic convertor system, meet relevant requirements of J.4.1 on monitoring of catalytic convertor (monitoring requirements, failure criteria, monitoring conditions, fault code storage and malfunction indicator light).

J.4.13.3 Monitoring conditions

J.4.13.3.1 Manufacturers shall determine the monitoring conditions for malfunctions defined in J.4.13.2.1 in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR).

J.4.13.4 MIL illumination and storage fault code

MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2 in general requirements.

J.4.14 Comprehensive component monitoring

J.4.14.1 Requirement

J.4.14.1.1 Except as required in J.4.14.1.3, J.4.14.1.4 and J.4.15, OBD system shall monitor electronic power-train component/system (except otherwise specified in J.4.1-J.4.13): The component/system directly or indirectly inputs or receives commands to/from the onboard computer or smart device, and: (1) malfunction can cause emission to exceed the OBD threshold value, or (2) belongs to part of the diagnostic strategy for other monitored system/component. Each input and output of smart device that meet requirements of above mentioned criteria (1) or (2) shall be monitored as per requirements of J.4.14. It is unnecessary to further point out malfunction inside these smart devices. If malfunction or deterioration can be compensated or adjusted by vehicle, manufacturers are required to perform malfunction diagnostics as per the requirements of J.4.14.4.2.

(A) Input components: Input components required to be monitored shall include the vehicle speed sensor, crankshaft angle sensor, knock sensor, throttle position sensor, camshaft position sensor, fuel composition sensor (for flexible fuel), sensors which provide signals to the powertrain control system, module, and electromagnetic valve, etc..

(B) Output components/systems: Output components/systems required to be monitored shall include the idle speed control system, electromagnetic valve or control system of automatic transmission, variable manifold systems, mechanical supercharger or exhaust turbocharger electronic components, fuel heating systems, and catalytic convertor warm-up bypass valve, etc..

J.4.14.1.2 Where control system does not compensate or adjust, the manufacturer shall determine through test or engineering evaluation whether the influence of power-train input or output component malfunction upon emissions reaches the criteria (1) in J.4.14.1.1.

J.4.14.1.3 Manufacturers may request environmental compliance supervision competent authority approval to exempt manufacturer from monitoring of safety only component or system. Vehicle manufacturer shall submit data/engineering evaluation demonstrating that the component or system: (1) meets definition of "safety only component or system"; (2) the component is not used as part of the monitoring strategy for any other system or component.

J.4.14.1.4 For electronic powertrain input/output components that are associated with electronic control transmission and electronic power steering system, or components that are driven by engine and are not related to fueling, air supply system or emissions, manufacturers shall monitor it only if the component or system is used as part of the monitoring strategy for any other component or system.

J.4.14.1.5 Except as specified for hybrid electric vehicles in J.4.14.1.6, when an electronic powertrain input/output component or system is associated with components that only affect emissions by causing additional electrical load to the engine and is not related to the control of fueling, air supply or emissions, and the component or system belongs to

part of the diagnostic strategy for other monitored system or component, manufacturers shall monitor it.

J.4.14.1.6 For hybrid electric vehicles, manufacturer shall monitor hybrid electric vehicle and OVC-HEV vehicle in accordance with the malfunction criteria defined in J.4.14.2.3.

J.4.14.2 Malfunction criteria

J.4.14.2.1 Input components

(A) OBD system shall detect electric circuit malfunctions (malfunction of interruption of communication with onboard computer for digital signal) or malfunction of out of range or rationality malfunction if feasible. To the extent feasible, the rationality diagnostics shall verify whether a sensor output is inappropriately high or inappropriately low (i.e. "two-sided" diagnostics).

(B) With the exception of monitoring of input component of emission neutral diagnostic, rationality malfunction shall be separately detected and store different fault codes than malfunction of circuit or out of range. It is not required to store different fault codes for "two-sided" diagnostics of rationality. Furthermore:

(i) For digital signal input of coding: It is necessary to individually detect interruption of communication from input terminal to on-board computer and store separated fault code, but it is not required to store separate fault codes for different out-of-range malfunction.

(ii) For all other input components, it is necessary to individually monitor malfunction of input component circuit or out of range and store different fault codes for each type of malfunction (such as out-of-range low, out-of-range high, open circuit and etc.). Nevertheless, for malfunction of open circuit that cannot be distinguished from other out-of-range malfunction, manufacturer is not required to distinguish fault codes. Two-sided rationality fault does not require use of different fault code for two sides. For sensor that is integrated on control unit circuit board, manufacturer may combine out-of-range and circuit malfunction and store fault code that points to the sensor.

(C) If the relative position between the crankshaft and the camshaft of vehicle requires precise adjustment, the OBD system shall monitor the crankshaft position sensor and camshaft position sensor to verify the matching between the camshaft and crankshaft in addition to monitoring the sensors for circuit continuity and rationality malfunctions. Relative position between crankshaft and camshaft shall only be monitored in cases where both camshaft and crankshaft are equipped with position sensors.

(i) For vehicles equipped with VVT system phase adjustment and timing belt or timing chain driving system, OBD system shall detect a malfunction if the matching between the camshaft and crankshaft is off on one

or more sprocket cogs (for example, the timing belt or timing chain has slipped by one or more teeth). If a manufacturer demonstrates that a single tooth mismatch cannot cause increase in emissions exceeding OBD threshold value, the manufacturer shall detect malfunction upon the minimum number of teeth mismatch needed to cause emission exceeding OBD threshold value.

(ii) Manufacturer may apply to the competent authority for approval to use a number of teeth mismatch more than one tooth in malfunction criteria. The environmental compliance supervision competent authority shall approve the application if the manufacturer has demonstrated that vehicle hardware modifications are necessary to realize detection of malfunction in case of the one tooth mismatch and that further software modifications are not able to realize the target.

(D) For input components (for example, exhaust temperature sensor used to control catalytic convertor inlet temperature at target window value) that directly or

indirectly apply to emission control system not included in J.4.1-J.4.13, OBD system shall monitor rationality malfunction of above mentioned input components if the above mentioned input components caused malfunction of the following emission control strategy. The malfunctions of emission control strategy include: inappropriate disablement or postpone of emission control strategy activation, causing system to exit from control strategy by mistake, or where control strategy has used up all adjustment limits but still cannot realize the control target. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the rationality malfunction of input component is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.4.14.2.2 Output components or systems

(A) OBD system shall detect a malfunction of an output component/system when proper functional response of the output component/system to computer commands does not occur. If a functional check is not feasible, OBD system shall detect malfunctions of the output components/systems caused by a lack of circuit continuity or circuit fault (for example, short to ground or short to the power supply). For output component's open circuit faults and circuit faults, manufacturers are not required to store different fault codes for each distinct malfunction (such as open circuit and short to ground, etc.). If the signal received by output part is digital signal, it is necessary to detect communication malfunction or communication interruption. It is not required to activate an output component/system if it would not be active when performing functional monitoring as per the stipulations of J.4.14.

(B) The idle speed control system shall be monitored by OBD system for proper functional response to computer commands. If a monitoring strategy is based on deviation from target idle speed, a malfunction shall be detected by the system when either of the following conditions occurs:

(i) A malfunction shall be detected when the idle speed control system cannot achieve stable speed within the target speed (+200/-100)rpm. The environmental compliance supervision competent authority shall approve larger deviation if data/engineering evaluation submitted by manufacturer demonstrate that it can not meet the requirements of the above target speed deviation.

(ii) The idle speed control system cannot enable idle speed to reach the target idle speed and within the smallest allowable deviation range (the smallest allowable deviation range refers to the rotation range required by OBD system to enable other monitor system).

(C) For output components (for example, used for control of fuel rail pressure in control strategy) that directly or indirectly apply to emission control strategy not mentioned in sections J.4.1-J.4.13, OBD system shall detect rationality malfunction of the above mentioned output components if the above mentioned

output components cause the following emission control strategy malfunction. The malfunctions of emission control strategy include: inappropriate disablement or postpone of emission control strategy activation, causing system to exit from control strategy by mistake, or where control strategy has used up all adjustment limits but still cannot realize the control target. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the rationality malfunction of output component is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.4.14.2.3 Hybrid electric vehicle components

(A) Rechargeable Energy Storage System (REESS)

(i) For separated electronic components (for example, battery temperature sensor,
battery voltage sensor, battery cell) used for REESS system input or output, OBD system shall monitor as per the requirements of J.4.14.2.1 and J.4.14.2.2.

(ii) For malfunction required to be monitored in J.4.14.2.3 (A)(i), manufacturer shall at least store independent fault code for malfunction related to hybrid REESS system and clarify the minimum replaceable unit upon repair, and point out malfunction type of malfunction components further at the same time.

(B) Thermal management system for hybrid electric vehicle

(i) REESS thermal management system

a. In accordance with the requirements in J.4.14.2.1 and J.4.14.2.2, separated electronic input and output components of REESS thermal management system (for example, heating or cooling) shall be monitored, excluding electronic components used for hybrid battery thermal management and completely controlled by driver.

(ii) Inverter thermal management system

a. In accordance with the requirements in J.4.14.2.1 and J.4.14.2.2, separated electronic input and output components of inverter thermal management system (for example, heating or cooling) shall be monitored. Electronic components that is only controlled by driver and is used for inverter thermal management shall be exempted from this monitoring requirement.

(C) Regenerative braking: OBD system shall detect a malfunction where a component failure causes disablement of braking energy recovery function or influences braking energy recovery function.

(D) Driving motor:

Manufacturer shall submit monitoring program and apply to type approval competent authority for approval, including the monitoring requirements, malfunction criteria and monitoring condition for driving motor. The environmental compliance supervision competent authority shall grant approval on the basis that the manufacturer can demonstrate that the monitoring program can correctly detect malfunction and can detect malfunction of driving motor that hinders the following circumstances:

(1) Activation and maintenance of emission control strategy;

(2) Vehicle operation can reach or exceed the minimum IUPR specified in J.3.3.2.1;

(3) The motor is used in vehicle operation process (for example, engine cannot be started, motor cannot drive vehicle or provide assistance).

(E) Generator

Manufacturer shall submit monitoring program, including the monitoring requirements, malfunction criteria and monitoring condition for generator. The environmental compliance supervision competent authority shall grant approval on the basis that the manufacturer can demonstrate that the monitoring

program can correctly detect malfunction and can detect malfunction of generator that hinders the following circumstances:
(1) Activation and maintenance of emission control strategy;
(2) Vehicle operation can reach or exceed the minimum IUPR specified in J.3.3.2.1;
(3) Appropriate functional response in accordance with fault criteria in J.4.14.2.
(F) OVC-HEV vehicle REESS charger: for online REESS charger of OVC-HEV vehicle, where failure causes disablement of REESS charging or influence upon charging performance, OBD system shall detect a malfunction (for example, REESS system fails to charge fully or charging speed is restricted). It is not required to detect REESS charging malfunction that is caused due to external charging of vehicle (for example, caused due to vehicle parts malfunction or identical malfunction characteristics due to external charging), or external charging equipment of vehicle (for example, malfunction of charging equipment and insufficient power supply), and cannot be distinguished.
(G) For hybrid components not mentioned in J.4.14.2.3 (A)-(F), manufacturer shall monitor input/output components as per the criteria in J.4.14.2.1 and J.4.14.2.2 in accordance with the requirements of J.4.14.1.1.
(H) Plug-in hybrid electric vehicle can be exempted from the requirements specified in J.4.14.2.3 (A)-(G) on hybrid electric vehicle component monitoring, if manufacturer can demonstrate:
(i) The component is not used as part of the diagnostic strategy for any monitored system or component, and
(ii) As alternative for malfunction criteria of J.4.14.1.2, except as specified in J.4.14.2.3 (H)(ii) and (iv), no malfunction of component and system can cause:
a. Engine of fully charged vehicle is started in WLTP test process (while during normal operation, engine of fully charged vehicle is not started in test).
b. After three or more tests, average increase of accumulative net electric power consumed by malfunctioning vehicle for completion of WLTP test with engine off is 15% higher than malfunction-free vehicle. All tests shall adopt completely charged battery, and accumulative electric power consumption shall be measured at input terminal of electric power driving system. If it is impossible to measure, environmental compliance supervision competent authority may approve adoption of alternative method to measure accumulative consumption of electric power outputted to electric power driving system.
(iii) For thermal management system of hybrid, as alternative for the test cycle mentioned in J.4.14.2.3 (H)(ii), manufacturer shall submit to environmental compliance supervision competent authority the program for using other test cycle or vehicle operation condition to determine malfunction causing start of engine of fully charged vehicle (while engine is not started during normal operation of fully charged vehicle), or causing 15% decrease of full-electric range of vehicle. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer demonstrate that all conditions for activation of thermal management system (for example, high atmosphere ambient temperature, REESS charging and high load driving) have been considered, and alternative test cycle and operation condition represent the actual use conditions that are most likely influenced by malfunctioning components/systems.
(iv) If functions of hybrid component or system are not required to occur in test cycle mentioned in J.4.14.2.3 (H)(ii) above (for example, global positioning system components used to control operation of plug-in hybrid electric vehicle based on battery charging status), manufacturer shall apply to competent authority to use alternative driving cycle and vehicle operation condition for evaluation of vehicle engine start and accumulative net electric power consumption increase. The environmental compliance

supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer demonstrate that alternative driving cycle and vehicle operation condition represent the actual driving conditions that are
most likely influenced by malfunctioning components/systems, environmental compliance supervision competent authority shall grant approval. If any degree of failure and deterioration of component or system will cause start of engine when engine shall not be started, or in three or more tests, average increase of accumulative net electric power consumed by malfunctioning vehicle is 15% higher than malfunction-free vehicle, the component or system must meet the monitoring requirements specified in J.4.14.
(I) Non-plug-in hybrid electric vehicle can be exempted from the requirements specified in J.4.14.2.3 (A)-(G) on hybrid electric vehicle component monitoring, if manufacturer can demonstrate:
(i) The component is not used as part of the diagnostic strategy for any monitored system or component, and
(ii) The influence of parts malfunction upon emission will not reach the criteria in J.4.14.1.2.

J.4.14.3 Monitoring conditions

J.4.14.3.1 Input components
(A) Except as specified in J.4.14.3.1(C), monitoring for malfunctions of out-of-range and electric circuit of input components shall be conducted continuously.
(B) Rationality monitoring (if applicable):
Manufacturers shall determine the monitoring conditions for malfunctions in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.
(C) If out of range malfunction or circuit continuity malfunction of input component cannot be distinguished from other factors, subject to environmental compliance supervision competent authority approval, manufacturer may disable continuous monitoring of malfunction. Manufacturer shall provide test data/engineering evaluation to demonstrate that a properly functioning input component cannot be distinguished from a malfunctioning input component and that the above mentioned disablement time interval is limited to avoiding of false detection.
J.4.14.3.2 Output components/systems
(A) Except as specified in J.4.14.3.2 (D), monitoring for circuit continuity and circuit faults shall be conducted continuously.
(B) Except as specified in J.4.14.3.2 (C), manufacturers shall define the monitoring conditions for functional check as per requirements in J.3.3.1 and J.3.3.2 (minimum IUPR).
(C) For the idle speed control system, manufacturers shall define the monitoring conditions for functional check in accordance with requirements of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.
(D) Subject to environmental compliance supervision competent authority approval, manufacturer may disable continuous monitoring of malfunction when circuit continuity and electric circuit malfunction of output component/system cannot be distinguished from other factors. The environmental compliance supervision competent authority shall grant approval on the basis that manufacturer shall provide data/engineering evaluation to demonstrate that a properly functioning output component/system cannot

be distinguished from a malfunctioning output component/system and that the above mentioned disablement time interval is limited to avoiding of false detection.

J.4.14.3.3 Hybrid electric vehicle components

Manufacturers shall define the monitoring conditions for malfunctions listed in J.4.14.2.3 (A)(ii)-(iii), J.4.14.2.3 (B)(i)(b), J.4.14.2.3 (B)(ii)(b) and J.4.14.2.3 (C)-(F) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.

J.4.14.4 MIL illumination and storage fault code

J.4.14.4.1 Except as specified in J.4.14.4.2, MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2. See additional requirements on storage of input component fault code as per J.4.14.2.1 (B); J.4.14.2.2 (A) gives the additional conditions for storage of output component fault code, and J.4.14.2.3 (A)(iv) gives the additional requirements for storage of hybrid component fault code.

J.4.14.4.2 With the exception of requirements on MIL illumination and fault code storage, for components or systems that are only monitored through emission neutral diagnostic, it is not required to illuminate MIL and store fault code. Manufacturer shall demonstrate that emission neutral diagnostic will activate emission neutral default action, and emission neutral default action is sufficiently in compliance with definition regarding "emission neutral default action" in J.2.

J.4.15 Monitoring for other emission control or emission sources

J.4.15.1 Requirement

Other emission control or emission source systems refer to: (1) emission control or emission source systems are not addressed in J.4.1-J.4.14 (such as hydrocarbon traps, homogeneous compression-ignition control, NOx storage devices and fuel-fired heaters in vehicle, etc.); (2) addressed in J.4.1 but not corrected or compensated for by the adaptive fuel control (for example, swirl control valves), prior to sales of mass production vehicle, manufacturer shall submit a monitoring plan related to requirements for monitoring, malfunction criteria and monitoring conditions, the environmental compliance supervision competent authority shall determine whether to grant approval in accordance with the effectiveness of monitoring strategy, the used malfunction criteria, monitoring conditions required by diagnose and whether the stipulations of J.4.15.3 and J.4.15.4 are met.

J.4.15.2 Emission sources specified in J.4.15 refer to components or devices that emit pollutants specified in vehicle evaporative or exhaust emission criterias (such as NMHC, CO, NOx, PM and etc.) and include non-electronic components and non-powertrain components (such as fuel-fired passenger compartment heaters, onboard fuel reforming unit and etc.).

J.4.15.3 Except as required in this segment below, if vehicle alters intake air flow or cylinder charge characteristics by control valve, regulating valve, or other ways (for example, swirl control valve), so as to control emission, provided that manufacturer meets the requirements of J.4.15.1, OBD system shall monitor proper functional response of the shaft to which all control valves / regulating valves in one same intake passage are physically attached in place of monitoring proper operation of the intake air flow, cylinder charge, or each control valve / regulating valve. For nonmetal shafts or segmented shafts, it is necessary to verify that all parts of shafts have proper functional response (for example, by verifying proper operation of the furthest segment of the shaft). For adoption of multiple shafts for control of valve for multiple passages, manufacturer is not required to add another set of measurement hardware (such as sensor and switch, etc) for each air intake passage.

J.4.15.4 For emission control strategy not included in J.4.1-J.4.13 (for example, control strategy of fuel pressure adjustment), OBD system shall detect those malfunctions that hinder monitoring components from operating as per the designed mode. These malfunctions include: inappropriate disablement or postpone of emission control strategy activation, causing system to exit from control strategy by mistake, or where control strategy has
used up all adjustment limits but still cannot realize the control target. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.4.16 Exceptions to monitoring

J.4.16.1 Manufacturers may request environmental compliance supervision competent authority approval to disable an OBD system monitor at ambient temperatures below -7°C (lower limit of ambient temperature may be determined as per intake air temperature or engine coolant temperature) or at elevations above 2,440m. If data/engineering evaluation provided by manufacturer demonstrate that monitoring under the conditions would be unreliable, environmental compliance supervision competent authority shall grant approval. A manufacturer may further request that an OBD system be disabled at other ambient temperatures, if data/engineering evaluation provided by manufacturer demonstrate that misdiagnosis would occur under the condition because of characteristics of the component itself (for example, component freezing), environmental compliance supervision competent authority shall grant approval.

J.4.16.2 Manufacturers may apply to disable monitoring system that can be affected by extremely low fuel level or running out of fuel (for example, misfire detection) when the fuel level is less than 15% of the nominal capacity of the fuel tank. If data/engineering evaluation provided by manufacturer demonstrate that monitoring under the condition of relevant fuel level would be unreliable, environmental compliance supervision competent authority shall grant approval.

J.4.16.3 Manufacturer may disable monitoring systems that can be affected by vehicle battery or system voltage.

J.4.16.3.1 For monitoring systems that may be affected by low battery or extremely low system voltages of vehicle, manufacturer may disable monitoring systems when the battery or system voltage is less than 11.0V. Manufacturers may apply to disable system monitoring under situation more than 11.0V. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that monitoring at relevant voltage conditions would be unreliable and that: 1) operation time of a vehicle below the disablement voltage will not be extended due to disablement of monitoring; or 2) OBD system monitors the battery voltage or system voltage and will detect voltage malfunction when voltage drops to the voltage to disable other monitors.

J.4.16.3.2 For monitoring systems that may be affected by extremely high battery voltage or extremely high system voltage, manufacturer may apply to disable monitoring systems when the battery or system voltage exceeds a manufacturer-defined value. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that monitoring above the given value of battery or system voltage would be unreliable and 1) the electrical charging system/alternator warning light is illuminated (or voltage is in the "red zone"); or 2)

OBD system will detect a voltage malfunction at the battery voltage or system voltage that can disable other monitors.

J.4.16.4 A manufacturer may apply to disable the monitoring items affected by PTO activation in vehicles installed with PTO units, provided disablement occurs only while the PTO unit is active, and the OBD ready state is cleared by the onboard computer (for example, all monitors set to indicate "not complete") while the PTO unit is activated. If the disablement occurs, upon end of interruption, readiness status shall resume the status prior to PTO activation.

J.4.16.5 A manufacturer may apply to competent authority to disable relevant monitoring system working for vehicles equipped with tire pressure monitoring systems if it causes a vehicle to automatically enter a default operating mode (for example, reduced maximum speed) when a tire pressure problem is detected. If data/engineering evaluation submitted by manufacturer can demonstrate that the operation mode can affect

monitoring system performance, that the tire pressure monitoring system will likely result in action by the consumer to solve tyre pressure malfunction, and that the disablement of the monitoring will not hinder effective testing in inspection and maintenance (I/M), environmental compliance supervision competent authority shall grant approval.

J.4.16.6 Whenever J.4 of this Standard requires monitoring "to the extent feasible", manufacturer shall submit relevant monitoring program. The environmental compliance supervision competent authority shall grant approval on the basis of the following consideration: the best available monitoring technology that is known or shall have been known to the manufacturer; given the situations of the manufacturer's existing hardware, the degree to which requirements are met in full; the necessity to avoid significant false indication or omission; and the efforts made by the manufacturer to try other monitoring strategy to meet the requirements in full. The effort to try other monitoring strategy shall include evaluation of improvement to the existing monitoring program, the monitored components themselves, and monitors that use the monitored components (e.g.: improve monitoring function to lessen the requirements on sensitivity or characteristics of monitored components).

J.4.16.7 Manufacturers may request the competent authority to disable relevant monitoring if a monitoring item specified in J.4 is not be reliable due to use of alternate fuels for alternative fuel vehicles. The environmental compliance supervision competent authority shall grant approval on the basis that the manufacturer has demonstrated that the use of the alternate fuel could not avoid false illumination of the MIL even when using the best available monitoring technologies.

J.5 Requirements for diesel vehicles/motor vehicles installed with compression-ignition engine

J.5.1 Non-methane hydrocarbon (NMHC) catalytic convertor monitoring

J.5.1.1 Requirement

OBD system shall monitor the NMHC catalytic convertor for proper catalytic conversion capability.

J.5.1.2 Malfunction criteria

J.5.1.2.1 In order to meet the requirements of J.5.1.1, for NMHC catalytic convertor in a series configuration, it is allowed to monitor either individual catalytic convertor or the entire catalytic convertor combination.

J.5.1.2.2 Conversion efficiency

(A) OBD system shall detect a malfunction when the conversion capability of catalytic convertor decreases to the point that emissions exceed the OBD threshold value.

(B) With the exception of the conditions mentioned in J.5.1.2.2 (C), if no failure or deterioration of the catalytic convertor could result in the emissions exceeding the OBD threshold value, OBD system shall detect a malfunction when the catalytic convertor cannot convert NMHC or NOx.
(C) The environmental compliance supervision competent authority shall approve the application for exemption upon determining that the manufacturer has demonstrated, through data/engineering evaluation, that the average NMHC catalytic convertor conversion efficiency is less than 30% under emission cycle (for example, the cumulative NMHC emissions measured at the outlet of the catalytic convertor are more than 70% of the cumulative NMHC emissions measured at the inlet of the catalytic convertor).
J.5.1.2.3 Catalytic convertor's aging and monitoring
(A) In order to determine the malfunction criteria in J.5.1.2.2 for individually monitored catalytic convertors, the manufacturer shall use a catalytic convertor deteriorated to
the malfunction criteria established by the manufacturer to represent catalytic convertor deterioration under normal and malfunctioning engine operating conditions. If the catalytic convertor system contains catalytic convertor arranged in parallel (for example, bilateral exhaust systems respectively have their own catalytic convertor), parallel arrangement of the catalytic convertor's deterioration shall be equal.
(B) In order to determine the catalytic convertor malfunction criteria in J.5.1.2.2 for combined monitoring of catalytic convertors, the manufacturer shall submit a catalytic convertor system aging and monitoring plan to the environmental compliance supervision competent authority. The plan shall include: overall description, emission control target, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of J.5.1.2.2 including the deterioration/aging process of catalytic convertors. If the catalytic convertor system contains catalytic convertor arranged in parallel (for example, bilateral exhaust systems respectively have their own catalytic convertor), parallel arrangement of the catalytic convertor's deterioration shall be equal. The environmental compliance supervision competent authority shall determine whether to grant approval to the plan on the basis of the following principles: the representativeness of the aging to catalytic convertor system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of J.5.1.2.2, the ability of the monitor component to pinpoint the most likely area of malfunction and confirm the components are repaired/replaced correctly, and the ability of the component monitor to correctly verify that each catalytic convertor component is functioning.

J.5.1.3 Monitoring conditions

J.5.1.3.1 Manufacturers shall define the monitoring conditions for malfunctions in J.5.1.2 in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.1.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.1.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.5.1.4 MIL illumination and storage fault code

J.5.1.4.1 Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.
J.5.1.4.2 The monitoring method for the adoptive catalytic converter (system) shall be capable of detecting the following circumstances: catalytic converter has not been replaced with effective catalytic converter but fault code has been cleared (except OBD system self-clearing).

J.5.2 Nitrogen oxide (NOx) catalytic convertor monitoring

J.5.2.1 Requirement

OBD system shall monitor the NOx catalytic convertor for normal catalytic conversion capability. For vehicles equipped with selective catalytic reduction (SCR) systems or other catalytic convertor systems that utilize other reactant injection (for example, NOx load catalytic convertor utilizing diesel injection as reactant), OBD system shall monitor the performance of SCR or other reactant injection system. The electronic components (such as actuators, valves, sensors, heaters and pumps, etc.) in the SCR or other reactant injection system shall be monitored in accordance with the comprehensive component requirements in J.5.14.

J.5.2.2 Malfunction criteria

J.5.2.2.1 In order to meet the requirements of J.5.2, for NOx catalytic convertor in a series configuration, it is allowed to monitor either individual catalytic convertor or the entire catalytic convertor combination.

J.5.2.2.2 Conversion efficiency

(A) OBD system shall detect a malfunction before the catalytic convertor conversion capability decreases to exceed the OBD threshold value.

(B) Except the situations specified in J.5.2.2.2 (C), if no failure or deterioration of the catalytic convertor could result in the NMHC or NOx emissions exceeding the OBD threshold value, OBD system shall detect a malfunction when the catalytic convertor cannot convert NMHC or NOx.

(C) The environmental compliance supervision competent authority shall approve the application of exemption if the manufacturer has demonstrated, through data/engineering evaluation, that the average NOx conversion efficiency is less than 30% under emission cycle (for example, the cumulative NOx emissions measured at the outlet of the catalytic convertor are more than 70% of the cumulative NOx emissions measured at the inlet of the catalytic convertor).

J.5.2.2.3 Selective catalytic reduction (SCR) or other other reactant injection system performance:

(A) Reactant injection system performance

(i) OBD system shall detect a malfunction prior to any failure or deterioration of the system, these failures or deteriorations make it impossible to accurately inject reactant (for example, urea injection system, separate system of fuel injection, post injection of fuel, air assisted injection/mixing) that would cause a emission to exceed the OBD threshold value.

(ii) If no failure or deterioration of the reactant injection system could result in NOx or NMHC emissions exceeding the OBD threshold value, OBD system shall detect a malfunction when the reactant injection system has reached its control limits such that it is no longer able to reach the quantity of target injection.

(B) Except as described in J.5.2.2.3 (G), for the catalytic convertor system that uses a reactant other than engine fuel or uses a separate container for the reactant, OBD system shall detect a malfunction when reactant in catalytic convertor system is insufficient (for example, the reactant is used up).

(C) Except as described in J.5.2.2.3 (H), for the catalytic convertor system that uses a separate container for the reactant, OBD system shall detect a malfunction when an improper reactant is used in the container (for example, substances other than the reactant is added into container).

(D) Feedback control: Except as described in J.5.2.2.3 (E), if the reactant injection system features feedback or feedforward control, OBD system shall detect a malfunction under the following circumstances:

(i) A failure or deterioration causes open loop or default mode operation of system; or:

(ii) The control system has used the adjustment scope allowed by the manufacturer or reached its maximum allowable adjustment scope but cannot reach the target control value.

(E) A manufacturer may apply to environmental compliance supervision competent authority for approval to temporarily disable monitoring for the malfunction criteria specified in J.5.2.2.3 (D)(ii) when a manufacturer cannot effectively distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the application if data/engineering evaluation submitted by manufacturer demonstrate that: when control system has used the adjustment scope allowed by the manufacturer, the vehicle control system can still work according to the design, all modifications have reached the specified range.

(F) OBD system shall monitor the parameters or components that are used as inputs

for reactant injection feedback control system, if the monitors can detect all malfunctions specified in J.5.2.2.3 (D)(i), in lieu of detecting the malfunction in J.5.2.2.3 (D)(i) with a monitor.

(G) If it is possible to demonstrate that the adopted degrading strategy can ensure that vehicle cannot maintain operation when reactant is used up and all inputs of degrading strategy are monitored (for example, reactant level sensor), manufacturer can apply to be exempted from the monitoring requirements in J.5.2.2.3 (B) (i.e. monitoring requirements on insufficient reactant), environmental compliance supervision competent authority shall grant approval.

(G) If it is possible to demonstrate that the adopted degrading strategy can ensure that vehicle cannot maintain operation when improper reactant is used and all inputs of degrading strategy are monitored (for example, reactant mass sensor), manufacturer can apply to be exempted from the monitoring requirements in J.5.2.2.3 (C) (i.e. monitoring requirements on reactant mass), environmental compliance supervision competent authority shall grant approval.

J.5.2.2.4 Catalytic convertor system aging and monitoring

(A) In order to determine the malfunction criteria in J.5.2.2.2 for individually monitored catalytic convertors, the manufacturer shall use a catalytic convertor deteriorated to the malfunction criteria established by the manufacturer to represent catalytic convertor deterioration under normal and malfunctioning engine operating conditions. If the catalytic convertor system contains catalytic convertor arranged in parallel (for example, bilateral exhaust systems respectively have their own catalytic convertor), parallel arrangement of the catalytic convertor's deterioration shall be equal.

(B) In order to determine the catalytic convertor malfunction criteria in J.5.2.2.2 for combined monitoring of catalytic convertors, the manufacturer shall submit a catalytic convertor system aging and monitoring plan to the environmental compliance supervision competent authority. The plan shall include: overall description, emission control target, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of J.5.2.2.2 including the deterioration/aging process of catalytic convertors. If the catalytic convertor system contains catalytic convertor arranged in parallel (for example, bilateral exhaust systems respectively have their own catalytic convertor), parallel arrangement of the catalytic convertor's deterioration shall be equal. The environmental compliance supervision competent authority shall determine whether to grant approval to the plan on the basis of the following principles: the representativeness of the aging to catalytic convertor system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of J.5.2.2.2, the ability of the monitor component to pinpoint the most likely area of malfunction and confirm the components are repaired/replaced correctly, and the ability of the component monitor to correctly verify that each catalytic convertor component is functioning.

J.5.2.3 Monitoring conditions

J.5.2.3.1 Manufacturers shall define the monitoring conditions for malfunctions defined in J.5.2.2.2, J.5.2.2.3 (A) and J.5.2.2.3 (C) (for example, conversion efficiency, reaction agent injection performance and improper reactant) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.2.2.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.2.2.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.5.2.3.2 Except as specified in J.5.2.3.3, OBD system shall monitor continuously for malfunctions specified in J.5.2.2.3 (B) and J.5.2.2.3 (D) (for example, insufficient reactant and feedback control).

J.5.2.3.3 Manufacturers may apply to environmental compliance supervision competent authority to temporarily disable continuous monitoring under certain conditions. The environmental compliance supervision competent authority shall grant approval if data/engineering evaluation submitted by manufacturer demonstrate that a normal system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that necessary for avoiding false detection.

J.5.2.4 MIL illumination and storage fault code

J.5.2.4.1 Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.2.4.2 If OBD system is capable of identify that an empty urea tank is causing a fault:

(A) The manufacturer may apply to environmental compliance supervision competent authority to delay illumination of the MIL if the vehicle is equipped with an alternative indicator for notifying the vehicle driver of the malfunction. The environmental compliance supervision competent authority shall grant approval if it can be determined that the alternative indicator is of sufficient illumination and location to be readily visible under all lighting conditions and provides assurance that a vehicle driver can notice the malfunction and that corrective action will be undertaken.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be immediately extinguished and the corresponding fault codes erased once OBD system has verified that the reductant has been properly refilled and the MIL has not been illuminated for any other type of malfunction.

(C) The environmental compliance supervision competent authority may approve other diagnostic strategies if the diagnostic strategy provides equivalent assurance that a vehicle driver will be timely notified and that corrective action will be undertaken.

J.5.2.4.3 The monitoring method for the adoptive catalytic converter (system) shall be capable of detecting the following circumstances: catalytic converter has not been replaced with effective catalytic converter but fault code has been cleared (except OBD system self-clearing).

J.5.3 Misfire monitoring

J.5.3.1 Requirement

J.5.3.1.1 OBD system shall monitor the engine misfire. OBD system shall be capable of detecting misfire occurring in one or more cylinders. To the extent possible without adding hardware, OBD system shall also identify the specific misfiring cylinder.

J.5.3.1.2 If more than one cylinder is misfiring, a separate fault code shall be stored indicating that "multiple cylinders are misfiring". When identifying multiple cylinder misfire, OBD system is not required to identify each of the misfiring cylinders through separate fault codes.

J.5.3.2 Malfunction criteria

J.5.3.2.1 OBD system shall detect a misfire malfunction when one or more cylinders are continuously misfiring.

J.5.3.2.2 For light-duty diesel vehicles:
(A) For multiple cylinders misfire situations that result in a misfire rate more than or equal to 5%, OBD system shall be required to detect misfire malfunctions.
(B) Manufacturers shall determine the percentage of misfire as per 1,000 revolution of monitoring cycle;
(C) A manufacturer may request environmental compliance supervision competent authority's approval to adopt other rotation speed cycle for determination of percentage of misfire, if manufacturer can demonstrate that the alternative strategy can detect misfire malfunction equivalently, timely and effectively, environmental
compliance supervision competent authority shall grant approval.
J.5.3.2.3 A malfunction shall be detected by OBD if the percentage of misfire exceeds the percentage of misfire established in J.5.3.2.2 regardless of the pattern of misfire events (such as random, constant speed and continuous, etc).
J.5.3.2.4 If percentage of misfire caused due to multi-cylinders engine misfire is more than or equal to 50%, OBD system shall only be required to detect misfire malfunctions that are caused by a single component failure.
J.5.3.2.5 Manufacturer may apply to adopt higher percentage of misfire. If data/engineering evaluation submitted by manufacturer can demonstrate that higher percentage of misfire will not cause emission to exceed the OBD threshold value, environmental compliance supervision competent authority shall grant approval.

J.5.3.3 Monitoring conditions

J.5.3.3.1 Except the situations mentioned in J.5.3.3.2, OBD system shall monitor misfire defined in J.5.3.2.1 under engine idle conditions at least once per driving cycle in which the monitoring conditions for misfire are met. A manufacturer shall submit alternative monitoring conditions to the environmental compliance supervision competent authority. Under the following circumstances, competent authority shall approve manufacturer-defined alternative monitoring conditions (that are based on manufacturer-submitted data/engineering evaluation): (i) it is technically necessary to ensure robust detection of malfunctions (avoid missing and losing detection of malfunctions); (ii) Monitoring cycle is not more than 1,000 revolution; and (iii) in order to determine the fault, don't require any continuous working condition of idle for exceed 15s (for example, idle speed condition monitoring will be finished within 15s); or satisfy alternative engine operating conditions specified in J.3.3.1.
J.5.3.3.2 Manufacturers may apply to environmental compliance supervision competent authority to use alternative monitoring conditions (for example, off-idle condition) for replacement of the monitoring conditions defined in J.5.3.3.1. The environmental compliance supervision competent authority of shall approve alternative monitoring conditions (that are based on manufacturer-submitted data/other engineering evaluation) if the alternative monitoring conditions can ensure equivalent robust detection of malfunctions and equivalent timeliness in detection.
J.5.3.3.3 For misfire in J.5.3.2.2, OBD system shall detect the following misfires:
(A) Positive torque range of engine speed not more than 75% of maximum speed and torque less than 75% of maximum torque, but excluding the range constituted by engine positive torque line (i.e. torque of engine at neutral gear) and the two operating points as follows: the point where engine speed is 50% of maximum speed and torque is on positive torque line; and the point where engine speed is 75% of maximum speed and torque is at a point which is higher than positive torque line by 5% of peak torque.

(B) If OBD system cannot detect all misfire patterns under all required engine speed and load conditions as required in J.5.3.3.3 (A), the manufacturer might apply to the environmental compliance supervision competent authority for approval to accept its system. In evaluating the manufacturer's application, the environmental compliance supervision competent authority of certification shall consider the following factors: the magnitude of the region in which misfire detection is limited; the probability of detection of misfire events in the the region; the frequency with which the above mentioned region are expected to be encountered in-use; the type of misfire patterns for which misfire detection is difficult, and demonstration that the misfire monitoring technology used in the test can detect the misfire under the condition of the required monitoring (for example, compliance can be achieved on other engines). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and symmetrical cylinder (cylinders firing at the same crankshaft angle) continuous misfire.

(C) A manufacturer may apply to environmental compliance supervision competent authority to disable misfire monitoring or adopt alternative malfunction criteria when misfire cannot be distinguished from other factors. The environmental compliance supervision competent authority shall grant approval if it is determined that: time interval of misfire monitoring disablement is necessary for avoiding false detection.

The circumstances for disablement of monitoring include but are not limited to the followings:

(i) Rough road;

(ii) Fuel shut-off;

(iii) Gear changes for manual transmission vehicles;

(iv) Traction force control or other vehicle stability control activation, such as antilock braking or other engine torque modifications to enhance vehicle stability;

(v) When offline active test is performed on vehicle maintenance or assembling line;

(vi) Active diagnosis for vehicle that can significantly affect engine stability;

(vii) Regular regeneration for vehicle that can significantly affect engine stability.

J.5.3.4 MIL illumination and storage fault code

J.5.3.4.1 Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.3.4.2 Furthermore,

(A) In case of monitoring of the percentage of misfire specified in J.5.3.2.2, MIL illumination and fault code storage shall be in compliance with the following criteria:

(i) A pending fault code shall be stored before the 4 times monitoring of exceedance of the percentage of misfire specified in J.5.3.2.2 during a single driving cycle.

(ii) After a pending fault code is stored, regardless of the conditions encountered, OBD system shall illuminate the MIL and store a confirmed fault code if the percentage of misfire specified in J.5.3.2.2 is again exceeded 4 times: (a) following the storage of the pending fault code, the percentage of misfire exceeding that specified in J.4.3.2.1 is detected in the next driving cycle regardless of the operating condition; or (b) in the next driving cycle containing conditions similar to those in which the pending fault code was stored, the above mentioned percentage of misfire has been detected. Furthermore, in accordance with the provisions of J.6.4.4.5, shall continue to retain the pending fault code.

(iii) The pending fault code may be erased at the end of the driving cycle in which similar conditions to that occurred when the pending fault code was stored, but without an exceedance of the specified percentage

of misfire. The pending code may also be erased if similar conditions do not occur again during the next 80 driving cycles following initial detection of the malfunction.

(B) Storage of freeze frame conditions

(i) OBD system shall store and erase freeze frame conditions in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(ii) If the no freeze frame of J.5.4 is stored for misfire or fuel system malfunction, in case of occurrence of misfire malfunction freeze frame that is in compliance with definition in J.5.3.4.2, it shall replace the stored freeze frame with freeze

frame related to misfire malfunction. As an alternative, if the freeze frame of J.5.4 is stored for fuel system malfunction, in case of occurrence of misfire malfunction freeze frame that is in compliance with definition in J.5.3.4.2, it is allowed to replace the stored freeze frame with freeze frame related to misfire malfunction.

(C) In order to determine similar condition for misfire malfunction, in case of detection of misfire defined in J.5.3.4.2, OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(D) Extinguishment of MIL. The MIL may be extinguished after 3 sequential conditions in which similar misfire conditions have occurred without an exceedance of the specified percentage of misfire.

J.5.4 Monitoring of fuel system

J.5.4.1 Requirement

OBD system shall monitor whether the fuel injection system is working properly. The individual electronic components (for example, actuators, valves, sensors and pumps) that are used in the fuel system and not emphasized in this section shall be monitored in accordance with the stipulations in J.5.14 on comprehensive component monitoring.

J.5.4.2 Malfunction criteria

J.5.4.2.1 Fuel pressure control system

(A) OBD system shall detect a malfunction prior to emissions exceeding OBD threshold value due to fuel pressure control system malfunction.

(B) If no failure or deterioration of the fuel pressure control system could result in a emissions exceeding the OBD threshold value, OBD system shall detect a malfunction if the system has reached its work limits but the required fuel system pressure cannot be reached.

J.5.4.2.2 Feedback control

(A) Except as described in J.5.4.2.4 (B), if the fuel injection system of vehicle is equipped with feedback or feedforward control (for example, feedback control of fuel pressure), OBD system shall detect a malfunction in the following conditions:

(i) A failure or deterioration causes open loop or default mode operation of system; or

(ii) The control system has used the adjustment scope allowed by the manufacturer or reached its maximum allowable adjustment scope but cannot reach the target control value.

(B) A manufacturer may apply to competent authority for approval to temporarily disable monitoring for the malfunction criteria specified in J.5.4.2.4 (A)(ii) when a manufacturer cannot effectively distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the application if data/engineering evaluation submitted by manufacturer demonstrate that: when control system has used the adjustment scope allowed by the manufacturer, the vehicle control system can still work according to the design.

(C) OBD system shall monitor the parameters or components that are used as inputs for fuel injection feedback control system, if the monitors can detect all malfunctions specified in J.5.4.2.2 (A)(i), in lieu of detecting the malfunction in J.5.4.2.2 (A)(i) with a monitor.

J.5.4.3 Monitoring conditions

J.5.4.3.1 Except as described in J.5.4.3.2 and J.5.4.3.3, OBD system shall monitor continuously malfunctions defined in J.5.4.2.1 and J.5.4.2.2 (refers to fuel pressure control and feedback control).

J.5.4.3.2 For fuel systems that establish injection pressure within the injector or increase pressure within fuel injector, manufacturers may apply to environmental compliance supervision competent authority to define the monitoring conditions for malfunctions specified in J.5.4.2.1 in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR). The environmental compliance supervision competent authority shall approve the monitoring conditions if data/analysis submitted by manufacturer indicate all failures (for example, failure mode failure analysis) on fuel pressure control across the entire range of operating conditions for reliable monitoring.

J.5.4.3.3 A manufacturer may apply to environmental compliance supervision competent authority to temporarily disable continuous monitoring when it is not possible to distinguish between normal system and fault system, if documents provided by manufacturer can prove that: interval of temporary disablement is necessary to avoid wrong diagnostics, environmental compliance supervision competent authority shall grant approval.

J.5.4.4 MIL illumination and storage fault code

J.5.4.4.1 Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.4.4.2 For malfunctions defined in J.5.4.2.1 (fuel pressure control):

(A) A pending fault code shall be stored immediately if the fuel system exceeds the malfunction criteria determined in J.5.4.2.1.

(B) Except the following circumstances, if a pending fault code is stored by OBD system, OBD system shall illuminate the MIL and store a confirmed fault code when a malfunction is again detected during either of the following circumstances: (a) following the storage of the pending fault code, the fault has been detected in the next driving cycle regardless of the operating condition; or (b) in the next driving cycle containing conditions similar to those in which the pending fault code was stored, the fault has been detected. Furthermore, in accordance with the provisions of J.6.4.4.5, shall continue to retain the pending fault code.

(C) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to those in which the pending fault code occurs have occurred and fuel system malfunction criteria has not been exceeded. The pending code may also be erased if similar conditions do not occur again during the 80 consecutive driving cycles after the initial detection of fuel system malfunction.

(D) Storage of freeze frame conditions

(i) OBD system shall store and erase freeze frame conditions in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(ii) If freeze frame conditions are stored for a malfunction other than misfire (J.5.3) or fuel system malfunction mode is stored and a fuel system failure freeze frame is stored as specified in J.5.3.4.2, the stored freeze frame shall be replaced with freeze frame related to the fuel system malfunction.

(E) Storage of fuel system conditions under similar conditions

(i) In case of detection of a fuel system malfunction in J.5.4.4.2, OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.
(ii) The manufacturer may apply to environmental compliance supervision competent authority to use an alternate definition of similar conditions. The environmental compliance supervision competent authority shall approve the above mentioned application if data or analysis provided by manufacturer
demonstrates that: the alternate definition provides effective detection of fuel system faults, and the faults are intensively related to engine speed, load/warm-up status.
(F) Extinguishing the MIL. The MIL may be extinguished after 3 sequential driving cycles without similar malfunction of the fuel system.

J.5.5 Exhaust gas sensor monitoring

J.5.5.1 Requirement

J.5.5.1.1 OBD system shall monitor all exhaust gas sensors (for example, oxygen sensor, NOx sensor and PM sensor) that can affect emissions and are used for emission system feedback (for example, EGR, SCR and NOx adsorber), monitoring content includes output signal, activity, response rate, and other parameters that may affect the emission.
J.5.5.1.2 For vehicles equipped with heated exhaust gas sensors, OBD system shall monitor its performance of heater.

J.5.5.2 Malfunction criteria

J.5.5.2.1 Air-fuel ratio sensors
(A) For sensors located upstream of the exhaust after-treatment system
(i) Sensor performance faults: OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic that would cause a vehicle's emissions to exceed the OBD threshold values.
(ii) Circuit faults: OBD system shall detect malfunctions caused by a lack of circuit continuity or out-of-range values.
(iii) Feedback faults: OBD system shall detect a malfunction when a sensor failure or deterioration causes an emission control system (for example, EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feedforward input (for example, causes default operation or open-loop operation).
(iv) Monitoring capability: OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristics are no longer effectively meet the monitoring requirements (for example, for catalytic convertor, EGR, SCR, or NOx adsorber monitoring).
(B) For sensors located downstream of the exhaust after-treatment system
(i) Sensor performance faults: OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic that would cause a vehicle's emissions to exceed the OBD threshold values.
(ii) Circuit faults: OBD system shall detect malfunctions caused by a lack of circuit continuity or out-of-range values.
(iii) Feedback faults: OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (for example, EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feedforward input (for example, causes default operation or open-loop operation).

(iv) Monitoring capability: OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristics are no longer effectively meet the monitoring requirements (for example, for catalytic convertor, EGR, SCR, or NOx adsorber monitoring).

J.5.5.2.2 NOx and PM sensors

(A) Sensor performance faults: OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic that would cause a vehicle's emissions to exceed the OBD threshold values.

(B) Circuit faults: OBD system shall detect malfunctions caused by a lack of circuit continuity or out-of-range values.

(C) Feedback faults: OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (for example, EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feedforward input (for example, causes default operation or open-loop operation).

(D) Monitoring capability: OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristics are no longer effectively meet the monitoring requirements (for example, for catalytic convertor, EGR, SCR, or NOx adsorber monitoring).

J.5.5.2.3 Other exhaust gas sensors

For other exhaust gas sensors, the manufacturer shall submit a monitoring plan to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall approve the above mentioned application if data and engineering evaluation submitted by manufacturer can demonstrate that: the submitted monitoring plan is as reliable and effective as the monitoring plan required for air-fuel ratio sensors, NOx sensors, and PM sensors of J.5.5.2.1 and J.5.5.2.2.

J.5.5.2.4 Sensor heaters

(A) When the current or voltage drop in the heater circuit exceeds the manufacturer's specified requirements on high mileage performance index, OBD system shall detect a malfunction of the heater performance. If data/engineering evaluation submitted by manufacturer can demonstrate that: adoption of other malfunction criteria has equivalent monitoring effectiveness and timeliness for detection of heater malfunction, environmental compliance supervision competent authority shall grant approval.

(B) OBD system shall detect malfunctions of the heater circuit, including open circuit or short circuit malfunctions.

J.5.5.3 Monitoring conditions

J.5.5.3.1 Exhaust gas sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions specified in J.5.5.2.1 (A)(i), J.5.5.2.1 (B)(i), J.5.5.2.2 (A) and J.5.5.2.2 (D) (for example, sensor performance faults) in accordance with contents in J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.5.2.1 (A)(i), J.5.5.2.1 (B)(i), J.5.5.2.2 (A) and J.5.5.2.2 (D) in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.5.2.1 (A)(i), J.5.5.2.1 (B)(i) and J.5.5.2.2 (A) shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

(B) Manufacturers shall define the monitoring conditions for malfunctions specified in J.5.5.2.1 (A)(iv) and J.5.5.2.1 (B)(iv) (for example, monitoring capability) in accordance with contents in J.3.3.1 and J.3.3.2 (minimum IUPR).

(C) Except as specified in J.5.5.3.1 (D), monitoring for malfunctions defined in J.5.5.2.1 (A)(ii), J.5.5.2.1 (A)(iii), J.5.5.2.1 (B)(ii), J.5.5.2.1 (B)(iii), J.5.5.2.2 (B) and J.5.5.2.2 (C) (for example, circuit continuity, out-of-range, and open-loop malfunctions) shall be conducted continuously.

(D) A manufacturer may apply to environmental compliance supervision competent authority to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (for example, disable monitoring of less than lower limit value of the voltage of the oxygen sensor during fuel shut-off conditions). The environmental compliance supervision competent authority shall approve the application upon determining that test data/engineering evaluation submitted by manufacturer can demonstrate that: a normal sensor cannot be distinguished from a malfunction sensor and that the disablement interval is necessary for avoiding false detection.

J.5.5.3.2 Sensor heaters

(A) Manufacturers shall define monitoring conditions for malfunctions specified in J.5.5.2.4 (A) (for example, sensor heater performance) in accordance with the requirements in J.3.3.1 and J.3.3.2 (minimum IUPR).

(B) Monitoring for malfunctions defined in J.5.5.2.4 (B) (for example, circuit malfunctions) shall be conducted continuously.

J.5.5.4 MIL illumination and storage fault code

Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.6 Exhaust gas recirculation (EGR) system monitoring

J.5.6.1 Requirement

J.5.6.1.1 For vehicles equipped with EGR system, OBD system shall monitor following malfunctions: flow is too low, flow is too high and the response is too slow, and slow response. For vehicles equipped with EGR coolers (for example, heat exchangers), OBD system shall monitor the cooler system for insufficient cooling malfunctions. The individual components (for example, actuators, valves and sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component requirements in J.5.14.

J.5.6.1.2 For vehicles with other charge control strategies that may affect EGR flow (for example, systems that modify EGR flow to achieve a desired fresh air flow rate instead of a desired EGR flow rate), the manufacturer shall submit a monitoring plan to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall approve the above application if it can be determined that data and engineering evaluation submitted by manufacturer can demonstrate that: the monitoring plan is as reliable and effective as the monitoring plan required for EGR systems in J.5.6.

J.5.6.2 Malfunction criteria

J.5.6.2.1 Flow is too low

(A) OBD system shall detect a malfunction prior to a decrease of EGR flow from the manufacturer's specified EGR flow that would cause a vehicle's emission to exceed the OBD threshold value.

(B) If no failure or deterioration of the EGR system could result in a vehicle's emissions exceeding OBD threshold value, but when EGR system reaches its control limit value, it is still impossible to increase flow rate to the target flow rate or for EGR system without feedback control, no EGR flow rate is detected when EGR flow rate is required, OBD system shall also detect a malfunction.

J.5.6.2.2 Flow is too high

(A) OBD system shall detect a malfunction prior to an increase of EGR flow from the manufacturer's specified EGR flow that would cause a vehicle's emission to exceed the OBD threshold value.

(B) If no failure or deterioration of the EGR system could result in a vehicle's emissions exceeding OBD threshold value, but when EGR system reaches its control limit value, it is still impossible to decrease flow rate to the target flow rate or for EGR system without feedback control, EGR flow rate is detected when EGR flow rate is not required, OBD system shall also detect a malfunction.

J.5.6.2.3 Malfunction of slow response of EGR valve

(A) OBD system shall detect a malfunction at or prior to problem in the EGR valve response that would cause emission to exceed the OBD threshold value.

J.5.6.2.4 Feedback control

(A) Except as described in J.5.6.2.4 (B), if the vehicle is equipped with feedback or feedforward control of the EGR system (for example, feedback control of flow and valve position, feedback control of pressure difference before and after intake throttle valve or exhaust backpressure valve), OBD system shall detect a malfunction under the following circumstances:

(i) A failure or deterioration causes open loop or default mode operation of system, or

(ii) The control system has used the adjustment scope allowed by the manufacturer or reached its maximum allowable adjustment scope but cannot reach the target control value.

(B) A manufacturer may apply to competent authority for approval to temporarily disable monitoring for the malfunction criteria specified in J.5.6.2.4 (A)(ii) when a manufacturer cannot effectively distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the application if data/engineering evaluation submitted by manufacturer demonstrate that: when control system has used the adjustment scope allowed by the manufacturer, the vehicle control system can still work according to the design, all modifications have reached the specified range.

(C) OBD system shall monitor the parameters or components that are used as inputs for EGR system feedback control, if the monitors can detect all malfunctions specified in J.5.6.2.4 (A)(i), in lieu of detecting the malfunction in J.5.6.2.2 (A)(i) with a monitor.

J.5.6.2.5 EGR cooler performance:

(A) OBD system shall detect a malfunction prior to a reduction from the manufacturer's specified cooling performance of EGR cooling system performance that would cause a vehicle's emission to exceed the OBD threshold value.

(B) For vehicles in which no failure or deterioration of the EGR cooler system could result in a vehicle's emissions exceeding the OBD threshold value, OBD system shall also detect a malfunction when the the EGR cooling system is almost no cooling capacity.

(C) For EGR cooler systems that consist of multiple coolers (for example, a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit an EGR cooler system aging and monitoring plan to the environmental compliance supervision competent authority. The plan shall include the location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria determined in J.5.6.2.5 (A) including the deterioration process. The environmental compliance supervision competent authority shall examine and grant approval to the plan based on the representativeness of the aging to real world EGR cooler system component deterioration under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria adopted in J.5.6.2.5 (A).

J.5.6.3 Monitoring conditions

J.5.6.3.1 For malfunctions defined in J.5.6.2.1 and J.5.6.2.2 (refers to EGR flow is too low or too high), manufacturers shall:
(A) Manufacturer shall define monitoring conditions in accordance with requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
(B) Except as described in J.5.6.3.5, continuous monitoring shall be carried out.
J.5.6.3.2 Define the monitoring conditions for malfunctions specified in J.5.6.2.3 (refers to slow response) in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR), with the exception that monitoring shall be conducted every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in J.3.3.1.2. And track and report IUPR of monitors in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.4.8.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
J.5.6.3.3 OBD system shall monitor continuously for malfunctions defined in J.5.6.2.4 (refers to EGR feedback control).
J.5.6.3.4 Manufacturers shall define the monitoring conditions for malfunctions specified in J.5.6.2.5 (refers to cooler performance) in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
J.5.6.3.5 Manufacturers may apply to environmental compliance supervision competent authority to disable continuous monitoring under specific conditions (for example, disable EGR low flow monitoring when EGR flow is zero or very little; disable EGR high and low flow monitoring when freezing may affect performance of the system). The environmental compliance supervision competent authority shall grant approval upon determining that test data/engineering evaluation submitted by manufacturer demonstrate that the monitoring is unreliable under these conditions.

J.5.6.4 MIL illumination and storage fault code

Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.7 Boost pressure control system monitoring

J.5.7.1 Requirement

J.5.7.1.1 For vehicles installed with boost pressure control system, OBD system shall monitor: under-pressure and over-pressure malfunctions and slow response malfunctions. For vehicles equipped with inter-cooler, OBD system shall monitor the malfunction of insufficient cooling effect of cooling system. Each component (for example, actuators, valves and sensors) that is installed in the boost pressure control system shall be monitored in accordance with the comprehensive component requirements in J.5.14.
J.5.7.1.2 For vehicles with other boost pressure control strategies that affect boost pressure (refers to systems that modify boost pressure to achieve the air-fuel ratio instead of a boost pressure), the manufacturer shall submit a monitoring plan to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall approve the above mentioned application if data and engineering evaluation submitted by manufacturer can demonstrate that: the monitoring plan is as reliable and effective as the monitoring plan required for boost pressure control systems in J.5.7.

J.5.7.2 Malfunction criteria

J.5.7.2.1 Under-pressure

(A) OBD system shall detect a malfunction prior to a decrease from the manufacturer's specified boost pressure that would cause a vehicle's emission to exceed the OBD threshold value.

(B) For vehicles in which no failure or deterioration of the boost pressure control system that causes a decrease of pressure could result in a vehicle's emissions exceeding the OBD threshold value, OBD system shall detect a malfunction under the following conditions: when the boost pressure control system has reached its control limits but cannot increase to the required pressure or, for non-feedback controlled boost systems, the boost system cannot detect the expected boost pressure value.

J.5.7.2.2 Over-pressure

(A) OBD system shall detect a malfunction prior to an increase from the manufacturer's specified boost pressure that would cause a vehicle's emission to exceed the OBD threshold value.

(B) For vehicles in which no failure or deterioration of the boost pressure control system that causes a increase of pressure could result in a vehicle's emissions exceeding the OBD threshold value, OBD system shall detect a malfunction under the following conditions: when the boost pressure control system has reached its control limits but cannot decrease to the required pressure or, for non-feedback controlled boost systems, the boost system can detect the unexpected boost pressure value.

J.5.7.2.3 Slow response

(A) For vehicles equipped with variable geometry turbochargers (VGT), OBD system shall detect a malfunction prior to any failure or deterioration in the VGT system to achieve the expected turbocharger geometry within a manufacturer-specified time interval when would cause a emission to exceed the OBD threshold value. For vehicles in which no failure or deterioration of the VGT system response could result in a vehicle's emissions exceeding the OBD threshold value, OBD system shall detect a malfunction of the VGT system when VGT system detects no deformation response to a change in turbocharger geometry.

J.5.7.2.4 Supercharging air under-cooling

(A) OBD system shall detect a malfunction prior to that malfunction of supercharging intercooler causes a decrease from the manufacturer's specified cooling rate that would cause a vehicle's emission to exceed the OBD threshold value.

(B) For vehicles in which no failure or deterioration of the supercharging intercooler system that causes a decrease in cooling performance could result in emission exceeding the the OBD threshold value, OBD system shall also detect a malfunction when supercharge inter-cooling system is almost no cooling capacity.

(C) For supercharging intercooler systems that consist of more than one cooler (for example, a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit a supercharging intercooler system deterioration and monitoring plan to the environmental compliance supervision competent authority. The plan shall include the location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria of J.5.7.2.4 (A). The environmental compliance supervision competent authority shall determine whether to grant approval to the plan based on the representativeness of supercharging intercooler system under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria of J.5.7.2.4 (A).

J.5.7.2.5 Feedback control

(A) Except as described in J.5.7.2.5 (B), if the vehicle is equipped with feedback or feedforward control of the boost pressure system (for example, control of VGT position, turbine speed and manifold pressure), OBD system shall detect the malfunction in the following conditions:
(i) A failure or deterioration causes open loop or default mode operation of system; or
(ii) The control system has used the adjustment scope allowed by the manufacturer or reached its maximum allowable adjustment scope but cannot reach the target control value.
(B) A manufacturer may apply to environmental compliance supervision competent authority for approval to temporarily disable monitoring for the malfunction criteria specified in J.5.7.2.5 (A)(ii) when a manufacturer cannot effectively distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the application if data/engineering evaluation submitted by manufacturer demonstrate that: when control system has used the adjustment scope allowed by the manufacturer, the vehicle control system can still work according to the design, all modifications have reached the specified range.
(C) OBD system shall monitor the parameters or components that are used as inputs for feedback control, if the monitors can detect all malfunctions specified in J.5.7.2.5 (A)(i), in lieu of detecting the malfunction in J.5.7.2.5 (A)(i) with a monitor.

J.5.7.3 Monitoring conditions

J.5.7.3.1 Except as described in J.5.7.3.4, OBD system shall monitor continuously for malfunctions specified in J.5.7.2.1, J.5.7.2.2 and J.5.7.2.5 (refers to over-boost, under-boost and feedback control malfunctions).
J.5.7.3.2 Manufacturers shall define the monitoring conditions for malfunctions in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.7.2.3 (refers to slow response) in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.7.2.3 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
J.5.7.3.3 Manufacturers shall define the monitoring conditions for malfunctions in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.7.2.4 (refers to intercooler performance) in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.7.2.4 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.
J.5.7.3.4 Manufacturers may apply to environmental compliance supervision competent authority to disable continuous monitoring under specific conditions (for example, disable monitoring of under-boost when target boost pressure is very low). The environmental compliance supervision competent authority shall grant approval upon determining that data/engineering evaluation submitted by manufacturer demonstrate that the monitoring is unreliable under these conditions.

J.5.7.4 MIL illumination and storage fault code

Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.8 NOx adsorber monitoring

J.5.8.1 Requirement

OBD system shall monitor whether the NOx adsorber on vehicles operates normally. For
vehicles equipped with active injection (for example, exhaust pipe fuel/air injection) to achieve load of the NOx adsorber, OBD system shall monitor the performance of active injection system. The electronic

components (such as injectors, valves and sensors, etc.) that are used in the active injection system shall be monitored in accordance with the comprehensive component monitoring requirements in J.5.14.

J.5.8.2 Malfunction criteria

J.5.8.2.1 NOx adsorber capability

(A) OBD system shall detect a malfunction when the NOx adsorber capability decreases to the point that would cause a vehicle's emissions to exceed the OBD threshold value.

(B) If no failure or deterioration of the NOx adsorber system could result in emissions exceeding the OBD threshold value, OBD system shall also detect a malfunction when catalytic convertor is almost no NOx load capability.

J.5.8.2.2 For vehicles that utilize active injection (for example, in-cylinder post fuel injection and air-assisted fuel injection in exhaust system) to achieve load of the NOx adsorber, OBD system shall detect a malfunction when any failure or deterioration of the injection ability controlled by the injection system causes impossibility to achieve load of the NOx adsorber.

J.5.8.2.3 Feedback control

(A) Except as described in J.5.8.2.3 (B), if the vehicle is equipped with feedback or feedforward control of the NOx adsorber or active injection system (for example, feedback control of injection quantity and injection time), OBD system shall detect a malfunction under the following circumstances:

(i) A failure or deterioration causes open loop or default mode operation of system; or

(ii) The control system has used the adjustment scope allowed by the manufacturer or reached its maximum allowable adjustment scope but cannot reach the target control value.

(B) A manufacturer may apply to competent authority for approval to temporarily disable monitoring for the malfunction criteria specified in J.5.8.2.3 (A)(ii) when a manufacturer cannot effectively distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the application if data/engineering evaluation submitted by manufacturer demonstrate that: when control system has used the adjustment scope allowed by the manufacturer, the vehicle control system can still work according to the design.

(C) OBD system shall monitor the parameters or components that are used as inputs for feedback control, if the monitors can detect all malfunctions specified in J.5.8.2.3 (A)(i), in lieu of detecting the malfunction in J.5.8.2.3 (A)(i) with a monitor.

J.5.8.2.4 For NOx adsorber systems that consist of more than one NOx adsorber (for example, two or more adsorbers in series), the manufacturer shall submit a NOx adsorber system aging and monitoring plan to the environmental compliance supervision competent authority. The plan shall include the location of each component, the monitoring strategy for each component and/or combination of components, and the aging method for determining the malfunction criteria of J.5.7.2.4 (A). The environmental compliance supervision competent authority shall determine whether to grant approval to the plan on the basis of the following principles: the representativeness of supercharging intercooler system under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of J.5.8.2.1 (A).

J.5.8.3 Monitoring conditions

J.5.8.3.1 Manufacturers shall define the monitoring conditions for malfunctions in J.5.8.2.1 (refers to adsorber performance) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.2.2.2 in accordance with the stipulations of J.3.3.2.2.

During track and report of IUPR, all monitors defined in J.5.8.2.1 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.5.8.3.2 Except as specified in J.5.8.3.3, OBD system shall monitor continuously for malfunctions mentioned in J.5.8.2.2 and J.5.8.2.3 (such as injection function and feedback control, etc.).

J.5.8.3.3 Manufacturers may apply to environmental compliance supervision competent authority to temporarily disable continuous monitoring under certain conditions. The environmental compliance supervision competent authority shall grant approval if data/engineering evaluation submitted by manufacturer demonstrate that a normal system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that necessary for avoiding false detection.

J.5.8.4 MIL illumination and storage fault code

Basic requirements for MIL illumination and storage fault code shall be in compliance with the stipulations in J.3.2.

J.5.9 Particulate matter (PM) filter monitoring

J.5.9.1 Requirement

OBD system shall monitor the particulate filter installed on vehicles for proper performance. For vehicles equipped with active regeneration systems that utilize an active injection (for example, exhaust fuel injection, exhaust fuel/air burner), OBD system shall monitor the active/intrusive injection system for proper performance. The individual electronic components (such as injectors, valves and sensors, etc.) in the active injection system shall be monitored in accordance with the comprehensive component requirements in J.5.14.

J.5.9.2 Malfunction criteria

J.5.9.2.1 Performance of filter

(A) OBD system shall detect a malfunction prior to a decrease in performance of the particulate filter that would cause a vehicle's PM emissions to exceed the OBD threshold value.

(B) Even if no failure or deterioration of the particulate filter performance could result in a vehicle's PM emissions exceeding the OBD threshold value, OBD system shall also detect a malfunction when particulate filter cannot filter particulate (refers to the particulate filter carrier is completely destroyed, removed, or missing, or if the particulate filter is completely replaced with a muffler or straight pipe).

J.5.9.2.2 Regeneration frequency

(A) OBD system shall detect relevant malfunction when particulate filter regeneration frequency is higher than the manufacturer's specified regeneration frequency such that it would cause a vehicle's emissions to exceed the OBD threshold value.

(B) If no deterioration or failure of component performance will cause vehicle emission exceeding OBD threshold value due to increase of regeneration frequency of particulate filter (for example, emission under regenerating condition is still within OBD threshold value), then it is not required to monitor regeneration frequency.

J.5.9.2.3 Incomplete regeneration:

(A) OBD system shall detect an incomplete regeneration malfunction when the particulate filter does not properly regenerate under manufacturer-defined regeneration conditions such that it would cause a vehicle's emissions to exceed the OBD threshold value.

(B) If no deterioration or failure of component performance will cause vehicle emission exceeding OBD threshold value due to incomplete regeneration of particulate filter (for example, emission under

regenerating condition is still within OBD threshold value), then it is not required to monitor incomplete regeneration.

J.5.9.2.4 Missing carrier: OBD system shall detect a malfunction if the particulate filter carrier is completely destroyed, removed or missing, or if the particulate filter assembly is replaced with a muffler or straight pipe.

J.5.9.2.5 Active injection: for particulate filter that utilizes active injection (for example, in-cylinder post fuel injection, exhaust assisted fuel injection) to achieve regeneration of the particulate filter, OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to regulate injection causes the particulate filter system to be unable to achieve regeneration.

J.5.9.2.6 Feedback control

(A) Except as specified in J.5.9.2.6 (B), for the vehicle which is equipped with feedback or feedforward control of the particulate filter regeneration system (for example, control of oxidation catalytic convertor inlet temperature, control of particulate filter inlet and outlet temperature, and control of in-cylinder or exhaust passage fuel injection), OBD system shall detect the following malfunction:

(i) A failure or deterioration causes the system to enter open loop control or default control mode;

(ii) Control system has used up all of the adjustment range allowed by the manufacturer or reached its maximum adjustment capability but cannot reach the target value.

(B) A manufacturer may request environmental compliance supervision competent authority approval to temporarily disable monitoring for the malfunction specified in J.5.9.2.6 (A)(ii) when a manufacturer cannot accurately distinguish between a malfunctioning system and a normal system. The environmental compliance supervision competent authority shall approve the above request if data and/or analysis submitted by manufacturer demonstrate that the vehicle emission control system has operated as per design after that the adjustment range allowed by manufacturer has been used up.

(C) In lieu of monitoring the malfunction specified in J.5.9.2.6 (A)(i), OBD system may monitor the individual parameters or components at input of particulate filter regeneration feedback control, provided that malfunction monitoring of these monitors meet the criteria specified in J.5.9.2.6 (A)(i).

J.5.9.3 Monitoring conditions

J.5.9.3.1 Manufacturers shall determine the monitoring conditions for malfunctions defined in J.5.9.2.1 in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). Furthermore, manufacturers shall also track and report IUPR of the monitoring for malfunctions defined in J.5.9.2.1 as per J.3.3.2.2. For tracking and reporting as required in J.3.5.2.2, all malfunction monitors defined in J.5.9.2.1 shall be tracked individually but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.5.9.3.2 Manufacturers shall define the monitoring conditions for malfunctions in J.5.9.2.2-J.5.9.2.5 in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR), with the exception that monitoring shall be conducted every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in J.3.3.1.2.

J.5.9.3.3 Except as specified in J.5.9.3.3, OBD system shall monitor continuously malfunctions defined in J.5.9.2.7 (refers to particulate filter feedback control).

J.5.9.3.4 Manufacturers may request environmental compliance environmental compliance supervision competent authority approval to temporarily disable continuous monitoring

under conditions technically necessary to ensure robust detection of malfunctions and to avoid false indications of malfunctions, provided that test data and/or document submitted by manufacturer

demonstrate that a normal system cannot be distinguished correctly from a malfunctioning system and that the disablement of monitoring is limited only to technical demand.

J.5.9.4 MIL illumination and storage fault code

The requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.5.10 Crankcase ventilation (CV) system monitoring

J.5.10.1 Requirement

To ensure system integrity, manufacturers shall monitor the CV system if vehicle is equipped with the CV system, for vehicles unequipped with the CV system, it is unnecessary to monitor the CV system.

J.5.10.2 Malfunction criteria

J.5.10.2.1 For the purposes of J.5.10, "CV system" refers to all types of crankcase ventilation system, regardless of whether the system utilizes positive pressure. "CV valve" refers to all valves or orifices used to control crankcase ventilation flow. Furthermore, for all types of pipeline and hose externally connected with CV system, if they are used to equalize crankcase pressure or to provide a ventilation between various areas of the engine (for example, between crankcase and valve chamber cover, or air intake system of natural suction engine using dry type of oil sump), then these pipelines and hoses are considered part of the CV system "between the crankcase and the CV valve", and malfunction monitoring shall be in compliance with the requirements in J.5.10.2.2.

J.5.10.2.2 Except as specified below, OBD system shall detect a malfunction of the CV system whenever a disconnection occurs between the crankcase and the CV valve, or between the CV valve and the intake manifold.

(A) If disconnection in the system results in a rapid loss of oil or other prominent malfunctions of CV system such that the vehicle driver is certain to respond and have the vehicle repaired, the environmental compliance supervision competent authority shall exempt the manufacturer from monitoring of the malfunction.

(B) If the CV valve is designed as being fastened directly to the crankcase and it is necessary to disconnect CV valve from intake manifold firstly before removing the PCV valve from the crankcase (taking aging effects into consideration), the environmental compliance supervision competent authority shall exempt the manufacturer from monitoring of disconnection between the crankcase and the CV valve.

(C) Subject to environmental compliance supervision competent authority approval, designs that utilize tubing connection between the CV valve and the crankcase shall also be exempted from the monitoring of "disconnection" between the crankcase and the PCV valve. The manufacturer shall provide request and submit data/engineering evaluation document in support of the request.

The environmental protection competent authority shall grant approval upon determining that the connections between the crankcase and the PCV valve belong to the following circumstances:

(i) The connection can prevent aging/deterioration or accidental disconnection of the connection;

(ii) It is more difficult to disconnect the CV valve from the crankcase than disconnecting the CV valve from the intake manifold;

(iii) For manufacturer's maintenance and service for non-CV system, it is not related to the CV system.

(D) Manufacturers are not required to detect "disconnections" that are unlikely to occur if a CV system design is integral to the induction system (for example, internal machined passages rather than tubing or hoses).

J.5.10.3 Monitoring conditions

Manufacturer shall define the monitoring conditions for malfunctions in J.5.10.2 in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPRn).

J.5.10.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

The stored fault code need not specifically aim at the CV system (for example, a fault code for EGR and intake air mass flow rationality monitoring can be stored) if the manufacturer demonstrates that additional monitoring hardware would be necessary for this identification and the manufacturer's malfunction diagnostic and repair procedures include direction requirements to check the integrity of the CV system.

J.5.11 Monitoring of engine cooling system

J.5.11.1 Requirement

J.5.11.1.1 OBD system shall monitor whether operation status of thermostat is normal for vehicle installed with thermostat.

J.5.11.1.2 OBD system shall monitor the engine coolant temperature (ECT), monitoring contents include: circuit continuity, out-of-range values and rationality faults.

J.5.11.1.3 For engine that does not use thermostat for controlling coolant temperature (for example, electronic water pump is used), manufacturer shall submit alternative monitor program to environmental compliance supervision competent authority, if data and engineering evaluation submitted by manufacturer can demonstrate that the alternative monitor program is as reliable and effective as the requirements of J.5.11 on thermostat monitoring, environmental compliance supervision competent authority shall grant approval.

J.5.11.1.4 If vehicle is not based on cooling system and coolant temperature sensor (for example, use oil temperature and cylinder head temperature) for representation of engine temperature for emission control (for example, modification of ignition time and fuel injection time or fuel injection volume). Manufacturer shall submit alternative monitor program to environmental compliance supervision competent authority, if data/engineering evaluation submitted by manufacturer can demonstrate that the alternative program is as reliable and effective as the requirements of J.5.11 on cooling system monitoring, environmental compliance supervision competent authority shall grant approval.

J.5.11.2 Malfunction criteria

J.5.11.2.1 Thermostat

(A) OBD system shall detect a malfunction within a specified time interval or equivalent calculation time (to be approved by environmental compliance supervision competent authority) after starting the engine in case of malfunction of thermostat under one of the following circumstances:

(i) The coolant temperature can not reach the highest temperature required by OBD system to perform other monitors;

(ii) The coolant temperature does not reach a warmed-up temperature, definition of warmed-up temperature is within deviation range of 11°C from the manufacturer's thermostat regulating temperature. Manufacturer can apply for the use of lower temperature to determine the malfunction. The manufacturer is required to demonstrate that the fuel, spark timing, and/or other coolant
temperature-based modifications to the engine control strategies would not cause an emission increase of OBD threshold value, environmental compliance supervision competent authority shall grant approval.

(B) The manufacturer shall provide sufficient data/engineering evaluation to indicate "provisions of the time after engine start" or "equivalent time calculated value" mentioned in J.5.11.2.1 (A).

(C) For monitoring of malfunctions in J.5.11.2.1 (A), the manufacturer may apply for the use of alternative malfunction criteria and/or monitoring conditions (see J.5.11.3). These alternative malfunction criteria and/or monitoring conditions shall be related to temperature at engine start. The environmental compliance supervision competent authority shall grant approval, if the manufacturer has submitted data to demonstrate that under the condition of the normal work of the thermostat, coolant temperature does not reach the specified temperatures in the malfunction criteria within the prescribed time, that the monitoring system is capable of meeting the specified malfunction criteria at engine start temperatures greater than 10°C, and that the effectiveness of the monitoring system is equivalent to monitoring systems that fully meet the monitoring requirements at a lower temperature.

(D) Subject to approval of environmental compliance supervision competent authority, manufacturers may be exempted from the monitoring requirements in J.5.11.2.1 (A) and (B) provided that the manufacturer has demonstrated that a malfunctioning thermostat neither causes a measurable increase in emissions during any reasonable driving condition nor causes any disablement of normal operation of other monitors.

J.5.11.2.2 Engine coolant temperature (ECT) sensor

(A) Circuit continuity. OBD system shall detect a malfunction if open circuit or out-of-range value occurs.

(B) The time to achieve temperature required by closed-loop control

(i) If the ECT sensor does not achieve the stabilized minimum temperature which is needed for the emission control system (for example, feedback control of fuel pressure, EGR flow and boost pressure) to perform closed-loop control, feedback control and feedforward control within specified time interval (approved by environmental compliance supervision competent authority) after starting the engine.

(ii) The above mentioned time interval shall be related to coolant temperature and intake air temperature upon engine startup, environmental compliance supervision competent authority shall grant approve the time intervals if the data/engineering evaluation submitted by the manufacturer supports the applied specific time intervals.

(iii) If engine control system does not utilize ECT signal to enable start conditions of the closed loop or feedback operation related to the emission controls, subject to permission from the environmental compliance supervision competent authority, vehicle manufacturer is not required to monitor as per the stipulations of J.5.11.2.2 (B).

(C) Malfunction of stuck in range below lower limit of the highest enable temperature

To use all available information to the maximum extent feasible, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature below the lower limit of the highest enable temperature required by the OBD system, making it impossible for OBD system to enable other diagnostics (e.g., an OBD that requires ECT to be more than 60°C for starting diagnostic, when the ECT sensor inappropriately indicates a temperature less than 60°C, OBD system shall detect a malfunction). For temperature range monitored in J.5.11.2.1 or J.5.11.2.2 (B), manufacturers are exempted from the monitor requirement for the temperature region in J.5.11.2.2 (C).

(D) Malfunction of stuck in range below lower limit of the lowest enable temperature

(i) OBD system shall use available information to the maximum extent, if the ECT sensor inappropriately indicates a temperature above the upper limit of the lowest temperature causing impossibility of OBD system to perform other diagnostics, OBD system shall detect malfunctions (for example, if an OBD system requires temperature to less than 32°C to perform a diagnostic monitor, then OBD system shall detect malfunctions when ECT sensor inappropriately indicates a temperature more than 32°C).

(ii) It is allowed to be exempted from monitor requirement for temperature regions in J.5.11.2.1, J.5.11.2.2 (B) or J.5.11.2.2 (C) if vehicle OBD system detects ECT sensor malfunctions specified in J.5.11.2.2 (D) (ECT sensor or thermostat malfunctions) and the MIL is illuminated as per J.3.2.2.3 (for example, over-temperature protection strategies) for default.

(iii) For vehicles that have a temperature indication (not a warning light) on the instrument panel and where instrument temperature and OBD system utilize one same ECT sensor, manufacturers are exempted from the monitor requirements of J.5.11.2.2 (D) on instrument temperature red zone.

J.5.11.3 Monitoring conditions

J.5.11.3.1 Thermostat

(A) Manufacturers shall define the monitoring conditions for malfunctions specified in J.5.11.2.1 (A) in accordance with the stipulations of J.3.3.1. Except as specified in J.5.11.3.1 (C)-(E), monitoring for malfunctions specified in J.5.11.2.1 (A) shall be conducted once per driving cycle in which the ECT sensor indicates, at engine start, a temperature lower than the temperature specified in the malfunction criteria in J.5.11.2.1 (A).

(B) Manufacturers shall define the monitoring conditions for malfunctions in J.5.11.2.1 (B) in accordance with J.3.3.1, and monitoring shall be conducted on every driving cycle if monitoring criteria are met.

(C) Manufacturers may disable malfunction monitoring for thermostat at ambient temperatures less than -7°C.

(D) Manufacturers may apply to environmental compliance supervision competent authority to disable or prohibit thermostat monitoring in case of potential false diagnostic (such as vehicle operation at idle for exceed 50% of the warm-up time, in case of heating operation of engine block, etc.). Regarding the circumstance where monitoring of the driving cycle is disabled solely due to high ECT temperature during engine start, manufacturer may disable monitoring if ECT temperature at engine start is more than 20°C below malfunction criteria temperature in J.5.11.2.1 (A) in driving cycle (for example: malfunction criteria temperature value is 71°C, and start ECT temperature is more than 51°C, then it is allowed to disable monitoring).

(E) Notwithstanding the stipulations in J.5.11.2.1 (D), manufacturer may apply to start malfunction monitoring where ECT temperature at engine start is less than 20°C below thermostat malfunction temperature in driving cycle (for example, if thermostat malfunction temperature is 75°C, vehicle manufacturer may request for approval to start OBD monitoring where ECT temperature is between 55-75°C during engine start).

(F) For the purpose of this section, monitoring condition that can be encountered during the emission test cycle in J.3.3.1.1 refers to on-road driving as per the emission test cycle rather than driving on a chassis dynamometer.

J.5.11.3.2 ECT sensor

(A) In addition to the following circumstances in J.5.11.3.2 (E), monitoring for malfunctions specified in J.5.11.2.2 (A) (for example, circuit continuity and
out-of-range value) shall be conducted continuously.

(B) Manufacturers shall define the monitoring conditions for malfunctions specified in J.5.11.2.2 (B) in accordance with contents in J.3.3.1. Additionally, except as specified in J.5.11.3.2 (D), monitoring for malfunctions in J.5.11.2.2 (B) shall be conducted once per driving cycle in which the ECT sensor indicates a temperature lower than the closed loop enabled temperature at engine start (i.e. engine start temperature is greater than the ECT sensor range lower limit and less than the closed loop enabled temperature).

(C) Manufacturers shall monitor the malfunctions specified in J.5.11.2.2 (C) and (D) in accordance with stipulations (Minimum IUPR) of J.3.3.1 and J.3.3.2.
(D) Manufacturers may disable or delay the time to reach closed loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnostic (for example, vehicle operation at idle for exceed 50%-75% of the warm-up time).
(E) A manufacturer may apply to environmental compliance supervision competent authority to disable continuous ECT sensor monitoring when an ECT sensor malfunction cannot be distinguished from other effects. The environmental compliance supervision competent authority shall grant approval if test data/engineering evaluation submitted by manufacturer can demonstrate that a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

J.5.11.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.5.12 Cold start emission reduction strategy monitoring

J.5.12.1 Requirement

J.5.12.1.1 If a vehicle adopts a special control strategy to reduce cold start emissions, OBD system shall monitor the strategy for reaching the desired effect (for example, speed up the ignition temperature of catalytic convertor), and monitor whether the work of the instruction components/parts is normal (such as delay the fuel injection time, improve the idle speed, increase engine load via intake or exhaust throttle and etc.)

J.5.12.1.2 If components/parts required to be monitored in the cold start emission reduction strategy specified in J.5.11 are required to be monitored in other sections (for example, fuel injection timing), manufacturer may use different malfunction diagnostic strategy to distinguish malfunction identified as per J.5.11 from malfunction identified as per other criteria (for example, distinguish malfunctions that are related to cold start emission reduction strategy from malfunctions that are not related to cold start).

J.5.12.2 Malfunction criteria

OBD system shall detect a malfunction under the following circumstances:

J.5.12.2.1 There is under-control object which does not properly respond to control command while the cold start strategy is active. For purposes of this stipulation, "properly respond" refers to "under-control components/parts respond", (A) Can be detected reliably; (B) Response direction meets command; (C) When using the cold start emission reduction strategy, enough differences what relevant under-control object would achieve without the cold start emission reduction strategy (for example, assume that the cold start strategy is to raise idle speed, but there is no prominent amount of engine speed increase above engine speed without the cold start emission reduction strategy, a fault must be detected).

J.5.12.2.2 Any failure or deterioration of the cold start emission control strategy causes a vehicle's emissions to exceed the OBD threshold value:

J.5.12.2.3 For J.5.12.2.2

(A) OBD system may monitor malfunction of the individual components of cold start emissions reduction strategy or the comprehensive effect of cold start emissions reduction strategy (for example, increased engine speed, increased engine load from restricting an exhaust throttle) that cause emissions to exceed the OBD threshold value.

J.5.12.3 Monitoring conditions

Manufacturers shall define the monitoring conditions for malfunctions in J.4.11.2 in accordance with J.3.3.1 and J.3.3.2 (minimum IUPR).

J.5.12.4 MIL illumination and storage fault code

MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.5.13 VVT system monitoring

J.5.13.1 Requirement

For the purpose of this section, VVT system generally refers to variable valve timing control system (VVT) and variable valve lift control system (VVL).

If VVT system is used on vehicles, OBD system shall monitor control target errors and slow response malfunctions. Manufacturer shall perform comprehensive malfunction mode and failure analysis for hydraulic system and mechanical system (for example: partial or total blockage of hydraulic passage, broken return spring and the pin of a certain cylinder enters the target position of the lift mechanism), so as to identify target errors and slow response malfunctions of system. The individual electronic components (such as actuators, valves and sensors, etc.) in the VVT system shall be monitored in accordance with the comprehensive components monitoring requirements in J.4.14.

J.5.13.2 Malfunction criteria

J.5.13.2.1 Target error: OBD system shall monitor VVT system for capability to reach valve timing required by system and capability to control crankshaft angle and valve lift, prior to above failure causing emission to exceed the OBD threshold value, OBD system shall detect corresponding malfunction. If the system operates as per a non-continuous state (for example, two-stage valve driving mechanism), it is not required to detect malfunction before emission exceeds OBD threshold value, but it is required to detect all malfunctions exceeding OBD threshold value.

J.5.13.2.2 Slow response: OBD system shall monitor whether valve timing capability of VVT system meets command system requirements within specified time, and shall detect malfunction prior to emissions exceeds OBD threshold value. If the system operates as per a discrete state, it is not required to detect malfunction before emission exceeds OBD threshold value, but it is required to detect all malfunctions exceeding threshold value.

J.5.13.2.3 When no failure or deterioration of the VVT system could result in a vehicle's emissions exceeding the OBD threshold value, OBD shall monitor the VVT for electronic components response in accordance with the malfunction criteria in J.5.14.2.

J.5.13.3 Monitoring conditions

Manufacturers shall define the monitoring conditions for malfunctions in J.5.13.2 in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR). And track and report IUPR of monitors defined in J.5.13.2 in accordance with the stipulations of J.3.3.2.2. During track and report of IUPR, all monitors defined in J.5.13.2 shall be tracked separately but reported as a single set of values in accordance with the requirements in J.3.5.2.2.

J.5.13.4 MIL illumination and storage fault code

General requirements for MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2.

J.5.14 Comprehensive component monitoring

J.5.14.1 Requirement

J.5.14.1.1 Except as required in J.5.15.1.3, J.5.15.1.4 and J.4.5, OBD system shall monitor electronic power-train component/system (except otherwise specified in J.5.1-J.5.14): The component/system directly or

indirectly inputs or receives commands to/from the onboard computer or smart device, and: (1) malfunction can cause emission to exceed the OBD threshold value, or (2) belongs to part of the diagnostic strategy for other monitored system/component. Each input and output of smart device that meet requirements of above mentioned criteria (1) or (2) shall be monitored as per requirements of J.5.14. It is unnecessary to further point out malfunction inside these smart devices. If malfunction or deterioration can be compensated or adjusted by vehicle, manufacturers are required to perform malfunction diagnostics as per the requirements of J.3.2.2.3 or J.5.14.4.5.

(A) Input components: Input components required to be monitored include the vehicle speed sensor, crankshaft angle sensor, accelerator pedal position sensor, intake air flow sensor, camshaft position sensor, fuel pressure sensor, intake air temperature sensor, exhaust temperature sensor, sensors, modules and solenoids which provide signals to the powertrain control system, etc..

(B) Output components/systems: Output components/systems required to be monitored include: idle speed control system, fuel injectors, automatic transmission solenoids or control system, turbocharger electronic components, the wait-start indicator, and cold start aid components (such as glow plug and intake air heaters, etc).

J.5.14.1.2 In order to meet criteria (1) in J.5.14.1.1, where control system does not compensate or correct in case of occurrence of malfunction or deterioration in system, the manufacturer shall determine through demonstration test whether a power-train system input or output components can affect emissions.

J.5.14.1.3 Manufacturers may request environmental compliance supervision competent authority approval to exempt manufacturer from monitoring of safety only component or system. Vehicle manufacturer shall submit data/engineering evaluation demonstrating that the component or system: (1) meets definition of "safety only component or system"; (2) the component is not used as part of the monitoring strategy for any other system or component.

J.5.14.1.4 For electronic powertrain input/output components that are associated with electronic control transmission and electronic power steering system, or components that are driven by engine and are not related to fueling, air supply system or emissions, manufacturers shall monitor it only if the component or system is used as part of the monitoring strategy for any other component or system.

J.5.14.1.5 Except as specified for hybrid electric vehicles in J.5.14.1.6, manufacturers shall monitor for malfunction when electronic powertrain input/output components/systems are associated with components that affect emissions by causing additional electrical load to the engine and are not related to the control of fueling, air intake control, or emissions control only if the component/system is used as part of the diagnostic strategy for other monitored system/component.

J.5.14.1.6 For hybrid electric vehicles, manufacturer shall monitor hybrid electric vehicle and plug-in hybrid electric vehicle in accordance with the malfunction criteria defined in J.5.14.2.3.

J.5.14.2 Malfunction criteria

J.5.14.2.1 Input components

(A) OBD system shall detect electric circuit malfunctions (malfunction of interruption of communication with onboard computer for digital signal) or malfunction of out of range or rationality malfunction if feasible. To the extent feasible, the rationality diagnostics shall verify whether a sensor output is inappropriately high or inappropriately low (i.e. "two-sided" diagnostics).

(B) With the exception of monitoring of input component of emission neutral diagnostic, rationality malfunction shall be separately detected and store different fault codes than malfunction of circuit or out of

range. It is not required to store different fault codes for "two-sided" diagnostics of rationality. Furthermore:

(i) For digital signal input of coding: it is necessary to individually detect interruption of communication from input terminal to on-board computer and store separated fault code, but it is not required to store separate fault codes for different out-of-range malfunction.

(ii) For all input components, it is necessary to individually monitor malfunction of input component circuit or out of range and store different fault codes for each type of malfunction (such as out-of-range low, out-of-range high, open circuit, short-circuit to power supply and short-circuit to ground, etc.). Nevertheless, for malfunction of open circuit that cannot be distinguished from other out-of-range malfunction, manufacturer is not required to distinguish fault codes. Two-sided rationality fault does not require use of different fault code for two sides. For sensor that is integrated on control unit circuit board, manufacturer may combine out-of-range and circuit malfunction and store fault code that points to the sensor.

(C) For input components (for example, exhaust temperature sensor used to control catalytic convertor inlet temperature at target window value) that directly or indirectly apply to emission control system not included in J.5.1-J.5.13, OBD system shall monitor rationality malfunction of above mentioned input components if the above mentioned input components caused malfunction of the following emission control strategy. The malfunctions of emission control strategy include: inappropriate disablement or postpone of emission control strategy activation, causing system to exit from control strategy by mistake, or where control strategy has used up all adjustment limits but still cannot realize the control target. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the rationality malfunction of input component is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.5.14.2.2 Output components/systems

(A) OBD system shall detect a malfunction of an output component/system when proper functional response of the output component/system to computer commands does not occur. If a functional check is not feasible, OBD system shall detect malfunctions of the output components/systems caused by a lack of circuit continuity or circuit fault (for example, short to ground or short to the power supply). For output component's open circuit faults and circuit faults, manufacturers are not required to store different fault codes for each distinct malfunction (such as open circuit and short to ground, etc.). It is not required to activate an output component/system if it would not be active when performing functional monitoring as per the stipulations of J.5.14.

(B) The idle speed control system shall be monitored by OBD system for proper functional response to computer commands. If a monitoring strategy is based on deviation from target idle speed, a malfunction shall be detected by the system when either of the following conditions occurs:

(i) The idle speed cannot achieve ±30% of the manufacturer-specified target rotation speed.

(ii) The idle speed control system cannot enable idle speed to reach the target idle speed and within the smallest allowable deviation range (the smallest allowable deviation range refers to the rotation range required by OBD system to enable other monitor system).

(C) Glow plug/intake air heaters shall be monitored for whether reasonable functional response is made to computer commands. The glow plug/intake air heater circuit shall be monitored for whether current and voltage drop are reasonable. The environmental compliance supervision competent authority shall approve other monitoring strategies if manufacturer's data or engineering analysis demonstrates that other

monitoring strategies are equally reliable or timely. Further, without adding additional hardware, it shall be possible to identify the specific malfunctioning glow plug on the basis of fault code.

(D) The wait-start indicator lamp shall be monitored for malfunctions that cause the lamp to fail to illuminate (for example, burned out bulb).

(E) For other components/systems that are not covered in J.5.1-J.5.13 but belong to part of any emission control strategies (for example, a control strategy that controls intake throttle position to regulate SCR catalytic convertor inlet temperature within a target window), the OBD system shall detect functional malfunctions that prevent the component/system from achieving the desired functional response and cause the control strategy failure. These malfunctions include: inappropriately prevent or delay the activation of the emission control strategy, or is still unable to achieve the desired condition where all of the adjustment ranges. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the rationality malfunction of output component is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.5.14.2.3 Hybrid electric vehicle components

(A) Rechargeable Energy Storage System (REESS)

(i) For separated electronic components (for example, battery temperature sensor, battery voltage sensor, battery cell) used for REESS system input or output, OBD system shall monitor as per the requirements of J.5.14.2.1 and J.5.14.2.2.

(ii) For malfunction required to be monitored in Chapter J.5.14.2.3 (A)(i), manufacturer shall at least store independent fault code for malfunction related to hybrid REESS system and clarify the minimum replaceable unit upon repair, and point out malfunction type of malfunction components further at the same time.

(B) Thermal management system for hybrid electric vehicle

(i) REESS thermal management system

a. In accordance with the requirements in J.5.14.2.1 and J.5.14.2.2, separated electronic input and output components of REESS thermal management system (for example, heating or cooling) shall be monitored, excluding electronic components used for hybrid battery thermal management and completely controlled by driver.

b. OBD system shall perform functional check of cooling performance and heating performance (if applicable) as much as possible.

(ii) Inverter thermal management system

a. In accordance with the requirements in J.5.14.2.1 and J.5.14.2.2, separated electronic input and output components of inverter thermal management system (for example, heating or cooling) shall be monitored. Electronic components that is only controlled by driver and is used for
inverter thermal management shall be exempted from this monitoring requirement.

b. OBD system shall perform functional check of cooling performance and heating performance (if applicable) as much as possible.

(C) Regenerative braking: OBD system shall detect a malfunction where a component failure causes disablement of braking energy recovery function or influences braking energy recovery function.

(D) Driving motor:

Manufacturer shall submit monitoring program and apply to environmental compliance supervision competent authority for approval, including the monitoring requirements, malfunction criteria and

monitoring condition for driving motor. The environmental compliance supervision competent authority shall grant approval on the basis that the the manufacturer can demonstrate that the monitoring program can correctly detect malfunction and can detect malfunction of driving motor that hinders the following circumstances:

(1) Activation and maintenance of emission control strategy;

(2) Vehicle operation can reach or exceed the minimum IUPR specified in J.3.3.2.1;

(3) The motor is used in vehicle operation process (for example, engine cannot be started, motor cannot drive vehicle or provide assistance).

(E) Generator:

Manufacturer shall submit monitoring program and apply to environmental compliance supervision competent authority for approval, including the monitoring requirements, malfunction criteria and monitoring condition for generator. The environmental compliance supervision competent authority shall grant approval on the basis that the manufacturer can demonstrate that the monitoring program can correctly detect malfunction and can detect malfunction of generator that hinders the following circumstances:

(1) Activation and maintenance of emission control strategy;

(2) Vehicle operation can reach or exceed the minimum IUPR specified in J.3.3.2.1;

(3) Appropriate functional response in accordance with fault criteria in J.5.14.2.

(F) Plug-in hybrid electric vehicle REESS charger: for online REESS charger of plug-in hybrid electric vehicle, where failure causes disablement of REESS charging or influence upon charging performance, OBD system shall detect a malfunction (for example, REESS system fails to charge fully or charging speed is restricted). It is not required to detect REESS charging malfunction that is caused due to external charging of vehicle (for example, caused due to vehicle parts malfunction or identical malfunction characteristics due to external charging), or external charging equipment of vehicle (for example, malfunction of charging equipment and insufficient power supply), and cannot be distinguished.

(G) For hybrid components not mentioned in J.5.14.2.3 (A)-(F), manufacturer shall monitor input/output components as per the criteria in J.5.14.2.1 and J.5.14.2.2 in accordance with the requirements of J.5.14.1.1.

(H) Plug-in hybrid electric vehicle can be exempted from the requirements specified in J.5.14.2.3 (A)-(G) on hybrid electric vehicle component monitoring, if manufacturer can demonstrate:

(i) The component is not used as part of the diagnostic strategy for any monitored system or component, and

(ii) As alternative for malfunction criteria of J.5.14.1.2, except as specified in J.5.14.2.3 (H)(ii) and (iv), no malfunction of component and system can cause:

a. Engine of fully charged vehicle is started in WLTP test process (while during normal operation, engine of fully charged vehicle is not started in test).

b. After three or more tests, average increase of accumulative net electric power consumed by malfunctioning vehicle for completion of WLTP test with engine off is 15% higher than malfunction-free vehicle. All tests shall adopt completely charged battery, and accumulative electric power consumption shall be measured at input terminal of electric power driving system. If it is impossible to measure, environmental compliance supervision competent authority may approve adoption of alternative method to measure accumulative consumption of electric power outputted to electric power driving system.

(iii) For thermal management system of hybrid, as alternative for the test cycle mentioned in J.5.14.2.3 (H)(ii), manufacturer shall submit to environmental compliance supervision competent authority the

program for using other test cycle or vehicle operation condition to determine malfunction causing start of engine of fully charged vehicle (while engine is not started during normal operation of fully charged vehicle), or causing 15% decrease of full-electric range of vehicle. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer demonstrate that all conditions for activation of thermal management system (for example, high atmosphere ambient temperature, REESS charging and high load driving) have been considered, and alternative test cycle and operation condition represent the actual use conditions that are most likely influenced by malfunctioning components/systems.

(iv) If functions of hybrid component or system are not required to occur in test cycle mentioned in J.5.14.2.3 (H)(ii) above (for example, global positioning system components used to control operation of plug-in hybrid electric vehicle based on battery charging status), manufacturer shall apply to competent authority to use alternative driving cycle and vehicle operation condition for evaluation of vehicle engine start and accumulative net electric power consumption increase. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer demonstrate that alternative driving cycle and vehicle operation condition represent the actual driving conditions that are most likely influenced by malfunctioning components/systems, environmental compliance supervision competent authority shall grant approval. If any degree of failure and deterioration of component or system will cause start of engine when engine shall not be started, or in three or more tests, average increase of accumulative net electric power consumed by malfunctioning vehicle is 15% higher than malfunction-free vehicle, the component or system must meet the monitoring requirements specified in J.5.14.

(I) Non-plug-in hybrid electric vehicle can be exempted from the requirements specified in J.5.14.2.3 (A)-(G) on hybrid electric vehicle component monitoring, if manufacturer can demonstrate:

(i) The component is not used as part of the diagnostic strategy for any monitored system or component, and

(ii) The influence of parts malfunction upon emission will not reach the criteria in J.5.14.1.2.

J.5.14.3 Monitoring conditions

J.5.14.3.1 Input components

(A) Except as specified in J.5.14.3.1(C), monitoring for malfunctions of out-of-range and electric circuit of input components shall be conducted continuously.

(B) Rationality monitoring (if applicable):

Manufacturers shall determine the monitoring conditions for malfunctions in accordance with the stipulations of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.

(C) If out of range malfunction or circuit continuity malfunction of input component cannot be distinguished from other factors, subject to environmental compliance supervision competent authority approval, manufacturer may disable continuous monitoring of malfunction. Manufacturer shall provide test data/engineering evaluation to demonstrate that a properly functioning input component cannot be distinguished from a malfunctioning input component and that the above mentioned disablement time interval is limited to avoiding of false detection.

J.5.14.3.2 Output components/systems

(A) Except as specified in J.5.14.3.2 (D), monitoring for circuit continuity and circuit faults shall be conducted continuously.
(B) Except as specified in J.5.14.3.2 (C), manufacturers shall define the monitoring conditions for functional check as per requirements in J.3.3.1 and J.3.3.2 (minimum IUPR).
(C) For the idle speed control system, manufacturers shall define the monitoring conditions for functional check in accordance with requirements of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.
(D) Subject to approval by environmental compliance supervision competent authority, manufacturer may disable continuous monitoring of malfunction when circuit continuity and electric circuit malfunction of output component/system cannot be distinguished from other factors. The environmental compliance supervision competent authority shall grant approval on the basis that the manufacturer shall provide data/engineering evaluation to demonstrate that a properly functioning output component/system cannot be distinguished from a malfunctioning output component/system and that the above mentioned disablement time interval is limited to avoiding of false detection.
J.5.14.3.3 Hybrid electric vehicle components
Manufacturers shall define the monitoring conditions for malfunctions listed in J.5.14.2.3 (A)(ii)-(iii), J.5.14.2.3 (B)(i)(b), J.5.14.2.3 (B)(ii)(b) and J.5.14.2.3 (C)-(F) in accordance with the requirements of J.3.3.1 and J.3.3.2 (minimum IUPR), but monitoring shall be conducted every time the monitoring conditions are met in lieu of once per driving cycle which meets monitoring conditions in accordance with the stipulations of J.3.3.1.2.

J.5.14.4 MIL illumination and storage fault code

J.5.14.4.1 Except as specified in J.5.14.4.2, J.5.14.4.4 and J.5.14.4.5, MIL illumination and fault code storage shall be in compliance with the stipulations of J.3.2. See additional requirements on storage of input component fault code as per J.5.14.2.1(B); J.5.14.2.2(A) gives the additional conditions for storage of output component fault code, and J.5.14.2.3(A)(iv) gives the additional requirements for storage of hybrid component fault code.
J.5.14.4.2 With the exception of requirements on MIL illumination and fault code storage, for components or systems that are only monitored through emission neutral diagnostic, it is not required to illuminate MIL and store fault code. Manufacturer shall demonstrate that
emission neutral diagnostic will activate emission neutral default action, and emission neutral default action is sufficiently in compliance with definition regarding "emission neutral default action" in J.2.

J.5.15 Other emission control system or emission source monitoring

J.5.15.1 Requirement

Other emission control or emission source systems refer to: emission control or emission source systems are not addressed in J.5.1-J.5.14 (such as hydrocarbon traps, homogeneous compression-ignition control, NOx storage devices and fuel-fired heaters in vehicle, etc.) Prior to sales of mass production vehicle, manufacturer shall submit a monitoring plan related to monitoring strategy, malfunction criteria and monitoring conditions, the environmental compliance supervision competent authority shall determine whether to grant approval in accordance with the effectiveness of monitoring strategy, the used malfunction criteria, monitoring conditions required by diagnose and whether the stipulations of J.5.15.3 and J.5.15.4 are met.

J.5.15.2 Emission sources specified in J.5.15 refer to components or devices that emit pollutants specified in vehicle evaporative or exhaust emission criterias (such as NMHC, CO, NOx, PM and etc.) and include non-electronic components and non-powertrain components (such as fuel-fired passenger compartment heaters, onboard fuel reforming unit and etc.).

J.5.15.3 Except as required in this segment below, if vehicle alters intake air flow or cylinder charge characteristics by control valve, regulating flap, or other ways (for example, swirl control valve), so as to control emission, provided that manufacturer meets the requirements of J.5.15.1, OBD system shall monitor proper functional response of the shaft to which all valves / regulating flaps in one same intake passage are physically attached in place of monitoring proper operation of the intake air flow, cylinder charge, or each valve / regulating flap. For nonmetal shafts or segmented shafts, it is necessary to verify that all parts of shafts have proper functional response (for example, by verifying proper operation of the furthest segment of the shaft). For adoption of multiple shafts for control of valve for multiple passages, manufacturer is not required to add another set of measurement hardware (such as sensor and switch, etc.) for each air intake passage.

J.5.15.4 For emission control strategy not included in J.5.1-J.5.14 (for example, a control strategy that controls SCR catalytic convertor exhaust inlet temperatures within a target window). OBD system shall monitor malfunctions of emission control strategy, the malfunctions include: inappropriate disablement or postpone of emission control strategy activation, causing system to exit from control strategy by mistake, or where control strategy has used up all adjustment limits but still cannot realize the control target. If data/engineering evaluation submitted by manufacturer can demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware, environmental compliance supervision competent authority may exempt manufacturer from relevant malfunction monitoring requirements.

J.5.16 Exceptions to monitoring

J.5.16.1 Manufacturers may request competent authority approval to disable an OBD system monitor at ambient temperatures below -7°C (lower limit of ambient temperature may be determined as per intake air temperature or engine coolant temperature) or at elevations above 2,440m. If data/engineering evaluation provided by manufacturer demonstrate that monitoring under the conditions would be unreliable, environmental compliance supervision competent authority shall grant approval. A vehicle manufacturer may further request that an OBD system be disabled at other ambient temperatures, if data/engineering evaluation provided by manufacturer demonstrate that misdiagnosis would occur under the condition because of characteristics of the component itself (for example, component freezing), environmental compliance supervision competent authority shall grant approval.

J.5.16.2 Manufacturers may apply to disable monitoring system that can be affected by extremely low fuel level or running out of fuel (for example, misfire detection) when the
fuel level is less than 15% of the nominal capacity of the fuel tank. If data/engineering evaluation provided by manufacturer demonstrate that monitoring under the condition of relevant fuel level would be unreliable, environmental compliance supervision competent authority shall grant approval.

J.5.16.3 Manufacturers may disable monitoring systems that can be affected by vehicle battery or system voltage.

J.5.16.3.1 For monitoring systems that may be affected by low battery or extremely low system voltages of vehicle, manufacturer may suspend monitoring systems when the battery or system voltage is less than 11.0V. Manufacturers may apply to disable system monitoring under situation more than 11.0V. If

data/engineering evaluation submitted by manufacturer can demonstrate that monitoring at relevant voltage conditions would be unreliable and that: 1) operation time of a vehicle below the disablement voltage will not be extended due to disablement of monitoring or 2): OBD system monitors the battery voltage or system voltage and will detect voltage malfunction when voltage drops to the voltage to disable other monitors.

J.5.16.3.2 For monitoring systems that may be affected by extremely high battery voltage or extremely high system voltage, manufacturer may apply to disable monitoring systems when the battery or system voltage exceeds a manufacturer-defined value. The environmental compliance supervision competent authority shall grant approval on the basis that data/engineering evaluation submitted by manufacturer can demonstrate that monitoring above the given value of battery or system voltage would be unreliable; and 1) the electrical charging system/alternator warning light is illuminated (or voltage is in the "red zone"); or 2) OBD system will detect a voltage malfunction at the battery voltage or system voltage that can disable other monitors.

J.5.16.4 A manufacturer may apply to disable the monitoring items affected by PTO activation in vehicles installed with PTO units, provided disablement occurs only while the PTO unit is active, and the OBD ready state is cleared by the onboard computer (for example, all monitors set to indicate "not complete") while the PTO unit is activated. If the disablement occurs, upon end of interruption, readiness status shall resume the status prior to PTO activation.

J.5.16.5 Whenever J.5 of this Standard requires monitoring "to the extent feasible", manufacturer shall submit relevant monitoring program. The environmental compliance supervision competent authority shall grant approval on the basis of the following consideration: the best available monitoring technology that is known or shall have been known to the manufacturer; given the situations of the manufacturer's existing hardware, the degree to which requirements are met in full; the necessity to avoid significant false indication or omission; and the efforts made by the manufacturer to try other monitoring strategy to meet the requirements in full. The effort to try other monitoring strategy shall include evaluation of improvement to the existing monitoring program, the monitored components themselves, and monitors that use the monitored components (e.g.: improve monitoring function to lessen the requirements on sensitivity or characteristics of monitored components).

J.6 Standardization requirements

J.6.1 Reference documents

The following documents in SAE and ISO are referenced in this regulation:

J.6.1.1 SAE J1930 "Electronic Systems Diagnostic Items, Definitions and Abbreviations -- Equivalent to ISO/TR 15031-2", October 2008 (SAE J1930).

J.6.1.1.1 SAE J1930-DA "Electronic Systems Diagnostic Items, Definitions and Abbreviations, and Spreadsheet acronym network tools -- Equivalent to ISO/TR 15031-2", March 2014.

J.6.1.2 SAE J1962

J.6.1.2.1 SAE J1962 "Diagnostic Interface -- Equivalent to ISO/DIS 15031-3: 14 December 2001", April 2002 (SAE J1962).

J.6.1.2.2 SAE J1962 "Diagnostic Interface -- Equivalent to ISO/DIS 15031-3: 14 December 2001", September 2015 (SAE J1962).

J.6.1.3 SAE J1978 "OBD II Scan Tool -- Equivalent to ISO/DIS 15031-4: 14 December 2001", April 2002 (SAE J1978).

J.6.1.4 SAE J1979 "Electronic/Electrical Diagnostic Test Modes", August 2014 (SAE J1979).

J.6.1.4.1 SAE J1979-DA, "Digital Annex of Electronic/Electrical Diagnostic Test Modes", June 2014.
J.6.1.5 SAE J1850 "Class B Data Communications Network Interface", June 2006 (SAE 1850).
J.6.1.6 SAE J2012 "Diagnostic Trouble Code Definitions", March 2013 (SAE J2012).
J.6.1.6.1 SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions", January 2013 (SAE J2012).
J.6.1.7 ISO 15765-4:2011 "Road vehicles -- Diagnostics on Controller Area Network (CAN) -- Part 4: Requirements for emissions-related systems", February 2011 (ISO 15765-4).
J.6.1.7.1 ISO 15765-4:2011 "Road vehicles -- Diagnostics on Controller Area Network (CAN) -- Part 4: Requirements for emissions-related systems -- Amendment 1", February 2013 (ISO 15765-4).
J.6.1.8 SAE J1699-3- "OBD II Compliance Test Cases", July 2015.
J.6.1.9 SAE J2534-1- "Recommended Practice for Pass-Thru Vehicle Program", October 2015 (SAE J2534-1);
J.6.1.10 ISO 26262-5:2011 "Road vehicles -- Functional safety -- Part 5: Product development at the hardware level", November 2011 (ISO 26262-5)

J.6.2 Diagnostic interface

J.6.2.1 Standardized diagnostic interface installed on vehicle shall meet the requirements of "Type A" in SAE J1962.
J.6.2.1.1 The interface shall be designed and installed in the driver's side near driver's foot in adjacency to the driver's side edge of the center console (or: shall be placed at the vehicle centerline position if the vehicle does not have a center console) and at a location no higher than the lowest position of the steering wheel. The interface shall not be located on or in the center console (for example, neither on the horizontal faces near the gear selector, parking brake lever, or cup holders nor on the vertical faces near the onboard stereo system, air conditioning system and navigation system). The installation position of the interface shall meet the following requirements: be capable of being easily accessible by a "crouched" technician entering the vehicle from the driver's side.
J.6.2.1.2 If the interface is covered, the cover layer must be removable by hand directly without the use of any tools and be labeled to facilitate technicians in identifying the position of the interface. Access to the diagnostic interface shall not require opening or the removal of any storage device (such as ashtray, etc.). The label shall be submitted to the environmental compliance supervision competent authority for review and approval, or before the time the manufacturer submits its certification application. The environmental compliance supervision competent authority shall grant approval if environmental compliance supervision competent authority identifies that the label clearly indicates the position of the interface and the language and/or symbols used on label are consistent with language and/or symbols commonly used in the automotive industry.
J.6.2.2 Any pins in the interface that provide voltage shall be fused to protect the integrated circuit and usefulness of the diagnostic connector and the voltage shall not exceed 20V DC regardless of the nominal vehicle system or battery voltage (such as 12V, 24V and 42V, etc.).
J.6.2.3 Manufacturer may not install "Type A" diagnostic interface meeting SAE 1962 for other purposes at central line of vehicle and the area bound by the vehicle driver's feet area and central line of vehicle.

J.6.3 Communications to a scan tool

Manufacturers shall acquire emission-related information from onboard computer by using a scan tool meeting SAE J1978 definitions. For criteriaized protocols defined as per ISO 15765-4, communication shall adopt baud rate of 500kbps.

J.6.4 Required emission related functions

The following criteriaized functions shall be implemented in accordance with the provisions in SAE J1979 to allow for access to the required information by a scan tool meeting SAE J1978 provisions:

J.6.4.1 **Readiness status:** In accordance with SAE J1979 provisions, OBD system shall indicate "complete" or "not complete" after the stored fault code was last cleared for each of the monitored components or systems specified and designed in J.4.1-J.4.8, J.4.14, J.5.1-J.5.4, J.5.6, J.5.8 and J.5.14, diesel vehicles shall additionally indicate readiness status for monitor components defined in J.5.5, J.5.7 and J.5.9. All vehicles equipped with VVT system monitoring function and subject to the test results requirements specified in J.6.4.5.4 (C) shall additionally indicate readiness status for VVT system monitors specified in J.4.12 and J.5.13.

J.6.4.1.1 Readiness bit of readiness status of the components/systems listed as followings shall always indicate "complete":

(A) Gasoline engine misfire (J.4.3);

(B) Diesel engine misfire (J.5.3), mainly for vehicles that are not designed to use separate monitoring of misfire in J.5.3.2.1 to meet requirements of J.5.3.3.1 and J.5.3.3.2;

(C) Gasoline engine fuel system (J.4.6);

(D) Gasoline engine and diesel engine comprehensive components (J.3.14 and J.4.15).

J.6.4.1.2 For components and systems that are not listed in J.6.4.1.1, after relevant monitors (with the exception of the monitor described in J.6.4.1.6 below) confirm that components or systems are free from malfunction, readiness status shall immediately indicate "complete" status. After the number of decisions required for determination of MIL status has been completely executed, if components or systems monitor displays malfunction, then readiness status of components or systems shall also indicate "complete".

J.6.4.1.3 Except the readiness status bit mentioned in J.6.4.1.1, the readiness status of each monitored component or system shall indicate "not complete" whenever fault memory has been cleared by a method other than that specified in J.3. Normal vehicle shut down (key "off", engine "off") shall not cause the readiness status to indicate "not complete".

J.6.4.1.4 In accordance with environmental compliance supervision competent authority approval, if monitoring is disabled for several driving cycles due to the continued extreme operating conditions (such as low ambient temperatures, high altitude conditions, etc.), readiness status for the monitoring system may be set to indicate "complete" before completion of monitoring. The environmental compliance supervision competent authority shall grant approval to set readiness as "complete" based on the conditions for monitoring system disablement and the number of driving cycles without completion of monitoring before readiness is set as "complete".

J.6.4.1.5 If the manufacturer still indicates readiness status by using MIL in the key On, engine Off position as specified in J.3.2.1.3, the readiness status shall be indicated as per the following criteria: if the readiness status for all monitored components or systems is "complete", the MIL shall remain continuously illuminated in the key On, engine Off position for at least 15s. If the readiness status for one or more of the monitored

components is "not complete", after 15-20s of operation in the key On, engine Off position (with the MIL illuminated continuously), the MIL shall blink once per second for the next 5-10s. The data stream value status (J.6.4.2) for MIL status shall indicate "commanded-off" unless the MIL has been commanded "commanded-on" for a detected fault.

J.6.4.1.6 For determining readiness status of specific components or systems, manufacturer is not required to use the following monitor:

(A) Circuit and out-of-range requiring continuous monitoring;
(B) Gasoline engine and diesel engine exhaust sensor monitoring in J.4.7.2.1 (C), J.5.5.2.1 (A)(iii), J.5.5.2.1 (B)(iii) and J.5.5.2.2 (C);
(C) Diesel engine feedback control monitoring in J.5.2.2.3 (D), J.5.4.2.4, J.5.6.2.4, J.5.7.2.5, J.5.8.2.3 and J.5.9.2.7.
J.6.4.2 **Data stream:** The following signals shall be available as per requirements of the standardized diagnostic interface defined in SAE J1979. The actual signal value shall be always used instead of a default or limp home signal.
J.6.4.2.1 Calculated load value, number of stored confirmed fault codes, engine coolant temperature, engine speed, absolute throttle position (if equipped with a throttle), vehicle speed, OBD requirements and MIL status (for example, "commanded-on" or "commanded-off") for type inspection.
J.6.4.2.2 For vehicles installed with the following systems:
(A) Fuel control system status (such as open loop and closed loop, etc.), fuel trim (short term and long term, secondary), fuel pressure, ignition advance angle, intake air temperature, intake manifold absolute pressure, intake air flow rate from air mass meter, secondary air system status (upstream, downstream, or atmosphere), oxygen sensor output, air-fuel ratio sensor output.
(B) EGR temperature, variable geometry turbine control status (for example, open loop or closed loop), number of reductants (for example, urea level), alcohol percentage in fuel, NOx adsorber regeneration status, NOx adsorber DeSOx status, hybrid battery pack state; and distance traveled after low/empty SCR reductant warning for driver.
J.6.4.2.3 For all vehicles using the ISO 15765-4 protocol to meet the standardized functions required in J.6, the following signals can also be used: absolute load, fuel level (if used to enable or disable any other diagnostics), relative throttle position (if equipped with a throttle), atmosphere pressure (directly measured or estimated), engine control module system voltage, required equivalence ratio, catalytic convertor temperature (if it is allowed to measure or estimate directly for purposes of enabling the catalytic convertor monitor), monitor status (for example, unable to monitor the rest of driving cycle, complete this driving cycle, or not complete this driving cycle) after last engine shut-off for each monitor used for monitoring readiness status, time elapsed after engine start, distance traveled after MIL activated, distance traveled after fault code last cleared, and number of warm-up cycles after fault code last cleared.
J.6.4.2.4 For vehicles installed with the following systems/components and using the ISO 15765-4 protocol for the standardized functions required in J.6: ambient air temperature, evaporative system vapor pressure, command purge valve duty cycle/position, command EGR valve duty cycle/position, EGR error between actual and command requirements, PTO status (active or not active), absolute position of other throttle (for electronic throttle or systems that utilize two or more sensors), absolute position of throttle pedal, absolute position of redundant throttle pedal, and command throttle motor position.
J.6.4.2.5 For diesel vehicle
(A) Calculated load (actual engine torque and maximum torque value at the current
engine speed), desired engine torque of driver (a percentage in relation to maximum engine torque), actual engine torque (or percentage in relation to maximum engine torque), engine oil temperature (if used for emission control or other OBD diagnostics), time elapsed after engine start, and:
(B) Fuel level (if used to enable or disable other diagnostics), atmospheric pressure (directly measured or estimated), system voltage of engine control module; and:

(C) Status (for example, unable to monitor the rest of driving cycle, complete this driving cycle, or not complete this driving cycle) after last engine shutoff for monitor used for monitoring readiness status, distance traveled (or engine run time for vehicles not utilizing vehicle speed information) while MIL activated, distance traveled (or engine run time for vehicles not utilizing vehicle speed information) after fault code last cleared, and number of warm-up cycles after fault code last cleared.
(D) For all engines equipped with the following systems/components: absolute throttle position, relative throttle position, fuel injection timing, manifold surface temperature, intercooler temperature, ambient air temperature, commanded EGR valve duty cycle/position, deviation between actual and required EGR, PTO status (active or not active), absolute position of accelerator pedal, required throttle driver position, absolute position of accelerator pedal, absolute position of the redundant throttle pedal, commanded throttle driving motor position, fuel rate, boost pressure, commanded/target boost pressure, turbo inlet air temperature, fuel rail pressure, commanded fuel rail pressure, particulate filter inlet pressure, particulate filter inlet temperature, particulate filter outlet pressure, particulate filter outlet temperature, particulate filter pressure drop, exhaust pressure sensor output, exhaust gas temperature sensor output, injection control pressure, commanded injection control pressure, turbocharger/turbine speed, variable geometry turbo position, commanded variable geometry turbo position, turbocharger compressor inlet temperature, compressor inlet pressure, turbine inlet temperature, turbine outlet temperature, waste valve position, glow plug lamp status, PM sensor output and NOx sensor output;
(E) Standardized trigger for particulate filter regeneration, particulate filter regeneration status, and:
(F) Average traveling distance (or engine run time for vehicle not utilizing vehicle speed information) between this time of particulate filter regeneration and the next time of regeneration.

J.6.4.3 Freeze frame

J.6.4.3.1 "Freeze frame" information shall be stored in accordance with J.3.2.2.7, J.4.3.4.4, J.4.6.4.4, J.5.3.4.2 (B) and J.5.4.4.2 (D), freeze frame information shall be made available through the standardized diagnostic interface in accordance with the stipulations of SAE J1979.
J.6.4.3.2 Except number of stored fault codes, OBD requirements, MIL status, and absolute throttle position required in J.6.4.3.3 for type inspection, "freeze frame" conditions must include the fault code which caused the data to be stored and all of the signals required in J.6.4.2.1. Freeze frame conditions shall also include all of the signals required in J.6.4.2.2 (A), J.6.4.2.3-J.6.4.2.5 (D) (except J.6.4.2.5 (E)), these signals are used for diagnostic or control purposes in the key diagnostic or electronic emission power control unit, except for the following signals: oxygen sensor output, air-fuel ratio sensor output, catalytic convertor temperature, evaporative system vapor pressure, glow plug lamp status, PM sensor output, NOx sensor output, monitor status after last engine shut off, distance traveled after MIL activated, distance traveled after fault code last cleared, and number of warm-up cycles after fault code last cleared.
J.6.4.3.3 In lieu of the absolute throttle position freeze frame data specified in J.6.4.2.1, vehicles that do not use the absolute throttle position data for key diagnostic or electronic emission power control may use the relative throttle position data required in J.6.4.2.3 or accelerator pedal position data specified in J.6.4.2.4.
J.6.4.3.4 Only one frame of data is required to be recorded, manufacturers may choose to store additional freeze frames information, but relevant information can be read by a scan tool meeting stipulations in SAE J1978.

J.6.4.4 Fault codes

J.6.4.4.1 For all monitored components or systems, pending fault codes, confirmed fault codes or permanent fault codes shall be made available through the standardized diagnostic interface meeting SAE

J1979 requirements, and the system shall use fault codes conforming to SAE J2012 (or ISO 15031-6) standard.

J.6.4.4.2 Unless specified in J.4 and J.5, stored fault code shall point out the root-cause of malfunction as much as possible. Manufacturer shall use separate fault code for each diagnostic program, repair program and malfunction of different root-cause to the maximum extent.

J.6.4.4.3 Manufacturers shall use SAE fault codes defined in SAE J2012 (for example, P0xxx and P2xxx) whenever possible. Subject to environmental compliance supervision competent authority approval, manufacturers may also use customized fault codes in accordance with SAE J2012 standard (for example, P1xxx). Factors to be considered by the environmental compliance supervision competent authority for approval of the above mentioned request shall include: the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future application of the diagnostic or component, and estimated usefulness in providing additional diagnostic or repair information to service technicians. Manufacturer-customized fault codes shall be used uniformly (i.e. the same fault code shall not represent two different failure modes) across entire production line.

J.6.4.4.4 A fault code (pending and/or confirmed fault code, as required in J.3, J.4 and J.5) shall be stored and available to scan tool meeting SAE J1978 standard within 10s if an OBD system has determined that a malfunction has occurred. A permanent fault code shall be stored and readable to scan tool meeting SAE J1978 standard no later than the end of an ignition cycle (including electronic control unit shutdown) under the conditions where confirmed fault code has been stored and the MIL has been illuminated.

J.6.4.4.5 Pending fault code

(A) Pending fault codes for all components and systems (including continuously or non-continuously monitored components) shall be acquired through the standardized diagnostic interface meeting SAE J1979 requirements (for example, mode/service $07).

(B) A pending fault code shall be stored and acquired through scanning tool if the monitored component or system malfunctions, regardless of the MIL illumination status and confirmed fault code status (for example, even if a pending fault has transformed to a confirmed fault code and the MIL is illuminated, a pending fault code shall be stored and read if the most recent monitoring indicates existence of malfunctioning).

(C) If manufacturers want to use alternate statistical protocols for MIL illumination in J.3.2.2.6, manufacturers shall submit to the environmental compliance supervision competent authority y a protocol for setting pending fault codes. The environmental compliance supervision competent authority shall approve the above mentioned request if environmental compliance supervision competent authority determines that the alternate protocol can meet the requirements in J.6.4.4.5 (A) and (B) and provide a quick and accurate indication of a pending failure.

J.6.4.4.6 Permanent fault code

(A) Permanent fault codes for all components and systems shall be acquired through the diagnostic interface in a standardized format that distinguishes permanent fault codes from both pending fault codes and confirmed fault codes.

(B) A confirmed fault code shall be stored as a permanent fault code prior to the end of
the ignition cycle at latest and subsequently MIL shall be illuminated continuously (refers to system with malfunction at present, does not refer to period of the 40 warm-up cycles self-healing process described in J.3.2.4).

(C) Permanent fault codes shall be stored in NVRAM and shall not be erasable by any scan tool (generic or enhanced) or by disconnecting power to the on-board computer.

(D) Permanent fault codes shall not be erased by system when the control module containing the permanent fault codes is reprogrammed unless the readiness status (refers to J.6.4.1) for all monitored components and systems in addition to integrated components is set to "not complete" during reprogramming.

(E) OBD system shall have the ability to store a minimum of 4 confirmed fault codes as permanent fault codes and store them in NVRAM. If the number of confirmed fault codes for MIL illumination exceeds the maximum number of permanent fault codes that can be stored, OBD system shall store the earliest detected confirmed fault codes as permanent fault codes. If additional confirmed fault codes are stored when the maximum number of permanent fault codes is already stored in NVRAM, OBD system shall not replace any stored permanent fault code with the additional confirmed fault codes.

J.6.4.5 Test results

J.6.4.5.1 In addition to the provisions in the J.6.4.5.5, for all monitored components and systems in gasoline vehicles specified in J.4.1-J.4.8, and for all monitored components and systems in diesel vehicles specified in J.5.1-J.5.9 and J.5.13 except those required to be monitored continuously: results of the most recent monitoring of the components or systems and the test limits established for monitoring the components and systems shall be stored and available through the standardized diagnostic interface meeting SAE J1979 stipulations. For J.4.3, J.4.12 and J.5.13 (refers to the misfire monitoring, VVT system monitoring) monitoring, shall meet the requirements in J.6.4.5.4 (C).

J.6.4.5.2 The reported test results shall not cause a normal functioning of component or system (such as a "qualified" system) to exceed the set limits.

J.6.4.5.3 In addition to the requirements of J.6.4.5.4 (D) and (E), the test results shall be stored after test results are updated by most recent valid test results or the fault memory of OBD system is cleared. After the fault memory is cleared, if the fault memory was cleared, monitoring is not yet complete, it is necessary to report a test value which is not failure (i.e. test result which dose not exceed the set limits).

J.6.4.5.4 For vehicles using ISO 15765-4 (see J.6.3.4) communication protocol:

(A) The test results and limits can be readed in the standardized protocol format specified in SAE J1979 standard as per ISO 15765-4 protocol. Test results identified by vehicle manufacturer-customized monitor item (for example, in the range $E1-$FF of SAE J1979 OBD MIDs) shall not be used.

(B) Test limits shall include minimum and maximum acceptable values and all test results required in J.6.4.5.1 shall be reported. The test limits shall be defined as follows: if a test result is equal to limit, it shall be a "passing" value rather than a "failing" value.

(C) Following monitoring test results shall be calculated and reported in the standardized format specified in SAE J1979.

(i) Misfire monitoring (J.4.3 and J.5.3);

(ii) VVT monitoring (J.4.12 and J.5.13).

(D) Under the circumstances where monitors have not yet completed after the last time the stored fault was cleared, test result and limit value shall report 0.

(E) All test results and test limits shall be reported and the test results shall be stored continuously after test results are updated by the most recent valid test results or fault memory of OBD system is cleared. For monitors with multiple pass/fail criteria (for example, a purge diagnostic that can pass upon discovering a rich shift, lean shift, or engine speed change), the valid test result and limit value for determination detected most recently shall be reported while test result and test limit value for non-determination that are detected most recently shall be set as 0 (for example, if a purge flow monitoring

event is determined as passed based on discovering a rich shift, it is necessary to report the results and the limits of the rich shift test, while the lean shift and engine speed change test result and limit value shall be set as 0).

(F) For each separate diagnostic, OBD system shall respectively store and report unique test result (for example, if OBD system respectively diagnoses leak of 0.5mm and 1.0mm, test results of 0.5mm and 1.0mm shall be reported separately).

J.6.4.5.5 Requirements in J.6.4.5 don't apply to the following monitor:

(A) Gasoline vehicle

(i) Misfire monitoring, fuel system monitoring and VVT system monitoring (except for the requirements in J.6.4.5.4 (C));

(ii) All circuits requiring continuous monitoring and monitoring of out-of-range value;

(iii) Exhaust sensor feedback monitoring (J.4.7.2.1 (C)).

(B) Diesel vehicle

(i) VVT system monitoring (except for the requirements in J.6.4.5.4 (C));

(ii) Components and systems requiring continuous monitoring in J.4.1-J.4.9 and all circuits requiring continuous monitoring and monitoring of out-of-range value;

(iii) Exhaust sensor feedback monitoring (J.5.2.2.1 (A)(iii), J.5.2.2.1 (B)(iii) and J.5.2.2.2 (C)).

(iv) Feedback control monitoring (J.5.2.2.3 (D), J.5.4.2.2, J.5.6.2.4, J.5.7.2.5, J.5.8.2.3 and J.5.9.2.6).

J.6.4.6 Software calibration identification

J.6.4.6.1 On all vehicles, a software calibration identification number (CAL ID) for the onboard diagnostic system or emission-related control unit of powertrain shall be acquired through the standardized standardized diagnostic interface meeting the SAE J1979 requirements. Except as required in J.6.4.6.3, OBD system shall use a separate software calibration identification number (CAL ID) for each diagnostic or emission control unit of powertrain, and respond to a generic scan tool with a unique module address.

J.6.4.6.2 A unique CAL ID shall be used for every emission-related calibration/software set, which contains at least one bit of data different from other emission-related calibration/software set. Control units coded with multiple emission or diagnostic calibrations/software sets shall indicate a unique CAL ID for each variant by a certain method, which enables an off-board device to determine the variant that is being used by the vehicle. For control units that utilize a strategy that will result in MIL illumination if the incorrect variant is used (for example, control units that contain variants for manual and automatic transmissions but will illuminate the MIL if the variant selected does not match the type of transmission on the vehicle), it is not required to use unique CAL ID for each variant.

J.6.4.6.3 Manufacturers may apply to environmental compliance supervision competent authority for approval to respond to each diagnostic or powertrain emission control unit by using more than one CAL ID. The environmental compliance supervision competent authority may grant approval of the application if the manufacturer can ensure that CAL ID of each control unit will respond to a SAE J1978 scan tool as per the sequence from high priority
to low priority.

J.6.4.7 Software calibration verification number

J.6.4.7.1 It is necessary to use an algorithm to calculate a calibration verification number (CVN) that verifies the on-board computer software integrity in diagnostic system or emission-powertrain key control units, and reads CVN by using the s standardized diagnostic interface meeting the SAE J1979 requirements. The CVN can be used to determine whether the emission-related software and/or calibration data are valid and

applicable for that vehicle and CAL ID. One CVN shall apply to one CAL ID and each CVN shall output information to a scan tool in the order as the CAL IDs are output to the scan tool, so that the scan tool can match each CVN to the corresponding CAL ID.

J.6.4.7.2 Vehicle manufacturers may apply to environmental compliance supervision competent authority for approval to adopt an algorithm to calculate the CVN. The environmental compliance supervision competent authority shall determine whether to grant approval based on the complexity of the algorithm and the difficulty equivalence of CVN is calculated by using the modified calibration value.

J.6.4.7.3 The CVN shall be calculated at least once per driving cycle and stored until the CVN is updated. The stored CVN information shall not be erased when fault is erased by a generic scan tool meeting SAE J1979 stipulations or during normal vehicle shut down (for example, key off, engine off).

J.6.4.7.4 Where on-board computer received request information of CVN, the stored CVN information can be acquired through generic scan tool connected with data interface.

(A) With the exception of J.6.4.7.4 (B), when receiving CVN request, on-board computer shall neither respond with negative response code (refers to: when sending CVN code, neither respond with postpone nor respond with message indicating that current CVN value is unavailable) nor respond with default value. Default value is defined as any value or placeholder rather than valid CVN.

(B) If CVN request information is received within the 1st 120s of vehicle-start after reprogramming or non-volatile memory clear or the 1st 120s after volatile memory clear or battery disconnection, on-board computer shall respond with a negative response to instruct scan tool to wait, or resend request information after a period of postpone. Such response and postpone shall be in compliance with relevant stipulations of J1979 on CVN data transmission.

(C) Under the following circumstances, when communication malfunction causes failure to response to CVN report request of scan tool, it is allowed to use a default CVN value in lieu of valid CVN value:

(i) Storage of a pending fault code or confirmed fault code for MIL illumination indicates communication fault of failure to report valid CVN module, and

(ii) The default CVN value cannot be misunderstood as valid CVN value (for example: the default values are all zero or all question marks).

J.6.4.7.5 For purposes of inspection and maintenance (I/M) testing, manufacturers shall make the CVN and CAL ID combination information available in a standardized electronic format that enables off-board verification that the CVN is valid and verification whether it is suitable for a specific vehicle and CAL ID.

J.6.4.8 Vehicle identification number

J.6.4.8.1 All vehicles shall have a vehicle identification number (VIN) in a standardized format, the VIN can be acquired by using standardized diagnostic interface meeting SAE J1979 requirements. Only one electronic control unit per vehicle is required to report the VIN to SAE J1978 scan tool.

J.6.4.8.2 If the VIN is reprogrammable, all emission-related diagnostic information (i.e. all information required to be erased in accordance with SAE J1979 stipulations when a mode/service $04 clear/reset emission-related diagnostic information command is

received) shall be erased during the reprogramming of the VIN.

J.6.4.9 **ECU name:** The name of each electronic control unit that responds to SAE J1978 scan tool with a unique address or identifier shall be communicated in a standardized format meeting stipulations of SAE J1979 (for example, ECUNAME in Service/Mode $09, InfoType $0A).

J.6.5 IUPR tracking requirements

J.6.5.1 For each monitor required in J.4 and J.5 to separately report IUPR, manufacturers shall adopt software algorithms to report a numerator and denominator of IUPR in the standardized format specified, and the format shall meet the stipulations of SAE J1979.

J.6.5.2 Numerical value specifications

J.6.5.2.1 For the numerator, denominator, general denominator and ignition cycle counts:

(A) The minimum value of each number shall be 0, maximum value shall be 65,535 and resolution shall be 1.

(B) Each numeral shall meet the following requirements

(i) Each number shall be reset to 0 only when a non-volatile memory is reset (such as reprogramming event, etc.), or: if the numbers are stored in KAM, if KAM information is lost due to an interruption of electrical power to the control module (such as battery disconnect, etc.), numbers can be set as 0 too. Numbers shall not be reset to 0 under any other circumstances, including when use of a scan tool command to clear fault codes or KAM is reset.

(C) If the numerator or denominator for a specific component reaches 65,535±2, both shall be divided by 2 before numerator or denominator is incremented continuously to avoid overflow.

(D) If the value of ignition cycle counter reaches 65,535±2, it shall continuously increment and set to 0 on the next ignition cycle after exceeding the maximum value, so as to avoid overflow.

(E) If the general denominator reaches the 65,535±2, its value shall continuously increment and set to 0 on the next driving cycle provided that the general denominator definition is met, so as to avoid overflow.

(F) If a vehicle is not equipped with a component (for example, oxygen sensor bank 2 and secondary air system), the corresponding numerator and denominator for relevant component shall always be reported as 0.

J.6.5.2.2 For IUPR

(A) Minimum value of IUPR shall be 0 and maximum value shall be 7.99527, resolution shall be 0.000122;

(B) An IUPR for a specific component shall be 0 if the numerator is equal to 0 and the denominator is not 0 for a specific component.

(C) An IUPR for a specific component shall be considered to be the maximum value of 7.99527 if denominator is 0 or if the ratio of the numerator to the denominator exceeds 7.99527.

J.7 Administrative stipulations on deficiencies of OBD system

J.7.1 Manufacturer may apply for environmental compliance supervision competent authority acceptance of OBD system that has one or more deficiencies and cannot completely meet requirements of this Standard.

J.7.2 In considering the application of enterprise, environmental compliance supervision competent authority shall determine whether requirements of this Annex have been effectively and reasonably met. On the basis of data provided by manufacturer, environmental compliance supervision competent authority shall determine whether they describe the details including (but not limited to) the following factors: technical feasibility, product development cycle and production cycle, including design of engine and vehicle, upgraded operation of electronic control unit or cycle of gradual elimination of old products, the extent to which this Standard is satisfied by final OBD system, and evidence of acceptable effort made by the manufacturer to meet requirements of this Standard.

J.7.2.1 The environmental compliance supervision competent authority shall not accept deficiency request without the required diagnostic monitoring function or compulsory record and report of data related to monitoring.

J.7.2.2 The environmental compliance supervision competent authority shall not accept deficiency request without consideration of OBD threshold value.

J.7.3 Classification of deficiency

According to potential influence of deficiency upon vehicle emission, deficiency is divided into two major categories of serious deficiency and non-serious deficiency.

J.7.3.1 For gasoline vehicle/ positive-ignition engine vehicle, serious deficiency means deficiency that does not meet the monitoring requirements in J.4.1, J.4.2, J.4.3, J.4.4, J.4.6, J.4.7 and J.4.13.

J.7.3.2 For diesel vehicle/compression-ignition engine vehicle, serious deficiency means deficiency that does not meet the monitoring requirements in J.5.2, J.5.4, J.5.5, J.5.6, J.5.8 and J.5.9.

J.7.3.3 Deficiency that does not meet other monitoring requirements specified in J.4 and J.5 is non-serious deficiency.

J.7.4 Deficiency period

J.7.4.1 Manufacturer must correct within 12 months deficiency which is required to modify marking only. For deficiency which need to modify software strategy, it could be extended to 24months. For deficiency which need to be redesigned with hardware and verified via test, it could be extended to 36months.For serious deficiency, the environmental protection competent authority should review this deficiency period every 12months within deficiency exemption period.

J.7.4.2 If deficiency is found on vehicle types that have passed type inspection, manufacturer could request to trace and identify the deficiency, and the environmental protection competent authority should verify this deficiency according to J.7.2-J.7.3. In such cases, manufacturer should correct this deficiency according to J.7.4.1 starting from the approval date of the environmental protection competent authority. In case that deficiency request is not proved by the environmental protection competent authority, manufacturer shall immediately adopt measures for correction, including correction for sold vehicle.

Appendix JA
(Normative Appendix)
Functional Item Test of OBD System

JA.1 Summary

This Appendix describes the procedure adopted for test specified in J.4 and J.5. The procedure describes the method for inspection of functions of OBD system installed on vehicle through simulation of failure of relevant systems in engine management system or emission control system. This Appendix also specifies the procedure for determination of durability of OBD system.

Manufacturer shall provide defective components and (or) electric devices for malfunction simulation. During WLTC test, these defective components or devices shall not cause vehicle emissions to exceed the OBD threshold value ~~by more than 1.2 times.~~

During test of vehicle equipped with these defective components or devices, if MIL is activated, then the OBD system passes type inspection. ~~If MIL is activated below OBD threshold value, then the OBD system also passes type inspection.~~

JA.2 Test description

JA.2.1 Test of OBD system includes following phases

JA.2.1.1 Simulation of malfunction of engine management system or emission control system components;

JA.2.1.2 Preconditioning of vehicle with simulated malfunction in accordance with the preconditioning method specified in JA.6.2.1 or JA.6.2.2;

JA.2.1.3 Operation of vehicle with simulated malfunction as per WLTC test cycle and measurement of pollutants from vehicle;

JA.2.1.4 Determine whether OBD system responses to the simulated malfunction, and indicates malfunction to driver through appropriate method.

JA.2.2 Or in accordance with requirements of manufacturer and stipulations of JA.6, simulate malfunction of one or multiple components by using electronic instruments.

JA.2.3 If manufacturer can demonstrate to the environmental compliance supervision competent authority that monitor under WLTC test cycle operation conditions will affect the monitoring conditions restricted in actual use of vehicle, it is allowed to request to monitor under conditions outside WLTC test cycle.

JA.3 Test vehicle and fuel

JA.3.1 Motor vehicle

Manufacturer shall use emission durability test vehicle, or vehicles with identical characteristics of durability test.

JA.3.2 Fuel

Gasoline, diesel, LPG and NG reference fuel specified in Annex K shall be adopted in test. The environmental compliance supervision competent authority may select fuel type used for each fault mode under test (as specified in JA.6.3). It is allowed to select from K.2 for mono-fuel gas vehicle, and select from K.1 or K.2 for bi-fuel vehicle. It is not allowed to change the selected fuel during the entire test (as specified in JA.2.1-JA.2.3). When LPG or NG is used as fuel, it is allowed to start engine with gasoline, after elapse of the predetermined time, shift automatically to LPG or NG (without control by driver).

JA.4 Test temperature and pressure

JA.4.1 Test temperature and pressure shall meet requirements of Annex C on test.

JA.5 Test equipments

JA.5.1 Chassis dynamometer

Chassis dynamometer shall meet requirements of Annex C.

JA.6 OBD system test procedure

JA.6.1 Test cycle performed on chassis dynamometer shall meet requirements of Annex C.

JA.6.2 Vehicle preconditioning

JA.6.2.1 Simulation of malfunction: The manufacturer shall adjust the test component or system on the vehicle to the status of malfunction criteria prior to conducting the preconditioning cycle in JA.6.2.2. If a second preconditioning cycle is permitted in accordance with the stipulations of JA.6.2.3, the manufacturer may adjust the test system or component before conducting the preconditioning cycle. But it is not allowed to replace, modify, or adjust the test system or component after start of the last preconditioning cycle.

JA.6.2.2 Vehicle manufacturer can use relevant cycle (for example, WLTC) for preconditioning prior to conducting each test specified in JA.6.4. The vehicle manufacturer shall not require the test vehicle to be cold soaked prior to conducting preconditioning cycles in order to ensure that the monitoring system test is successful.

JA.6.2.3 Optional 2nd preconditioning cycle: Manufacturer may apply to environmental compliance supervision competent authority for approval to use the 2nd preconditioning cycle. If test data/engineering evaluation provided by manufacturer can prove that additional pretreatment cycle is necessary for stabilization of emission control system, environmental compliance supervision competent authority shall grant approval.

JA.6.2.4 Exemption clause for gasoline engine evaporative system monitor test: the gasoline engine evaporative system monitor specified in JA.6.3.1.2.11 can be exempted from the requirements in JA.6.2.

JA.6.3 Monitoring system verification requirements

JA.6.3.1 Vehicles equipped with positive-ignition engine

JA.6.3.1.1 Test equipment and requirements

- The requirements set in Annex C and Annex K apply to test equipment, emission test method, fuel for test, standard gas, dynamometer driving cycle and instrument calibration.
- It is necessary to select a vehicle that has passed durability test or a vehicle of which catalytic converter has deteriorated.
- Method of diagnostic system to confirm fault code shall be identical with the method specified in "J.6 standardization requirement".

JA.6.3.1.2 Test contents required to be tested

Manufacturer shall perform test of single fault of following components/systems by adopting customized malfunction criteria on the basis of WLTC test cycle. When performing verification test, manufacturer may also electronically simulate the deteriorated components.

JA.6.3.1.2.1 Exhaust gas sensors

JA.6.3.1.2.1.1 Manufacturer shall perform test with all front oxygen sensors (conventional switching sensors and wide range or universal sensors) used for fuel control simultaneously possessing a response rate deteriorated to the malfunction limits in J.4.7.2.1 (A). For conventional switching sensors, manufacturer shall perform test for response rate malfunction under single worst case required in J.4.7.2.1 (A). For wide range or universal sensors, manufacturer shall perform test for response rate malfunction under single

worst case required in J.4.7.2.1 (A). It is also necessary to perform test for any other front oxygen sensor parameters that can cause vehicle emissions to exceed the OBD threshold value.

JA.6.3.1.2.1.2 For vehicles utilizing sensors other than oxygen sensors for basic fuel control (such as hydrocarbon sensors, etc.), manufacturer shall submit to environmental compliance supervision competent authority a test plan for performing test of all of the degradation failure s of sensor parameters that can cause emissions to exceed the malfunction threshold. The environmental compliance supervision competent authority shall approve the plan if the submitted data can assure proper performance of the diagnostic functions of sensor.

JA.6.3.1.2.2 EGR system: Manufacturer shall perform flow rate verification test where emission defined in J.4.8.2.1 reaches each limit of OBD threshold value.

JA.6.3.1.2.3 VVT system: Manufacturer shall perform test at each target error limits and response lag limits to the OBD threshold value of emission defined in J.4.12.2.1 and J.4.12.2.2. In the VVT system demonstration tests, manufacturer may use computer modifications to cause the VVT system to operate at the conditions of malfunction limits if manufacturer can demonstrate that the computer modifications produce results equivalent to an induced hardware malfunction.

JA.6.3.1.2.4 Fuel system:

JA.6.3.1.2.4.1 For vehicles with adaptive feedback adjustment based on the front oxygen fuel control, manufacturer shall perform a test with the adaptive feedback adjustment based on the front oxygen fuel control at the rich limits and a test at the lean limits, rich limits and lean limits shall be calibrated as per J.4.6.2.1 (A) by manufacturer.

JA.6.3.1.2.4.2 For vehicles with feedback adjustment using rear oxygen sensor and subject to the malfunction criteria in J.4.6.2.1 (B), manufacturer shall perform a test with the feedback adjustment based on the rear oxygen sensor at the rich limits and a test at the lean limits, rich limits and lean limits shall be calibrated as per standard of J.4.6.2.1 (B) by manufacturer.

JA.6.3.1.2.4.3 For other fuel metering or control system, manufacturer shall perform test at its criteria limits.

JA.6.3.1.2.4.4 When conducting the fuel system demonstration tests, manufacturer may use computer modifications to cause the fuel system to operate at the conditions of malfunction limits if manufacturer can demonstrate that the computer modifications produce results equivalent to an induced hardware malfunction.

JA.6.3.1.2.5 Misfire: Manufacturer shall perform a test at the malfunction limits defined in J.4.3.2.2 (A). For plug-in hybrid electric vehicle, manufacturer shall perform a test at the malfunction limits defined in J.4.3.2.3 (B), it is not required to perform malfunction test defined in J.4.3.2.3 (A).

JA.6.3.1.2.6 Secondary air system: Manufacturer shall perform a verification test at the lowest flow limits defined in J.4.5.2.2 (A).

JA.6.3.1.2.7 Catalytic convertor system: Manufacturer shall perform a verification test using a catalytic convertor system deteriorated to the malfunction criteria defined in J.4.1.2.1.

JA.6.3.1.2.8 Heated catalytic convertor systems: Manufacturer shall perform a verification test under malfunction limits defined in J.4.2.2.1.

JA.6.3.1.2.9 Cold start emission reduction strategy: Manufacturer shall perform a verification test under malfunction limits defined in J.4.11.2.1 (A) or J.4.11.2.1 (B). When performing demonstration test of cold start emission reduction strategy, the manufacturer may use computer modifications to cause the cold start emission reduction strategy to operate at the malfunction limit if the manufacturer can demonstrate that the computer modifications produce results equivalent to induced hardware malfunction.

JA.6.3.1.2.10 Other emission control or source systems: Manufacturer shall perform demonstration test for all other emission control components (such as hydrocarbon traps, adsorbers and etc.) of which malfunction criteria is designed and calibrated at emission reaching OBD threshold value as per requirements of J.4.15.

JA.6.3.1.2.11 Evaporative system: manufacturer shall perform test of evaporative system monitoring in accordance with the leakage orifice diameter defined in J.4.4.2.2 (B) or J.4.4.2.2 (C) (refers to 1mm orifice diameter) or other leakage orifice diameter defined in J.4.4.2.3 or J.4.4.2.4 as approved by environmental compliance supervision competent authority. Manufacturer shall perform test by using the orifice that has diameter determined above and meets the requirements of J.4.4.2.1. Manufacturer shall perform two tests with leakage orifices installed at following locations respectively: (1) in adjacency of refueling pipeline, at fuel tank cap or between fuel tank cap and fuel tank; and (2) in adjacency of carbon canister, between purge pipeline of carbon canister and fuel tank or between purge pipeline between carbon canister and carbon canister control valve. Manufacturer may apply to environmental compliance supervision competent authority for approval to select different installation points of leakage orifice (for example, in adjacency of carbon canister control valve). If data/engineering evaluation submitted by manufacturer can demonstrate that the installation point can verify leakage more effectively for the specific evaporative system design, environmental compliance supervision competent authority shall grant approval.

JA.6.3.1.2.12 For each test requirement in JA.6.3.1.2, if manufacturer could provide data or engineering evaluation to prove that no failure or deterioration of the test system would result in emissions exceeding OBD threshold and it is only necessary to perform functional check, manufacturer can be exempted from this verification test; ~~but manufacturer shall provide data/engineering evaluation to demonstrate that it is only necessary to perform functional check for the system.~~

JA.6.3.1.2.13 Except JA.6.3.1.2.5, for each of the testing requirements of JA.6.3.1.2, when performing a test, all components or systems used in parallel operation for the same purpose (for example, VVT systems distributed on different intake passages) shall be simultaneously deteriorated to the malfunction criteria limit. Components or systems in series or used for different purposes (for example, upstream and downstream exhaust gas sensors in one same exhaust pipe) need not be simultaneously deteriorated to the malfunction criteria limit.

JA.6.3.1.2.14 The manufacturer may electronically simulate deteriorated components when performing verification test if the manufacturer can demonstrate to the environmental compliance supervision competent authority that the electronic malfunction simulation is equivalent to hardware malfunction, but may not make any vehicle control unit modifications to simulate deteriorated components (unless otherwise allowed as mentioned above). All equipments necessary to perform the demonstration test must be provided to the environmental compliance supervision competent authority as per requirement. A manufacturer may apply to environmental compliance supervision competent authority for approval to simulate a deteriorated component with engine control unit modifications if the manufacturer has submitted data and engineering analysis demonstrating that is technically infeasible to implant the fault with modifications external to the engine control unit.

JA.6.3.2 Vehicles installed with compression-ignition engine

JA.6.3.2.1 Test equipments and requirements

- The requirements set in Annex C and Annex K apply to test equipment, emission test method, fuel for test, standard gas, dynamometer driving cycle and instrument calibration.

- It is necessary to select a vehicle that has passed durability test or a vehicle of which catalytic convertor has deteriorated.
- Method of diagnostic system to confirm fault code shall be identical with the method specified in "JA6.5 standardization requirement".

JA.6.3.2.2 ~~Fault mode of test in addition to the following requirements,~~ manufacturer shall complete test of single malfunction in WLTC under the standard limit value defined in the failure criteria. During verification test, manufacturer could also adopt electronic simulation of fault parts.

JA.6.3.2.2.1 NMHC catalytic convertor: Manufacturer shall perform an independent test for each monitored NMHC catalytic convertor that is used for different purposes (for example, oxidation catalytic convertor upstream of a particulate filter, and NMHC catalytic convertor downstream of a SCR catalytic convertor). Catalytic convertor that is deteriorated to the malfunction criteria in J.6.1.2.2 by using methods established by manufacturer in accordance with J.6.1.2.4 shall be adopted as the catalytic convertor being evaluated. For each monitored NMHC catalytic convertor, manufacturer shall also demonstrate that the OBD system will detect a catalytic convertor malfunction with the catalytic convertor at its severest level of deterioration (for example, the catalyst is completely removed from the catalytic convertor carrier or catalytic convertor removed). During test of complete elimination of catalyst from catalytic convertor carrier, it is not required to measure emission ~~data~~.

JA.6.3.2.2.2 NOx catalytic convertor:

Manufacturer shall perform an independent verification test for each NMHC catalytic convertor that is used for different purposes (for example, passive lean NOx catalytic convertor and SCR catalytic convertor). Catalytic convertor that is deteriorated to the malfunction criteria in J.6.2.2.2.1 and J.6.2.2.3.1 by using methods established by manufacturer in accordance with J.6.2.2.4 shall be adopted as the catalytic convertor being evaluated. For each monitored NOx catalytic convertor, manufacturer shall also demonstrate that the OBD system will detect a catalytic convertor malfunction with the catalytic convertor at its severest level of deterioration (for example, the catalyst is completely removed from the catalytic convertor carrier or catalytic convertor removed). During test of complete elimination of catalyst from catalytic convertor carrier, it is not required to measure emission ~~data~~.

JA.6.3.2.2.3 Misfire: Manufacturer shall perform a WLTC test under the standard limit value defined in the failure criteria.

JA.6.3.2.2.4 Fuel system: Manufacturer shall perform an independent verification test for malfunction of the fuel system parameters (for example, fuel pressure) under the failure criteria defined in J.6.4.2.1. When performing a test for a specific parameter, the fuel system shall be operating at the malfunction criteria limits for applicable parameter only, all other parameters shall be under normal conditions. When conducting the fuel system verification tests, manufacturer may use software simulation to cause the fuel system to operate at the conditions of malfunction limits if manufacturer can demonstrate that the software simulation can produce test results equivalent to the hardware malfunction.

JA.6.3.2.2.5 Exhaust gas sensor: Manufacturer shall perform test for each exhaust gas sensor parameter, which shall be calibrated to the malfunction criteria in the first item of J.6.5.2.1.1, the first item of J.6.5.2.1.2 and J.6.5.2.2.1. When performing a test, sensors used for the same purpose (for example, for one same feedback control loop, for one same control feature on dual exhaust pipes) shall be operating at the malfunction criteria limits for the relevant parameter only. Other exhaust gas sensor parameters shall be under normal conditions.

JA.6.3.2.2.6 Exhaust gas recirculation (EGR) system: Manufacturer shall perform verification test for exhaust gas flow, response lag and cooling capability in accordance with the malfunction criteria in J.6.6.2.1, J.6.6.2.3 and J.6.6.2.5. When conducting the EGR cooler performance verification test, the EGR cooler adopted shall be deteriorated to relevant malfunction criteria using methods established by manufacturer in accordance with J.6.6.2.5.3. When conducting the EGR system response lag verification tests,
manufacturer may use software simulation to cause the EGR system to operate at the malfunction limits if manufacturer can demonstrate that the software simulation can produce test results equivalent to the hardware malfunction or that there is no feasible method to induce a hardware malfunction.
JA.6.3.2.2.7 Boost pressure control system: Manufacturer shall perform verification test at each boost, response and cooling malfunction regarding the malfunction criteria specified in J.6.7.2.1 to J.6.7.2.4. When conducting the charge air inter-cooling verification test, the intercooler being evaluated shall be deteriorated to the malfunction criteria specified in J.6.7.2.4.1 using methods established by manufacturer in accordance with J.6.7.2.4.3.
JA.6.3.2.2.8 NOx adsorber: Manufacturer shall perform verification test using NOx adsorber deteriorated to the malfunction criteria specified in J.6.8.2.1. Manufacturer shall also demonstrate that the OBD system will detect a NOx adsorber malfunction with the NOx adsorber at its severest level of deterioration (for example, the catalyst is completely removed from the catalytic convertor carrier or catalytic convertor removed). During test of complete elimination of catalyst from catalytic convertor carrier, it is not required to measure emission data.
JA.6.3.2.2.9 Particulate matter (PM) filter: manufacturer shall perform verification test using a particulate matter (PM) filter as per malfunction criteria in J.6.9.2.1, J.6.9.2.2 and J.6.9.2.4. Manufacturer shall also demonstrate that the OBD system will detect a particulate matter (PM) filter fault with the particulate matter (PM) filter at its severest level of deterioration (for example, catalytic convertor completely removed from the catalytic convertor carrier or catalytic convertor removed). During test of complete elimination of catalyst from catalytic convertor carrier, it is not required to measure emission ~~data~~.
JA.6.3.2.2.10 Cold start emission reduction strategy: Manufacturer shall perform verification test at the malfunction criteria for the system or for each component monitored according to stipulations of J.6.12.2.
JA.6.3.2.2.11 VVT system: manufacturer shall perform test at target error limits or response lag condition set to the malfunction criteria in J.6.13.2.1 and J.6.13.2.2. When conducting the VVT system verification tests, manufacturer may use software simulation to cause the VVT system to reach the malfunction limit condition if manufacturer can demonstrate that the software simulation can produce test results equivalent to a hardware malfunction.
JA.6.3.2.2.12 Other emission control or source systems:
Manufacturer shall conduct demonstration tests for all other emission control components designed and calibrated to a malfunction conditions of emission limits (such as hydrocarbon traps, adsorbers, and etc.) as per requirements of J.6.15.
JA.6.3.2.2.13 For each of the monitoring requirements of JA.6, if manufacturer has confirmed that only a functional check is required because no failure or deterioration of the specific tested system could result in engine's emissions exceeding OBD threshold value, manufacturer is not required to perform a verification test, however manufacturer is required to provide the proof data and technical analysis report used to confirm that only a functional test of the system is required.
JA.6.3.2.2.14 For each of the monitoring requirements of JA.6, when performing test, all components or systems used in parallel for one same purpose (for example, VVT valve used for controlling the work of the

two groups of VVT, separate NOx catalytic convertor on dual exhaust pipes) shall be simultaneously deteriorated to the malfunction criteria. Components or systems in series or used for different purposes (for example, upstream and downstream exhaust gas sensors in one same exhaust post-treatment unit, separate high pressure and low pressure EGR systems) are not required to be simultaneously deteriorated to the malfunction criteria.

JA.6.3.2.2.15 Manufacturer may electronically simulate the deteriorated components if manufacturer can demonstrate to the environmental compliance supervision competent authority that

the test of computer simulation program can produce test results equivalent to that using hardware malfunction, but a precondition is that manufacturer may not make any vehicle control unit modifications when performing verification tests. All equipments necessary for the verification test must be provided upon request of environmental compliance supervision competent authority. Vehicle manufacturer may request environmental compliance supervision competent authority's approval to electronically simulate a deteriorated component with engine control unit modifications if manufacturer has submitted data and data analysis demonstrating that it is technically infeasible to implant the fault with modifications external to the engine control unit.

JA.6.4 OBD system test

JA.6.4.1 Test procedure

JA.6.4.1.1 Verification of test cycle: After manufacturer meets requirements of JA.6.2 on vehicle preconditioning, test vehicle shall be subjected to WLTC cycle operation for the sake of initial inspection of under-test system or component malfunction. If required by specific monitoring strategy, it is allowed to perform cold soaking before test cycle. If initial malfunction detection has been realized in pre-treatment of JA.6.2, manufacturer is not required to perform the verification test cycle.

JA.6.4.1.2 The optional 2nd verification test cycle: If a monitor is designed to be performed beyond WLTC cycle condition, manufacturer may operate test vehicle under appropriate condition before JA.6.4.1.3 exhaust emission cycle, so that OBD system stores confirmed fault code and illuminates MIL.

JA.6.4.1.3 Exhaust emission cycle: Manufacturer shall perform WLTC cycle test of test vehicle. Manufacturer may apply to the environmental compliance supervision competent authority to perform additional test cycle or other driving conditions before implantation of fault (for example, JA.6.2.1). If test data/engineering evaluation provided by manufacturer demonstrates that additional test cycle or driving conditions are necessary for stable emission control system, ~~the environmental compliance supervision competent authority shall grant approval.~~

JA.6.4.1.4 Exemption clause of gasoline engine evaporative system monitor test: gasoline engine evaporative system monitor specified in JA.6.3.1.2.11 can be exempted from the requirements in JA.6.4.1.1, JA.6.4.1.2 and JA.6.4.1.3. Manufacturer may operate vehicle under appropriate conditions, so that necessary monitoring condition is met, appropriate confirmed fault codes is stored, and MIL is illuminated. Test can be completed in laboratory with or without dynamometer, and can be completed on outdoor road surface too.

JA.6.4.2 Acquisition of test data

JA.6.4.2.1 In the test procedure specified in JA.6.4.1:

(A) The following data shall be acquired by the manufacturer:

(i) The approximate time (a period of time after engine start, unit is s) when MIL is illuminated during test cycle (For example, MIL is illuminated 402s after the start of emission cycle.);

(ii) Emission test data: Emission test data shall include emission data of NMHC, CO, NOx, PM and CO_2.

JA.6.4.2.2 Exemption clause of gasoline engine evaporative system monitor test: gasoline engine evaporative system monitor specified in JA.6.3.1.2.11, manufacturer can be exempted from the requirements in JA.6.4.2.1. Data defined in JA.6.4.2.2 (A) shall be collected. Manufacturer shall collect data after the completion of the monitoring and MIL is illuminated.

(A) The approximate time (a period of time after engine start, unit is s) when MIL is illuminated and running distance of vehicle prior to illumination of MIL.

JA.6.4.3 Evaluation criteria

JA.6.4.3.1 For all tests carried out as per requirements of this chapter, the MIL shall be illuminated upon detection of the tested system or component malfunction before the end of the exhaust emission test in accordance with requirements of J.4 and J.5.

JA.6.4.3.2 In accordance with the requirements of J.4 and J.5, if MIL is illuminated before emission exceeds 1.2 times of OBD threshold value, it is unnecessary to carry out further verification test. In the misfire demonstration test, if manufacturer has selected to use the minimum misfire malfunction criteria of 1% allowed in J.4 and J.5, no further demonstration test is required if the MIL illuminates in demonstration test adopting this percentage of misfire.

JA.6.4.3.3 If the MIL does not illuminate when the systems or components are set at malfunction boundary, the criteria limits or the type inspection of OBD system is not acceptable.

JA.6.4.3.3.1 If emissions exceed ~~1.2 times of~~ OBD threshold value specified in J.4 and J.5 when the MIL first illuminates, it is necessary to retest after malfunction setup of system or component is adjusted so that the MIL will illuminate before emissions exceed 1.2 times of OBD threshold value specified in J.4 and J.5. If malfunction setup of system or component cannot be adjusted to meet this criterion because a default fuel or emission control strategy is used when a malfunction is detected by OBD system (e.g., open loop fuel control used after an O2 sensor malfunction is detected by OBD system, etc.), the it is necessary to retest with malfunction setup of system or component adjusted to the worst but no malfunction is detected (for example, the applicable monitor indicates that performance of the component or system is OK but very close to the monitoring threshold value causing detection of malfunction, illumination of MIL and activation of default strategy). Manufacturer may apply to the environmental compliance supervision competent authority to keep certain safety distance from the absolute worst of malfunction setup of system or component but no malfunction is detected for the sake of discrete test and data robustness. If the data/engineering evaluation provided by manufacturer sufficiently demonstrates that emissions will not exceed ~~1.2 times of~~ OBD threshold value when malfunction setup of system or component is at the worst situations but no malfunction is detected, and emissions will not exceed ~~1.2 times of~~ OBD threshold value before performance exceeds the criterion limit for detection of malfunction, the environmental compliance supervision competent authority shall grant approval to the application. For monitoring of catalytic convertor or particulate filtering system, the stipulation only applies to those situations where default fuel or emission control strategy will be adopted after detection of malfunction, and the stipulations of JA.6.4.3.3.2 apply to other situations.

JA.6.4.3.3.2 Except the situations specified in JA.6.4.3.3.1, if the MIL first illuminates after emissions exceed the ~~1.2 times of~~ OBD threshold value specified in J.4 and J.5, the test vehicle shall be retested with a less deteriorated catalytic convertor or particulate filter system (for example, more of the engine pollutants are converted or trapped). Adjustment or test may be repeated for catalytic convertor or particulate filter system, it is determined as acceptable if the following results are acquired: the MIL is illuminated and emissions do not exceed ~~1.2 times of~~ the OBD threshold value specified in J.4 and J.5.

JA.6.4.3.4 In accordance with the above criteria, if OBD system is rejected, manufacturer may perform test again after calibration on one same test vehicle. Under such cases, manufacturer must ensure that all functions that passed test previously and are affected by the recalibration are recalibrated. Manufacturer shall demonstrate through retest results of these affected functions.

JA.6.4.3.5 The gasoline engine evaporative system monitor specified in JA.6.3.1.2.11 can be exempted from the requirements in JA.6.4.3.

JA.7 Batch production vehicle evaluation test

JA.7.1 Verification of standardization

JA.7.1.1 Requirement: Manufacturers shall perform test to verify that all vehicles meet the requirements of J.6.3 and J.6.4 relevant to proper communication of required
emission-related messages to SAE J1978 scan tool.

JA.7.1.2 Selection of test vehicles: For vehicles of one same vehicle OBD family specified in Appendix JB, manufacturer shall select one unit of representative vehicle for test, test shall be performed within two months after start of production of the product vehicle. Test results can be extended to one same vehicle OBD family specified in Appendix JB.

JA.7.1.3 Test equipments: For the test required in JA.7.1, manufacturers shall adopt off-board device to conduct the test. Prior to the test, manufacturers shall describe the off-board device required for test to environmental compliance supervision competent authority, and submitted data, specifications, and/or engineering evaluation that demonstrate that: the off-board device meets the minimum requirements to conduct test according to requirements of SAE J1699-3 and SAE J2534 on test software and hardware, ~~the environmental compliance supervision competent authority shall grant approval.~~

JA.7.1.4 Verification test

JA.7.1.4.1 The test shall verify that: it is possible to properly establish communications between all emission-related on-board computers and SAE J1978 scan tool designed as per communication protocols in J.6.3;

JA.7.1.4.2 Further test shall be performed to verify that the vehicle can properly communicate to any SAE J1978 scan tool:

(A) While the engine is running, the current readiness conditions from all on-board computers shall support readiness conditions in SAE J1979 and J.6.4.1;

(B) MIL command conditions shall meet requirements of SAE J1979 and J.6.4.2 while the engine is running, regardless whether the MIL is commanded on or off; shall meet requirements of SAE J1979 and J.3.2.1.2 while the engine is off for the MIL functional check, and shall meet requirements of J.6.4.1.3 for the check of MIL readiness conditions;

(C) All data stream parameters required in J.6.4.2 shall be in compliance with SAE J1979, including that definition of each data stream parameter shall be identical (for example, Mode/Service $01, PID $00);

(D) The CAL ID, CVN, VIN (if any) and ECU Name (if any) shall be in compliance with requirements of SAE J1979 and J.6.4.6 to J.6.4.8;

(E) Emission-related fault code (permanent code, confirmed code and pending code) shall be identical with requirements in SAE J1979 (including correctly indicating the number of stored fault codes and MIL command status (for example, Mode/Service $01, PID $01, Data A)) and J.6.4.4.

JA.7.1.4.3 The test shall verify that: the vehicle can properly respond as per any SAE J1978 scan tool request, clear emission-related fault codes and reset readiness conditions.

JA.7.1.5 Report

JA.7.1.5.1 Manufacturer shall notify the environmental compliance supervision competent authority within one month if identifying any vehicle that does not meet the requirements of JA.7.1.4. Manufacturer shall submit a written report regarding the problem identified and propose correct method (if any) to solve the problem to the environmental compliance supervision competent authority. The environmental compliance supervision competent authority shall consider the following factors in approving the solution: the severity of the problem, the ability of the vehicle to be tested in an I/M program, the ability of service technicians to access the required diagnostic information, the impact on equipment and tool manufacturers, and the length of time interval prior to implementation of the solution.

JA.7.1.5.2 Within three months, if vehicle passes test conducted pursuant to requirements of JA.7.1, vehicle manufacturer shall submit a report of the results and test record files to the environmental compliance supervision competent authority.

JA.7.1.5.3 In accordance with stipulations on retroactive deficiency statement, manufacturer may request environmental compliance supervision competent authority to grant approval to defect request in JA.7.1 evaluation test.

JA.7.2 Verification of monitoring requirements

JA.7.2.1 Within six months after normal production begins, manufacturers shall conduct a complete evaluation of the OBD system of one (or more units) of batch production vehicles (test vehicles) and submit the results of the evaluation to the environmental compliance supervision competent authority.

JA.7.2.2 Selection of test vehicles

JA.7.2.2.1 For vehicles of one same vehicle OBD family specified in Appendix JB, manufacturer shall select one unit of representative vehicle for test. Manufacturer shall perform test for select vehicles and provide evaluation test results. ~~The selection process may be performed during durability verification test for vehicle specified in JA.~~

JA.7.2.3 Evaluation requirements

JA.7.2.3.1 Except the emission neutral diagnosis, the evaluation shall verify the OBD system on the selected test vehicle: when the monitoring conditions have been satisfied for each individual diagnostic required in J, OBD system shall detect a malfunction, illuminate the MIL and store a confirmed fault code and permanent fault code. Manufacturer shall verify that OBD system can erase permanent fault code stored in test of JA.7. For emission neutral diagnosis, it is necessary to verify that the diagnosis can detect malfunction and activate relevant emission neutral default action.

JA.7.2.3.2 The evaluation shall verify that: When non-MIL illuminating diagnosis is used to enable any other diagnosis (for example, fuel level sensor), it will not inhibit malfunction detection capability of other diagnosis functions of OBD system after detecting malfunctions.

JA.7.2.3.3 For installed system on the vehicle, the evaluation shall verify that the numerator counter and denominator counter used to determine the In Use Performance Ratio can be correctly increased in accordance with J.3.4.

JA.7.2.3.4 Malfunctions can be simulated by defective parts or electrical equipment, or apply to the environmental compliance supervision competent authority to simulate a deteriorated component with engine control unit modifications. It is not required to perform emission test to verify whether malfunction threshold value is appropriate. For emission neutral diagnostic in control unit meeting automobile safety integrity level (ASIL) C or D criteria, if standard test flow has unsafe or dangerous situations, manufacturer may apply to change test flow or replace physical test with engineering evaluation.

JA.7.2.3.5 Manufacturers shall submit a proposed test plan to environmental compliance supervision competent authority prior to evaluation test being performed. The test plan shall identify the simulation method malfunction in each diagnosis. If the requirements of JA.7.2 are satisfied by test plan, the environmental compliance supervision competent authority shall grant approval.

JA.7.2.3.6 Subject to environmental compliance supervision competent authority approval, vehicle manufacturers may omit demonstration of specific diagnosis. The competent authority shall approve a manufacturer's request if the demonstration test cannot be performed without causing physical damage to the vehicle (for example, on-board computer internal circuit faults) or personal safety will be influenced, environmental compliance supervision competent authority shall grant approval.

JA.7.2.3.7 For evaluation of test vehicles selected in accordance with requirements of JA.7.2.2, it is unnecessary to perform those demonstration tests that were previously performed as per requirements of JA.

JA.7.2.4 Manufacturers shall submit a report of the results of all test conducted as per requirements of JA.7.2 to the environmental compliance supervision competent authority.

The report shall identify the method used to induce a malfunction in each diagnosis, the MIL illumination conditions, and the confirmed fault code stored. Report shall point out problems in test (for example, a monitor cannot detect malfunction, or cannot store fault code or illuminate MIL when detecting malfunction).

JA.7.2.5 In accordance with stipulations on retroactive deficiency statement, manufacturer may request environmental compliance supervision competent authority to grant approval to defect request in JA.7.2 evaluation test.

JA.7.3 Verification and reporting of in-use monitoring performance

JA.7.3.1 Manufacturers shall collect and report in-use monitoring performance data representative of the OBD family ~~validated by manufacturer for vehicle equipped with in-use monitoring performance tracking software in accordance with J.4.4~~ to environmental compliance supervision competent authority within 12 months after ~~test vehicles selected in the OBD family enter market or~~ the start of normal production of vehicles ~~(whichever is later)~~.

JA.7.3.2 The report must include all of the in-use monitoring performance tracking data reported in SAE J1979 (for example, all numerator counters, denominator counters, and the ignition cycle counters), manufacturer, vehicle model, test group, date of data collected, the odometer reading, the vehicle VIN, and the software calibration identification number. The report submitted by manufacturer shall point out problems of collected data (for example, monitoring item of which average In Use Performance Ratio is less than the minimum monitor performance ratio specified in J.3.2).

JA.7.3.3 Manufacturers shall submit a plan to the environmental compliance supervision competent authority regarding the sampling method, number of vehicles to be sampled, time arrangement to collect the data, and reporting format. If it can be determined that the following conditions are met: it provides data from a representative test vehicles, includes at a minimum 15 vehicles, and be able to cover batch production vehicles within 12 months, furthermore, the collect data can reflect the actual driving conditions of driver and ambient temperatures, and do not on purpose exclude or include vehicles with the highest In Use Performance Ratios, ~~environmental compliance supervision competent authority shall grant approval.~~

JA.7.3.4 Upon request of manufacturer, for vehicle type with annual sale volume less than 5000untis, the minimum number of sample vehicles could be reduced to 15 units (see JA.7.3.3). When granting approval of plan with a reduced number of sample vehicles, the environmental compliance supervision competent

authority shall consider: information submitted by vehicle manufacturer to justify the smaller number of sample vehicles, sales volume of the test vehicle, and the mechanism utilized by vehicle manufacturer to select test vehicles. ~~For vehicle with low sales volume, if sampling mechanism used for selecting test vehicle is identical with sampling mechanism for higher sales volume vehicles in JA.7.3.3, can use the sampling mechanism on test vehicle in JA.7.3.3, replace a fixed method on number of sampling vehicles in the test group of vehicle models with low sales volume, environmental compliance supervision competent authority shall grant approval.~~

Appendix JB
(Normative Appendix)
Basic Characteristics of OBD System Family

JB.1 Definition of various parameters of OBD system family

OBD system family shall be defined as per vehicles in one same family of which basic design parameters are identical. In order to ensure that one OBD system family only includes those vehicles with similar exhaust emission characteristics, it is necessary to take account of the influence caused by potential mutual interference between certain parameters.

JB.2 Vehicles of which the following parameters are identical are deemed as the same engine/emission control/OBD system combination.

Engine:

- Combustion process (i.e. positive-ignition, compression-ignition, 2-stroke and 4-stroke);
- Engine fuel supply mode (i.e. single point or multi-point fuel injection);
- Fuel type (i.e. gasoline, diesel, NG, LPG, bi-fuel of gasoline/NG and bi-fuel of gasoline/LPG).

Pollution control device:

- Catalytic convertor type (i.e. oxidation type, three-way type, heated catalytic convertor, SCR and others);
- Particulate filter type;
- Secondary air injection (i.e. with or without);
- Exhaust gas recirculation (EGR) (i.e. with or without).

Power transmission system:

Hybrid electronic vehicle (yes/no)

Components and functions of ECU and OBD system:

- OBD system function monitoring, malfunction monitoring and method of malfunction indication to vehicle driver.