

## **APPENDIX A**

Modifications to Malfunction and Diagnostic System Requirements for 2003 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II), Section 1968.2, Title 13, California Code Regulations

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## §1968.2 Malfunction and Diagnostic System Requirements--2003 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines

### (a) PURPOSE

- (1.0) The purpose of this regulation is to establish emission standards and other requirements for onboard diagnostic systems (OBD II systems) that are installed on new 2003 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles and engines certified for sale in California. The OBD II systems, through the use of an onboard computer(s), shall monitor emission systems in-use over normal driving conditions for the actual life of the vehicle and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions.

### (b) APPLICABILITY

- (1.0) All 2003 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles, including medium-duty vehicles with engines certified on an engine dynamometer, shall be equipped with an OBD II system.
- (2.0) All 2003 and subsequent model year vehicles and engines certified to run on alternate fuels shall meet these requirements. However, manufacturers may request the Executive Officer to waive specific monitoring requirements in section (e)<sup>1</sup> for which monitoring may not be reliable with respect to the use of alternate fuels through the 2004 model year. The Executive Officer shall grant such requests provided the manufacturer adequately demonstrates that the use of the alternate fuel could cause false illumination of the MIL even when using the best available monitoring technologies.

### (c) DEFINITIONS

- (1.0) "Alternate Phase-in" is one that achieves equivalent emission reductions by the end of the last year of the scheduled phase-in. The emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected sales volume of all vehicles and engines) meeting the new requirements per year by the number of years implemented prior to and including the last year of the scheduled phase-in and then summing these yearly results to determine a cumulative total (e.g., a three year, 30/60/100 percent scheduled phase-in would be calculated as  $(30\% \times 3 \text{ years}) + (60\% \times 2 \text{ years}) + (100\% \times 1 \text{ year}) = 310$ ). Manufacturers shall be allowed to include vehicles introduced before the first year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as  $(10\% \times 4 \text{ years})$  and added to the cumulative total). Any alternate phase-in which results in an equal or larger cumulative total by the end of the last year of the scheduled phase-in shall be considered acceptable by the Executive Officer; however, all vehicles shall comply with the respective

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<sup>1</sup> Unless otherwise noted, all section references refer to section 1968.2 of Title 13, CCR.

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requirements subject to the phase-in within one model year following the last year of the scheduled phase-in.

- (2.0) “Base Fuel Schedule” refers to the fuel calibration schedule programmed into the Powertrain Control Module or PROM when manufactured or when updated by some off-board source, prior to any learned on-board correction.
- (3.0) “Calculated load value” refers to an indication of the percent engine capacity that is being used and is defined in the SAE 1979 specifications. For diesel applications, the calculated load value shall be determined by the ratio of current output torque to maximum output torque at current engine speed.
- (4.0) “Confirmed fault code” is defined as the diagnostic trouble code stored when an OBD II system has confirmed that a malfunction exists (e.g., typically on the second driving cycle that the malfunction is detected) in accordance with the requirements of sections (e) and (f)(3.4).
- (5.0) “Continuous monitoring” means sampling at a rate no less than two samples per second. If for engine control purposes, a computer input component is sampled less frequently, the signal of the component may instead be evaluated each time sampling occurs.
- (6.0) “Deactivate” means to turn-off, shutdown, desensitize, or otherwise make inoperable during the conditions in section (e) through software programming or other means.
- (7.0) “Diagnostic or emission critical” electronic powertrain control unit refers to the engine and automatic transmission control unit(s) and any other on-board electronic powertrain control unit containing software that has primary control over any of the monitors required by sections (e)(2.0) through (e)(16.0) and (e)(18.0) or has primary control over the diagnostics for more than two of the components required to be monitored by section (e)(17.0).
- (8.0) “Diesel engines” refers to engines using a compression ignition thermodynamic cycle.
- (9.0) “Driving cycle” consists of engine startup and engine shutoff and includes the period of engine off time up to the next engine startup. For vehicles that employ engine shutoff strategies (e.g., engine shutoff at idle), the manufacturer may request Executive Officer approval to use an alternate definition for driving cycle (e.g., key on and key off). Executive Officer approval of the alternate definition shall be based on equivalence to engine startup and engine shutoff for a conventional vehicle. Engine restarts following an engine shut-off that has been neither commanded by the vehicle operator nor by the engine control strategy but caused by an event such as an engine stall may be considered a new driving cycle or a continuation of the existing driving cycle.
- (10.0) “Engine misfire” means lack of combustion in the cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. This does not include lack of combustion events in non-active cylinders due to default fuel shut-off or cylinder deactivation strategies.
- (11.0) “Engine Start” is defined as the point when the engine reaches a speed 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission). For hybrid vehicles or for engines employing alternate engine start hardware or strategies (e.g., integrated

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- starter and generators, etc.), the manufacturer may request Executive Officer approval to use an alternate definition for engine start. Executive Officer approval of the alternate definition shall be based on equivalence to an engine start for a conventional vehicle.
- (12.0) “Fault memory” means information pertaining to malfunctions stored in the onboard computer including but not limited to fault codes, stored engine conditions, and MIL status.
- (13.0) “Federal Test Procedure” (FTP) cycle or test. For passenger vehicles, light-duty trucks, and medium-duty vehicles certified on a chassis dynamometer, FTP cycle or test refers to the driving schedule in Code of Federal Regulations (CFR) 40, Appendix 1, Part 86, section (a) entitled, “EPA Urban Dynamometer Driving Schedule for Light-Duty Vehicles and Light-Duty Trucks.” For medium-duty engines certified on an engine dynamometer, FTP cycle or test refers to the engine dynamometer schedule in CFR 40, Appendix 1, Part 86, section (f)(1), entitled, “EPA Engine Dynamometer Schedule for Heavy-Duty Otto-Cycle Engines,” or section (f)(2), entitled, “EPA Engine Dynamometer Schedule for Heavy-Duty Diesel Engines.”
- (13.1) “Federal test procedure (FTP) standard” refers to the certification tailpipe exhaust emission standards (both 50,000 mile and FTP full useful life standards) applicable to the class to which the vehicle is certified.
- (13.2) “FTP full useful life standard” refers to the FTP standard applicable when the vehicle reaches the end of its full useful life as defined in “California Exhaust Emissions Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles”, adopted August 5, 1999, Section C.1.
- (14.0) “Fuel trim” refers to feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments.
- (15.0) “Functional check” for an output component means verification of proper response to a computer command.
- (16.0) “Key on, engine off position” refers to a vehicle with the ignition key in the engine run position (not engine crank or accessory position) but with the engine not running.
- (17.0) “Light-duty truck” is defined in Title 13, Section 1900 (b)(8).
- (18.0) “Low Emission Vehicle I” refers to a vehicle or engine certified in California to a “Low Emission Vehicle I” emission category including, but not limited to a Transitional Low Emission Vehicle (TLEV), a Low Emission Vehicle (LEV), an Ultra Low Emission Vehicle (ULEV), or a Super Ultra Low Emission Vehicle (SULEV). These vehicle categories are further defined in Title 13, Sections 1956.8 and 1960.1. For purposes of this regulation, “Low Emission Vehicle I” shall refer to vehicles or engines in any of the above subcategories while reference to the specific subcategories (“TLEV vehicles”, “LEV vehicles”, “ULEV vehicles”, and “SULEV vehicles”, etc.) shall refer only to vehicles or engines within that subcategory. Additionally, vehicles certified to Federal emission standards (bins) in California but categorized in a Low Emission Vehicle I

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standard for purposes of calculating NMOG fleet average in accordance with section H.1 of the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles”, amended December 27, 2000, shall be subject to all monitoring requirements applicable to Low Emission Vehicle I category vehicles but shall use the certification standard (i.e., the Federal bin) for purposes of determining the malfunction thresholds in section (e).

- (18.1) “MDV SULEV vehicles” shall refer only to medium-duty vehicles certified to the SULEV subcategory in the Low Emission Vehicle I standards.
- (19.0) “Low Emission Vehicle II” refers to a vehicle or engine certified in California to a “Low Emission Vehicle II” emission subcategory including, but not limited to a LEV, ULEV, or a SULEV. These vehicle subcategories are further defined in Title 13, Section 1961. For purposes of this regulation, “Low Emission Vehicle II” shall refer to vehicles or engines in any of the above subcategories while reference to a specific subcategory (“LEV II vehicles”, “ULEV II vehicles”, and “SULEV II vehicles”, etc.) shall refer only to vehicles or engines within that subcategory. Additionally, vehicles certified to Federal emission standards (bins) in California but categorized in a Low Emission Vehicle II standard for purposes of calculating NMOG fleet average in accordance with section H.1 of the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles”, amended December 27, 2000, shall be subject to all monitoring requirements applicable to Low Emission Vehicle II category vehicles but shall use the certification standard (i.e., the Federal bin) for purposes of determining the malfunction thresholds in section (e).
- (19.1) “PC/LDT SULEV II vehicles” shall refer only to passenger cars and light-duty trucks certified to the SULEV subcategory in the Low Emission Vehicle II standards.
- (19.2) “MDV SULEV II vehicles” shall refer only to medium-duty vehicles certified to the SULEV subcategory in the Low Emission Vehicle II standards.
- (20.0) “Malfunction” means any deterioration or failure of a component that causes the performance to be outside of the applicable limits in section (e).
- (21.0) “Medium-duty vehicle” is defined in Title 13, Section 1900 (b)(9).
- (21.1) “Medium-duty passenger vehicle” is defined in Title 40, Section 86.1803-01, Code of Federal Regulations.
- (22.0) “Passenger car” is defined in Title 13, Section 1900 (b)(12).
- (23.0) “Pending fault code” is defined as the diagnostic trouble code stored upon the initial detection of a malfunction (e.g., typically on a single driving cycle) prior to illumination of the MIL in accordance with the requirements of section (e) and (f)(3.4).
- (24.0) “Percentage of misfire” as used in (e)(4.2) means the percentage of misfires out of the total number of firing events for the specified interval.
- (25.0) “Power Take-Off (PTO) unit” refers to an engine driven output provision for the purposes of powering auxiliary equipment (e.g., a dump-truck bed, aerial bucket, or tow-truck winch).

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- (26.0) "Rationality fault diagnostic" for an input component means verification of the input signal being in the range of normal operation, including evaluation of the signal's rationality in comparison to all available information.
- (27.0) "Redline engine speed" means the manufacturer recommended maximum engine speed as normally displayed on instrument panel tachometers, or the engine speed at which fuel shutoff occurs.
- (28.0) "Response rate" for oxygen sensors refers to the delay between a switch of the sensor from lean to rich or vice versa in response to a commanded change in air/fuel ratio.
- (29.0) "SC03 cycle" refers to the driving schedule in CFR 40, Appendix 1, Part 86, section (h) entitled, "EPA SC03 Driving Schedule for Light-Duty Vehicles and Light-Duty Trucks".
- (30.0) "Secondary air" refers to air introduced into the exhaust system by means of a pump or aspirator valve or other means that is intended to aid in the oxidation of HC and CO contained in the exhaust gas stream.
- (31.0) "Similar conditions" as used in sections (e)(4.0) and (e)(7.0) means engine conditions having an engine speed within 375 rpm, load conditions within 20 percent, and the same warm-up status (i.e., cold or hot) as the engine conditions stored pursuant to (e)(4.4.3) and (e)(7.4.5). The Executive Officer may approve other definitions of similar conditions based on comparable timeliness and reliability.
- (32.0) "Small volume manufacturer" is defined in Title 13, Section 1900 (b)(18).
- (33.0) "Unified Cycle" is defined in "Speed Versus Time Data for California's Unified Driving Cycle", dated December 12, 1996, incorporated by reference.
- (34.0) "US06 cycle" refers to the driving schedule in CFR 40, Appendix 1, Part 86, section (g) entitled, "EPA US06 Driving Schedule for Light-Duty Vehicles and Light-Duty Trucks."
- (35.0) "Warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit (140 degrees Fahrenheit for diesel applications).

## (d) GENERAL REQUIREMENTS

### (1.0) The OBD II System.

- (1.1) If a malfunction is present as specified in section (e), the OBD II system shall detect the malfunction, store a pending or confirmed fault code in the onboard computer's memory, and illuminate the MIL as required.
- (1.2) The onboard computer system shall be equipped with a standardized data link connector to provide access to the stored fault codes.
- (1.3) The OBD II system shall be designed to operate, without any required scheduled maintenance, for the actual life of the vehicle in which it is installed and shall not be programmed or otherwise designed to deactivate based on age and/or mileage of the vehicle during the actual life of the vehicle.
- (1.4) Specific performance requirements for components and systems that shall be monitored are set forth in section (e) below.



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- (1.5) Computer-coded engine operating parameters shall not be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) computer enclosures). Subject to Executive Officer approval, manufacturers may exempt from this requirement those product lines that are unlikely to require protection. Criteria to be evaluated in making an exemption include, but are not limited to, current availability of performance chips, high performance capability of the vehicle, and sales volume.
- (2.0) MIL and Fault Code Storage.
  - (2.1) Unless otherwise provided in section (e), if a malfunction has been detected and a pending fault code is presently stored, the MIL shall illuminate to inform the vehicle operator of an OBD II related malfunction.
  - (2.2) The MIL shall also illuminate to inform the vehicle operator whenever the powertrain enters a default or “limp home” mode of operation that can affect emissions or the performance of the OBD II system, in the event of a malfunction of the on-board computer(s) itself, or whenever the fuel control system fails to enter closed-loop operation (if employed) within a manufacturer specified time interval.
  - (2.3) The MIL shall be located on the driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions. The MIL, when illuminated, shall display the phrase “Check Engine” or “Service Engine Soon”. The word “Powertrain” may be substituted for “Engine” in the previous phrases. Alternatively, the International Standards Organization (ISO) engine symbol may be substituted for the word “Engine” or for the entire phrase.
  - (2.4) The MIL shall continuously illuminate in the key on, engine off position before engine cranking to indicate that the MIL is functional. For all 2005 and subsequent model year vehicles, the MIL shall illuminate during this functional check for a minimum of 15-20 seconds. During this functional check of the MIL, the data stream value for MIL status shall indicate commanded off (see section (f)(3.2)) unless the MIL has also been commanded on for a detected malfunction. This functional check of the MIL shall not be required during vehicle operation in the key on, engine off position subsequent to the initial engine cranking of each driving cycle (e.g., due to an engine stall or other non-commanded engine shutoff).
  - (2.5) At the manufacturer's option, the MIL may be used to indicate readiness status in a standardized format (see section (f)(3.1.3)) in the key on, engine off position.
  - (2.6) The MIL shall not be used for any purpose other than specified in this regulation.
  - (2.7) Except as specifically provided elsewhere in this regulation:
    - (2.7.1) Upon detection of a malfunction, the OBD system shall immediately store a pending fault code indicating the likely area of the malfunction and “freeze frame” engine conditions present at the time the malfunction occurs.

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- (2.7.2) After storage of a pending fault code, if the identified malfunction is again detected before the end of the next driving cycle in which monitoring occurs, the MIL shall illuminate continuously and a confirmed fault code shall be stored within 10 seconds. If a malfunction is not detected before the end of the next driving cycle in which monitoring occurs (i.e., there is no indication of the malfunction at any time during the driving cycle), the corresponding pending fault code and “freeze frame” conditions set according to (d)(2.6.1) may be erased at the end of the driving cycle.
- (2.7.3) A manufacturer may request to employ alternate statistical MIL illumination and fault code storage protocols to those specified in these requirements. The Executive Officer shall grant approval if the manufacturer provides data and/or engineering evaluation that adequately demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Except as otherwise provided in section (e) for evaporative system malfunctions, strategies requiring on average more than six driving cycles for MIL illumination shall not be accepted.
- (2.8) Extinguishing the MIL
  - (2.8.1) Except as otherwise provided in sections (e)(4.4.4) and (e)(7.4.6) for misfire and fuel system malfunctions, once the MIL has been illuminated it may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions and the previously identified malfunction is no longer present provided no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
- (2.9) Erasing a confirmed fault code. The diagnostic system may erase a confirmed fault code if the identified malfunction has not been again detected in at least 40 engine warm-up cycles, and the MIL is presently not illuminated for that malfunction.
- (3.0) General Monitoring Conditions.
  - (3.1) For all 2003 and subsequent model year vehicles:
    - (3.1.1) Except as specifically provided elsewhere in sections (e)(2.0) through (e)(19.0), manufacturers shall define monitoring conditions, subject to Executive Officer approval, for detecting malfunctions identified in section (e). The Executive Officer shall approve monitoring conditions that are necessary to: ensure robust detection of malfunctions, ensure sufficient frequency of operation in-use such that malfunctions will be detected and the MIL will be illuminated within two weeks for 90% of the vehicles, and ensure monitoring will occur during the FTP (or other Executive Officer approved) test cycle.
    - (3.1.2) Monitoring shall occur at least once per driving cycle in which the monitoring conditions are met.
  - (3.2) For 50 percent of 2005 model year vehicles, 75 percent of 2006 model year vehicles, and 100 percent of all 2007 and subsequent model year vehicles:
    - (3.2.1) Manufacturers shall implement software algorithms in the OBD II system

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to track in-use performance of each of the following components: catalyst bank 1, catalyst bank 2, primary oxygen sensor bank 1, primary oxygen sensor bank 2, evaporative 0.020" leak detection system, EGR system, and secondary air system. For each of these components, the OBD II system shall report a numerator and denominator in the standardized format specified in sections (d)(3.2.2) through (3.2.4) below, section (f)(4.0), and in accordance with Mode \$09 of the SAE J1979 specifications. The OBD II system shall also report a ignition cycle counter in the standardized format specified in sections (d)(3.2.5) and (f)(4.0) and in accordance with Mode \$09 of the SAE J1979 specifications.

## (3.2.2) Numerator Specifications

### (A) Definition:

- (i) The numerator shall be defined as a measure of 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.
- (ii) The OBD II system shall report a separate numerator for each of the components listed in section (d)(3.2.1).
- (iii) For specific components that have multiple monitors required to be reported under section (e) (e.g., oxygen sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD II system shall separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio (as defined in (d)(3.2.4)). If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator shall be reported for the specific component.
- (iv) The numerator shall be reported in accordance with the specifications in section (f)(4.2.1).

### (B) Specifications for incrementing:

- (i) Except as provided for in section (d)(3.2.2)(B)(vi), each numerator shall be incremented a maximum of one time per driving cycle.
- (ii) The numerator for a specific component shall be incremented immediately (i.e., within ten seconds) if and only if the following conditions are satisfied on a single driving cycle:
  - a. Every condition necessary for the monitors of the specific component to detect a malfunction and store a pending fault code has been satisfied including, but not limited to, enable criteria, presence or absence of related fault codes, sufficient length of monitoring time, and diagnostic executive priority assignments. For the purpose of incrementing the numerator, satisfying all the conditions necessary for a monitor to determine the component is passing shall not, by itself, be sufficient to meet this criteria;
  - b. For monitors that require multiple stages or events in a single driving cycle to store a pending code, every condition necessary

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for all events to have completed must be satisfied;

- c. For monitors that require intrusive operation of components to execute specific monitors, every condition necessary for the intrusive event to occur must be satisfied.
  - (iii) For monitors that can generate results in a “gray zone” or “non-detection zone” (i.e., results that indicate neither a passing system nor a malfunctioning system), the manufacturer shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. In reviewing the plan for approval, the Executive Officer shall consider data and/or engineering evaluation submitted by the manufacturer demonstrating the expected frequency of results in the “non-detection zone” and the ability of the monitor to accurately determine if a monitor would have detected a malfunction instead of a result in the “non-detection zone”. In general, however, the Executive Officer shall not approve plans that allow the numerator to be incremented when the monitor indicates a result in the “non-detection zone”.
  - (iv) Within ten seconds of a malfunction being detected (i.e., a pending or confirmed code is stored) that disables a monitor required to be reported in section (e), the OBD II system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the malfunction is no longer detected (i.e., the pending code is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators shall resume within ten seconds.
  - (v) Within ten seconds of the start of a PTO (see (c)(25.0)) operation that disables a monitor required to be reported in section (e), the OBD II system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators shall resume within ten seconds.
  - (vi) Manufacturers utilizing alternate statistical MIL illumination protocols as allowed in section (d)(2.7.3) for any of the components requiring a numerator shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing support data and/or engineering evaluation justifying the proposed plan, the equivalence of the incrementing in the manufacturer's plan to the incrementing specified in section (d)(3.2.2)(B) for monitors using the standard MIL illumination protocol, and the overall equivalence of the manufacturer's plan to the intent of the specified requirements in representing a measure of MIL illumination in approximately two weeks time.
- (3.2.3) Denominator Specifications
- (A) Definition:
    - (i) The denominator shall be defined as a measure of the number of times

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- a vehicle has been operated.
  - (ii) The OBD II system shall report a separate denominator for each of the components listed in section (d)(3.2.1).
  - (iii) The denominator shall be reported in accordance with the specifications in section (f)(4.2.1).
- (B) Specifications for incrementing:
- (i) Each denominator shall be incremented a maximum of one time per driving cycle.
  - (ii) The denominator for a specific component shall be incremented immediately (i.e., within ten seconds) if and only if the following conditions are satisfied on a single driving cycle:
    - a. Time elapsed since engine start is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;
    - b. Cumulative vehicle operation at or above 25 miles per hour occurs for greater than or equal to 300 seconds;
    - c. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and vehicle speed less than or equal to one mile per hour) for greater than or equal to 30 seconds;
    - d. Additionally, for the secondary air system denominator only, commanded “on” operation of the secondary air system occurs for a time greater than or equal to ten seconds. For purposes of determining this commanded “on” time, the OBD II system shall not include time during intrusive operation of the secondary air system solely for the purposes of monitoring;
    - e. Additionally, for the evaporative system denominator only:
      - 1. Time elapsed since engine start is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit;
      - 2. Engine cold start occurs defined as engine coolant temperature at engine start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.
  - (iii) The OBD II system shall immediately (i.e., within ten seconds) disable further incrementing of all numerators and denominators if a malfunction of any component used to determine if the conditions in (d)(3.2.3)(C)(ii)(a) through (f) are satisfied (i.e., vehicle speed, ambient temperature, elevation, idle operation, engine cold start, or time of operation) has been detected and the corresponding pending fault code has been stored. Incrementing of all numerators and denominators shall immediately (i.e., within ten seconds) resume when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

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- (3.2.4) Ratio Specifications
- (A) The ratio shall be defined as the numerator divided by the denominator.
  - (B) For purposes of determining which ratio to report as required in section (d)(3.2.2)(A)(iii), the ratio shall be calculated in accordance with the specifications in section (f)(4.2.2).
- (3.2.5) Ignition cycle counter
- (A) Definition:
    - (i) The OBD II system shall report a single counter that indicates the number of ignition cycles.
    - (ii) The ignition cycle counter shall be reported in accordance with the specifications in section (f)(4.2.1).
  - (B) Specifications for incrementing:
    - (i) The ignition cycle counter shall be incremented a maximum of one time per driving cycle.
    - (ii) The ignition cycle counter shall be incremented immediately (i.e., within ten seconds) if and only if the vehicle meets the engine start definition (see (c)(11.0)) for at least one second.
    - (iii) The OBD II system shall immediately (i.e., within ten seconds) disable further incrementing of the ignition cycle counter if a malfunction of any component used to determine if the conditions in (d)(3.2.5)(B)(ii) are satisfied (i.e., engine speed, or time of operation) has been detected and the corresponding pending fault code has been stored. Incrementing of the ignition cycle counter shall immediately (i.e., within ten seconds) resume when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).
    - (iv) The OBD II system shall disable further incrementing of the ignition cycle counter within ten seconds of the MIL being commanded on (as reported through Mode \$01, PID \$01 of J1979) for any reason. When the MIL is extinguished (e.g., through self-clearing or through a scan tool command), incrementing of the ignition cycle counter shall resume within ten seconds.
- (3.2.6) For purposes of this regulation, monitors that report a numerator and denominator that represent a ratio (as defined in section (d)(3.2.4)) greater than or equal to 0.250 on a representative sample of in-use vehicles shall be accepted by the Executive Officer as meeting the requirements for ensuring sufficient frequency of operation in-use as required in section (d)(3.1.1) above.
- (3.2.7) Manufacturers may request Executive Officer approval to define monitoring conditions that are not encountered during the FTP (or other Executive Officer approved) test cycle as required in section (d)(3.1.1). In evaluating the manufacturer's request, the Executive Officer shall consider the degree to which the requirement to run during the FTP or other cycle restricts in-use monitoring, the technical necessity for defining monitoring conditions that are not encountered during the FTP or other cycle, and the ability of the manufacturer to demonstrate the monitoring

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conditions will satisfy the sufficient frequency of operation requirement as defined in section (d)(3.2.6).

## (e) MONITORING REQUIREMENTS

### (1.0)

### (2.0) CATALYST MONITORING

(2.1) Requirement: The diagnostic system shall monitor the catalyst system for proper conversion capability.

#### (2.2) Malfunction Criteria:

(2.2.1) Low Emission Vehicle I: The catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that either of the following occurs:

- (A) Hydrocarbon (HC) emissions exceed 1.75 times the applicable FTP standard, based on the FTP full useful life emission standards to which the vehicle has been certified with HC emissions multiplied by the certification reactivity adjustment factor for the vehicle;
- (B) The average FTP Non-Methane Hydrocarbon (NMHC) conversion efficiency of the monitored portion of the catalyst system falls below 50 percent (i.e., the cumulative NMHC emissions measured at the outlet of the monitored catalyst(s) are more than 50 percent of the cumulative engine-out emissions measured at the inlet of the catalyst(s)). With Executive Officer approval, manufacturers may use a conversion efficiency malfunction criteria of less than 50 percent if the catalyst system is designed such that the monitored portion of the catalyst system must be replaced along with an adjacent portion of the catalyst system sufficient to ensure that the total portion replaced will meet the 50 percent conversion efficiency criteria. Executive Officer approval shall be based on data and/or engineering evaluation demonstrating the conversion efficiency of the monitored portion and the total portion designed to be replaced, and the likelihood of the catalyst system design to ensure replacement of the monitored and adjacent portions of the catalyst system.

(2.2.2) Low Emission Vehicle II:

#### (A) 2003 and 2004 Model Years.

- (i) All LEV II, ULEV II, and MDV SULEV II vehicles shall use the malfunction criteria specified for Low Emission Vehicle I in section (e)(2.2.1).
- (ii) All PC/LDT SULEV II vehicles shall use the malfunction criteria specified for Low Emission Vehicle I in section (e)(2.2.1) except criterion (A), which applies to the conversion of HC emissions. In place of that criterion, PC/LDT SULEV II vehicles shall use a malfunction criterion of 2.5 times the applicable FTP HC standard.

(B) For 2005 and 2006 model years, the catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that any of the following occurs:

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- (i) For LEV II, ULEV II, and MDV SULEV II vehicles.
    - a. HC emissions exceed the criteria specified for Low Emission Vehicle I in section (e)(2.2.1)(A).
    - b. The average FTP NMHC conversion efficiency is below the criteria specified for Low Emission Vehicle I in section (e)(2.2.1)(B).
    - c. Oxides of nitrogen (NO<sub>x</sub>) emissions exceed 3.5 times the FTP full useful life NO<sub>x</sub> standard to which the vehicle has been certified.
  - (ii) PC/LDT SULEV II vehicles shall use the same malfunction criteria as 2005 and 2006 model year LEV II, ULEV II, and MDV SULEV II vehicles (section (e)(2.2.2)(B)(i)) except criterion a., which applies to the conversion of HC emissions. In place of that criterion, PC/LDT SULEV II vehicles shall use a malfunction criterion of 2.5 times the applicable FTP HC standard.
- (C) For 2007 and subsequent model years, the catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that any of the following occurs.
- (i) For LEV II, ULEV II, and MDV SULEV II vehicles.
    - a. HC emissions exceed the criteria specified for Low Emission Vehicle I in section (e)(2.2.1)(A).
    - b. The average FTP NMHC conversion efficiency is below the criteria specified for Low Emission Vehicle I in section (e)(2.2.1)(B).
    - c. NO<sub>x</sub> emissions exceed 1.75 times the FTP full useful life NO<sub>x</sub> standard to which the vehicle has been certified.
  - (ii) For PC/LDT SULEV II vehicles.
    - a. HC emissions exceed 2.5 times the applicable FTP HC standard to which the vehicle has been certified.
    - b. The average FTP NMHC conversion efficiency is below the criteria specified for Low Emission Vehicle I in section (e)(2.2.1)(B).
    - c. NO<sub>x</sub> emissions exceed 2.5 times the applicable FTP NO<sub>x</sub> standard to which the vehicle has been certified.
- (2.2.3) Non-Low Emission Vehicle I or II: The catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that HC emissions increase by more than 1.5 times the applicable FTP full useful life emission standards over an FTP test performed with a representative 4000 mile catalyst system.
- (2.2.4) For purposes of determining the catalyst system malfunction criteria in sections (e)(2.2.1) through (2.2.3):
- (A) The manufacturer shall use a catalyst system deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning operating conditions.
  - (B) Except as provided below in section (e)(2.2.4)(C), the malfunction criteria shall be established by using a catalyst system with all monitored and unmonitored (downstream of the sensor utilized for catalyst monitoring) catalysts simultaneously deteriorated to the malfunction criteria.
  - (C) For all Low Emission Vehicle I applications, all 2003 and 2004 model



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year Low Emission Vehicle II applications, all non-Low Emission Vehicle I or II applications, and all vehicles using fuel shutoff to prevent over-fueling during misfire conditions (see section (e)(4.4.1)(C)), the malfunction criteria shall be established by using a catalyst system with all monitored catalysts simultaneously deteriorated to the malfunction criteria while unmonitored catalysts shall be deteriorated to the end of the vehicle's full useful life.

- (2.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(2.2) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(2.2) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).
- (2.4) MIL Illumination and Fault Code Storage:
  - (2.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).
  - (2.4.2) The monitoring method for the catalyst(s) shall be capable of detecting when a catalyst fault code has been cleared (except diagnostic system self-clearing), but the catalyst has not been replaced (e.g., catalyst overtemperature approaches may not be acceptable).
- (2.5) CATALYST MONITORING FOR DIESELS
  - (2.5.1) Requirement: On all 2004 and subsequent model year diesel passenger cars, light-duty trucks, and medium-duty passenger vehicles (see (c)(21.1)) and all 2005 and subsequent model year medium-duty vehicles, the OBD II system shall monitor the catalyst system for proper conversion capability.
  - (2.5.2) Malfunction Criteria:
    - (A) For 2004 and subsequent model year diesel passenger cars, light-duty trucks, and medium-duty passenger vehicles:
      - (i) The catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that emissions exceed 1.5 times the applicable FTP full useful life NMHC, NO<sub>x</sub>, or PM standard.
      - (ii) For the 2004 through 2009 model year, a manufacturer may request to be exempted from the requirements for NMHC conversion catalyst system monitoring. The Executive Officer shall approve the request if the manufacturer has demonstrated, through data and/or engineering evaluation, that the average FTP NMHC conversion efficiency of the system is less than 30 percent (i.e., the cumulative NMHC emissions measured at the outlet of the catalyst are more than 70 percent of the cumulative engine-out NMHC emissions measured at the inlet of the catalyst(s)).
      - (iii) For the 2004 through 2009 model year, a manufacturer may request to be exempted from the requirements for NO<sub>x</sub> conversion catalyst system monitoring. The Executive Officer shall approve the request if the manufacturer has demonstrated, through data and/or engineering

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evaluation, that the average FTP NOx conversion efficiency of the system is less than 30 percent (i.e., the cumulative NOx emissions measured at the outlet of the catalyst are more than 70 percent of the cumulative engine-out NOx emissions measured at the inlet of the catalyst(s)).

(B) For 2005 and 2006 model year diesel medium-duty vehicles and engines (except medium-duty passenger vehicles):

- (i) The NOx conversion catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that emissions exceed 1.5 times the applicable FTP full useful life NOx or PM standard (or, if applicable, NMHC+NOx standard).
- (ii) A manufacturer may request to be exempted from the requirements for NOx conversion catalyst system monitoring. The Executive Officer shall approve the request if the manufacturer has demonstrated, through data and/or engineering evaluation, that the malfunction of the system will not cause emissions to exceed the emission threshold specified in section (e)(2.5.2)(A).
- (iii) Monitoring of the NMHC conversion catalyst system performance shall not be required.

(C) For 2007 and subsequent model year diesel medium-duty vehicles and engines:

- (i) The catalyst system shall be considered malfunctioning when its conversion capability decreases to the point that emissions exceed 1.5 times the applicable FTP full useful life NMHC, NOx, or PM standard (or, if applicable, NMHC+NOx standard).
- (ii) For the 2007 through 2009 model year, a manufacturer may request to be exempted from the requirements for NMHC conversion catalyst system monitoring. The Executive Officer shall approve the request if the manufacturer has demonstrated, through data and/or engineering evaluation, that the average FTP NMHC conversion efficiency of the system is less than 30 percent (i.e., the cumulative NMHC emissions measured at the outlet of the catalyst are more than 70 percent of the cumulative engine-out NMHC emissions measured at the inlet of the catalyst(s)).
- (iii) For the 2007 through 2009 model year, a manufacturer may request to be exempted from the requirements for NOx conversion catalyst system monitoring. The Executive Officer shall approve the request if the manufacturer has demonstrated, through data and/or engineering evaluation, that the average FTP NOx conversion efficiency of the system is less than 30 percent (i.e., the cumulative NOx emissions measured at the outlet of the catalyst are more than 70 percent of the cumulative engine-out NOx emissions measured at the inlet of the catalyst(s)).

(2.5.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(2.5.2) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2).

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For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(2.5.2) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).

(2.5.4) MIL Illumination and Fault Code Storage:

(A) General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

(B) The monitoring method for the reduction catalyst(s) shall be capable of detecting all instances, except diagnostic self-clearing, when a catalyst fault code has been cleared but the catalyst has not been replaced (e.g., catalyst overtemperature approaches may not be acceptable).

## (3.0) HEATED CATALYST MONITORING

### (3.1) Requirement:

(3.1.1) The diagnostic system shall monitor all heated catalyst systems for proper heating.

(3.1.2) The efficiency of heated catalysts shall be monitored in conjunction with the requirements of section (e)(2.0).

### (3.2) Malfunction Criteria:

(3.2.1) The catalyst heating system shall be considered malfunctioning when the catalyst does not reach its designated heating temperature within a requisite time period after engine starting. The manufacturer shall determine the requisite time period, but such time period shall not exceed the time that would cause emissions from a vehicle equipped with the heated catalyst system to exceed 1.75 times any of the applicable FTP standards.

(3.2.2) Manufacturers may use other monitoring strategies for the heated catalyst but must submit the alternate plan to the Executive Officer for approval. The Executive Officer shall approve alternate strategies for monitoring heated catalyst systems based on comparable reliability and timeliness to these requirements in detecting a catalyst heating malfunction.

(3.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(3.2) in accordance with the general requirements set forth in sections (d)(3.1).

(3.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (4.0) MISFIRE MONITORING

### (4.1) Requirement:

(4.1.1) The OBD II system shall monitor the engine for misfire causing catalyst damage and misfire causing excess emissions.

(4.1.2) The OBD II system shall, to the fullest extent possible, identify the specific cylinder that is experiencing misfire. Manufacturers may request Executive Officer approval to store a general misfire fault code instead of a cylinder specific fault code under certain operating conditions provided the manufacturer submits data and/or an engineering evaluation that

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adequately demonstrate that the misfiring cylinder cannot be reliably identified when such conditions occur.

- (4.1.3) If more than one cylinder is misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring except as allowed below. When identifying multiple cylinder misfire, the manufacturer is not required to also identify each of the misfiring cylinders individually through separate fault codes. If more than 90 percent of the detected misfires occur in a single cylinder, the manufacturer may elect to store the appropriate fault code indicating the specific misfiring cylinder in lieu of the multiple cylinder misfire fault code. If, however, two or more cylinders individually have more than 10 percent of the total number of detected misfires, a multiple cylinder fault code must be stored.
- (4.2) Malfunction Criteria: The OBD II system shall indicate a misfire malfunction pursuant to the following:
  - (4.2.1) Misfire causing catalyst damage:
    - (A) Manufacturers shall determine the percentage of misfire evaluated in 200 revolution increments for each engine speed and load condition that would result in catalyst damage. The manufacturer shall submit documentation to support this percentage of misfire as required in section (f)(2.5). For every engine speed and load condition that this percentage of misfire is determined to be lower than five percent, the manufacturer may set the malfunction criteria at five percent.
    - (B) Subject to Executive Officer approval, a manufacturer may employ a longer interval than 200 revolutions but only for determining, on a given driving cycle, the first misfire exceedance as provided in section (4.4.1)(A) below. Executive Officer approval shall be conditioned upon the manufacturer submitting data and/or an engineering evaluation that adequately demonstrate that catalyst damage would not occur due to unacceptably high catalyst temperatures before the interval has elapsed.
    - (C) A misfire malfunction shall be indicated if the percentage of misfire established in (A) is exceeded.
    - (D) For purposes of establishing the temperature at which catalyst damage occurs as required in section (e)(4.2.1)(A), manufacturers shall not define catalyst damage at a temperature more severe than what the catalyst system could be operated at for ten consecutive hours and still meet the applicable FTP full useful life emission standards.
  - (4.2.2) Misfire causing emissions to exceed 1.5 times the FTP standards:
    - (A) Manufacturers shall determine the percentage of misfire evaluated in 1000 revolution increments that would cause emissions from an emission durability demonstration vehicle to exceed 1.5 times any of the applicable FTP standards if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer shall utilize misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire

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is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent.

(B) Subject to Executive Officer approval, a manufacturer may employ other revolution increments if the manufacturer can adequately demonstrate that the strategy would be equally effective and timely in detecting misfire.

(C) A malfunction shall be indicated if the percentage of misfire established in (A) is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous, etc.).

(4.3) Monitoring Conditions:

(4.3.1) For all 2003 and subsequent model year vehicles, manufacturers shall continuously monitor for misfire from no later than the end of the second crankshaft revolution after engine start and under all positive torque engine speeds and load conditions except within the following range: the engine operating region bound by the positive torque line (i.e., engine load with the transmission in neutral), and the two following engine operating points: an engine speed of 3000 rpm with the engine load at the positive torque line, and the redline engine speed (defined in section (c)(27.0)) with the engine's manifold vacuum at four inches of mercury lower than that at the positive torque line.

(4.3.2) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in section (e)(4.3.1) above, the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, and demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., 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 paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(4.3.3) A manufacturer may request Executive Officer approval of reduced misfire detection capability during the portion of the first 1000 revolutions after engine start that a cold start emission reduction strategy that reduces engine torque (e.g., spark retard strategies) is active. The Executive Officer shall approve such requests if the manufacturer demonstrates that the probability of detection is greater than or equal to 75 percent and that the technology cannot reliably detect a higher percentage of the misfire events.

(4.3.4) A manufacturer may request Executive Officer approval to disable misfire monitoring or employ a higher malfunction criterion when misfire cannot be distinguished from other effects.

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- (A) In general, the Executive Officer shall approve disablement or the use of a higher malfunction criterion for conditions involving rough road, fuel cut, gear changes for manual transmission vehicles, traction control or other vehicle stability control activation such as anti-lock braking or other engine torque modifications to enhance vehicle stability, off-board control or intrusive activation of vehicle components or diagnostics during service or assembly plant testing, portions of intrusive evaporative system or EGR diagnostics that can significantly affect engine stability (i.e., while the purge valve is open during the vacuum pull-down of a evaporative system leak check but not while the purge valve is closed and the evaporative system is sealed or while an EGR diagnostic causes the EGR valve to be intrusively cycled on and off during positive torque conditions), or for throttle movements more rapid than occurs over the US06 test cycle for the worst case vehicle within each test group upon the manufacturer presenting sufficient documentation that the disablement interval or period of use of a higher malfunction criterion shall be limited only to that necessary for avoiding false detection.
  - (B) Additionally, in accordance with sections (e)(19.3) through (19.5), misfire monitoring may be disabled when fuel level is 15 percent or less of the nominal capacity of the fuel tank, when PTO units are active, or while engine coolant temperature is below 20 degrees Fahrenheit. When engine coolant temperature is below 20 degrees Fahrenheit at engine start, misfire monitoring may continue to be disabled on that driving cycle until engine coolant temperature exceeds 70 degrees Fahrenheit.
  - (C) In general, the Executive Officer shall not approve disablement for conditions involving normal air conditioning compressor cycling from on to off or off to on, automatic transmission gear shifts (except for shifts occurring during wide open throttle operation), transitions from idle to off-idle, or excess acceleration (except for acceleration rates that exceed the maximum acceleration rate obtainable at wide open throttle while the vehicle is in gear due to abnormal conditions such as slipping of a clutch).
  - (D) Misfire monitoring disablement or use of a higher malfunction criterion for any other condition may be approved by the Executive Officer on a case by case basis if the manufacturer can demonstrate that the request is based on an unusual or unforeseen circumstance and that the best available computer and monitoring technology are being applied.
- (4.3.5) For engines with more than eight cylinders that cannot meet the requirements of section (e)(4.3.1), a manufacturer may request Executive Officer approval to use alternative misfire monitoring conditions. The Executive Officer shall approve the request upon the manufacturer submitting data and/or an engineering evaluation which adequately demonstrates that misfire detection throughout the required operating region cannot be achieved when employing proven monitoring technology (i.e., a technology that provides for compliance with these requirements on other engines) and provided misfire is detected to the fullest extent permitted by the technology. But under no circumstances shall the

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Executive Officer grant the request if the misfire detection system is unable to monitor during all positive torque operating conditions encountered during an FTP test.

(4.4) MIL Illumination and Fault Code Storage:

(4.4.1) Misfire causing catalyst damage. Upon detection of the level of misfire specified in section (e)(4.2.1) above, the following criteria shall apply for MIL illumination and fault code storage:

(A) Pending fault codes

- (i) A pending fault code shall be stored immediately if, during a single driving cycle, the specified misfire level is exceeded three times when operating in the positive torque region encountered during an FTP test or is exceeded on a single occasion when operating at any other engine speed and load condition in the positive torque region defined in section (e)(4.3.1).
- (ii) Immediately after a pending fault code is stored as specified in section (e)(4.4.1)(A)(i) above, the MIL shall blink once per second at all times while misfire is occurring during the driving cycle.
  - a. The MIL may be extinguished during those times when misfire is not occurring during the driving cycle.
  - b. If, at the time a misfire malfunction occurs, the MIL is already illuminated for a malfunction other than misfire, the MIL shall blink as previously specified in this section while misfire is occurring. If misfiring ceases, the MIL shall stop blinking but remain illuminated as required by the other malfunction.
- (iii) If freeze frame conditions are stored for a malfunction other than misfire or fuel system malfunction (see section (e)(7.0)) when a pending fault code is stored as specified in section (e)(4.4.1)(A)(i) above, the stored freeze frame information shall be replaced with freeze frame information regarding the misfire malfunction.

(B) Confirmed fault codes

- (i) After storage of a pending fault code for exceeding the misfire level set forth in section (e)(4.2.1) or (4.2.2), the monitoring system shall store a confirmed fault code if the misfire level as set forth in (e)(4.2.1) is again exceeded one or more times during either the driving cycle immediately following the driving cycle in which the pending fault code was set, regardless of the conditions encountered, or the next driving cycle in which similar conditions are encountered (see (c)(31.0)).
- (ii) Upon storage of a confirmed fault code, the MIL shall blink as specified in subparagraph (e)(4.4.1)(A)(ii) above as long as misfiring is occurring and the MIL shall remain continuously illuminated, even if the misfiring ceases.

(C) Exemptions for vehicles with fuel shutoff and default fuel control.

Notwithstanding paragraphs (A) and (B) above, in vehicles that provide for fuel shutoff and default fuel control to prevent over fueling during catalyst damage misfire conditions, the MIL need not blink. Instead, the MIL may illuminate continuously in accordance with the requirements for

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continuous MIL illumination in sections (e)(4.4.1)(B)(ii) above upon detection of misfire, provided that the fuel shutoff and default control shall be activated as soon as misfire is detected. Fuel shutoff and default fuel control may be deactivated only to permit fueling outside of the misfire range. Manufacturers may also periodically, but not more than once every 30 seconds, deactivate fuel shutoff and default fuel control to determine if the specified catalyst damage misfire level is still being exceeded. Normal fueling and fuel control may be resumed if the specified catalyst damage misfire level is no longer being exceeded.

- (D) Pending fault codes and stored freeze frame conditions may be erased at the end of the next driving cycle in which similar conditions have been encountered without any exceedance of the specified misfire levels. The pending code and stored freeze frame conditions may also be erased if similar driving conditions are not encountered during 80 driving cycles subsequent to the initial detection of a malfunction.
  - (E) Manufacturers may request Executive Officer approval of strategies that steadily illuminate the MIL in lieu of blinking the MIL during extreme catalyst damage misfire conditions (i.e., catalyst damage misfire occurring at all engine speeds and loads). Executive Officer approval shall be granted if the manufacturer employs the strategy only when catalyst damage misfire levels cannot be avoided during reasonable driving conditions and the manufacturer demonstrates that the strategy will encourage operation of the vehicle in conditions that will minimize catalyst damage (e.g., at low engine speeds and loads).
- (4.4.2) Misfire causing emissions to exceed 1.5 times the FTP standards. Upon detection of the misfire level specified in section (e)(4.2.2), the following criteria shall apply for MIL illumination and fault code storage:
- (A) Misfire within the first 1000 revolutions after engine start.
    - (i) A pending fault code and freeze frame conditions shall be stored no later than after the first exceedance of the specified misfire level during a single driving cycle if the exceedance occurs within the first 1000 revolutions from engine start (defined in section (c)(11.0)) during which misfire detection is active.
    - (ii) Except as provided below, if a pending fault code is stored, the OBD II system shall immediately illuminate the MIL and store a confirmed fault code if misfire is again detected in the first 1000 revolutions during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see (c)(31.0)) to those that occurred when the pending fault code was stored are encountered.
    - (iii) The pending fault code and stored freeze frame conditions may be erased at the end of the next driving cycle in which similar conditions to those that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage



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of misfire. The pending code and stored freeze frame conditions may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following the initial detection of the malfunction.

- (B) Exceedances after the first 1000 revolutions after engine start.
  - (i) A pending fault code and freeze frame conditions shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (e)(4.2.2) during a single driving cycle.
  - (ii) Except as provided below, the OBD II system shall immediately illuminate the MIL and store a confirmed fault code if the percentage of misfire specified in section (e)(4.2.2) is again exceeded four times during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see (c)(31.0)) to those that occurred when the pending fault code was stored are encountered.
  - (iii) The pending fault code and stored freeze frame conditions may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified percentage of misfire. The pending code and stored freeze frame conditions may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

(4.4.3) Storage of misfire conditions for similar conditions determination. Upon detection of misfire under sections (e)(4.4.1) or (4.4.2), manufacturers shall store the engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(4.4.4) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

## (4.5) MISFIRE MONITORING FOR DIESELS

### (4.5.1) Requirement:

- (A) The diagnostic system on a diesel engine shall be capable of detecting misfire occurring continuously in one or more cylinders. To the extent possible without adding hardware for this specific purpose, the diagnostic system shall also identify the specific continuously misfiring cylinder.
- (B) If more than one cylinder is continuously misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring. When identifying multiple cylinder misfire, the manufacturer is not required to also identify each of the continuously misfiring cylinders individually through separate fault codes.

(4.5.2) Malfunction Criteria: The OBD II system shall indicate a misfire malfunction when one or more cylinders are continuously misfiring.

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- (4.5.3) Monitoring Conditions: The OBD II system shall monitor for misfire during engine idle conditions. Manufacturers shall submit monitoring conditions to the Executive Officer for approval. The Executive Officer shall approve the monitoring conditions as long as they are necessary for robust monitoring, require no more than 1000 cumulative engine revolutions, and do not require a continuous idle operation to make a determination that a malfunction is present.
- (4.5.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (5.0) EVAPORATIVE SYSTEM MONITORING

- (5.1) Requirement: The diagnostic system shall verify purge flow from the evaporative system and shall monitor the complete evaporative system, excluding the tubing and connections between the purge valve and the intake manifold, for the loss of HC vapor into the atmosphere. Individual components of the evaporative system (e.g. valves, sensors, etc.) shall be monitored in accordance with the comprehensive components requirements in section (e)(17.0) (e.g., for circuit continuity, out of range values, rationality, functional, etc.).
- (5.2) Malfunction Criteria:
  - (5.2.1) The OBD II system shall indicate an evaporative system malfunction when any of the following conditions exist:
    - (A) No purge flow from the evaporative system to the engine can be detected by the OBD II system;
    - (B) The evaporative system contains leak(s) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice.
    - (C) The evaporative system contains leak(s) greater than or equal in magnitude to a leak caused by a 0.020 inch diameter orifice.
  - (5.2.2) On vehicles with fuel tank capacity greater than 25 gallons, a manufacturer may request the Executive Officer to revise the orifice size in sections (e)(5.2.1)(B) and/or (C) if the most reliable monitoring method available cannot reliably detect a system leak of the magnitudes specified. Executive Officer approval shall be granted if the manufacturer provides adequate data and/or engineering analysis to support the request.
  - (5.2.3) Upon request by the manufacturer and submission of data and/or engineering evaluation which adequately support the request, the Executive Officer shall revise the orifice size in sections (e)(5.2.1)(B) and/or (C) upward to exclude detection of leaks that cannot cause evaporative or running loss emissions to exceed 1.5 times the applicable standards.
  - (5.2.4) For purposes of sections (e)(5.2.1)(B) and (C), an orifice shall be defined as a square edge orifice with a diameter of the specified dimension.
  - (5.2.5) A manufacturer may request Executive Officer approval to revise the orifice size in section (e)(5.2.1)(B) to a 0.090 inch diameter orifice. Executive Officer approval shall be granted if the manufacturer provides

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adequate data and/or engineering analysis demonstrating that the monitoring strategy for detecting orifices specified in section (e)(5.2.1)(C) has equivalent effectiveness (e.g., accuracy, robustness, frequency of operation, timeliness, etc.) as monitoring strategies designed to detect orifices specified in section (e)(5.2.1)(B).

## (5.3) Monitoring Conditions:

(5.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(5.2.1)(A) and (B) (e.g., purge flow and 0.040" leak detection) in accordance with the general requirements set forth in sections (d)(3.1).

(5.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(5.2.1)(C) (e.g., 0.020" leak detection) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(5.2.1)(C) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).

(5.3.3) Manufacturers may request Executive Officer approval to abort an evaporative system monitor under specific conditions (e.g., when the fuel tank level is over 85 percent of nominal tank capacity, when excessive fuel slosh is occurring, etc.) if data and/or an engineering evaluation are provided which adequately demonstrate that a reliable check cannot be made when these conditions exist.

(5.3.4) Manufacturers may request Executive Officer approval to execute the evaporative system monitor only on driving cycles determined by the manufacturer to be cold starts. However, the Executive Officer shall not approve criteria that exclude engine starts from being considered as cold starts solely on the basis that ambient temperature exceeds (i.e., indicates a higher temperature than) engine coolant temperature at engine start.

(5.3.5) Manufacturers may temporarily disable the evaporative purge system to perform an evaporative system leak check.

## (5.4) MIL Illumination and Fault Code Storage:

(5.4.1) Except as provided below for fuel cap leaks and alternate statistical MIL illumination protocols, general requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

(5.4.2) If the diagnostic system is capable of discerning that a system leak is being caused by a missing or improperly secured fuel cap:

(A) The manufacturer shall not be required to illuminate the MIL or store a fault code if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of such malfunctions. The alternative indicator shall conform to the requirements outlined in section (d)(2.3) for location and illumination.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be extinguished and the corresponding fault codes erased once the OBD II system has verified that the fuel cap has

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been securely fastened and the MIL has not been illuminated for any other type of malfunction.

(C) The Executive Officer may approve other strategies that provide equivalent assurance that a vehicle operator will be promptly notified of a missing or improperly secured gas cap and that corrective action will be undertaken.

(5.4.3) Notwithstanding section (d)(2.7.3), manufacturers may request Executive Officer approval to use alternative statistical MIL illumination and fault code storage protocols that require up to twelve driving cycles on average for monitoring strategies designed to detect malfunctions specified by section (e)(5.2.1)(C). Executive Officer approval shall be granted in accordance with the bases identified in section (d)(2.7.3) and if the manufacturer submits data and/or an engineering analysis adequately demonstrating that the most reliable monitoring method available cannot reliably detect a malfunction of the specified size without the additional driving cycles and that the monitoring system will still meet the monitoring conditions requirements specified in sections (d)(3.1) and (3.2).

## (6.0) SECONDARY AIR SYSTEM MONITORING

(6.1) Requirement: The OBD II system on vehicles equipped with any form of secondary air delivery system shall monitor the proper functioning of the secondary air delivery system including any air switching valve(s) while the secondary air system is active (e.g., during vehicle warm-up following engine start).

(6.2) Malfunction Criteria:

(6.2.1) For all Low Emission Vehicle I and 2003 and 2004 model year Low Emission Vehicle II applications, manufacturers may request Executive Officer approval to indicate a malfunction when no detectable amount of air flow is delivered to the exhaust system in lieu of the malfunction criteria in section (e)(6.2.2). The Executive Office shall grant approval upon determining that deterioration of the secondary air system is unlikely based on data and/or engineering evaluation submitted by the manufacturer demonstrating that the materials used for the secondary air system (e.g., air hoses, tubing, valves, connectors, etc.) are inherently resistant to disconnection, corrosion, or other deterioration.

(6.2.2) For 2005 and subsequent model year Low Emission Vehicle II applications, the diagnostic system shall indicate a secondary air delivery system malfunction when the air flow delivered by the system to the exhaust system during normal operation of the secondary air system (e.g., during vehicle warm-up following engine start, not when the system is intrusively turned on solely for the purpose of diagnostics) falls below the manufacturer's specified low flow limit such that a vehicle would exceed 1.5 times any of the applicable FTP emission standards.

(6.2.3) For 2005 and 2006 model year Low Emission Vehicle II applications only, a manufacturer may request Executive Officer approval to use the malfunction criteria specified in (e)(6.2.1) in lieu of the criteria specified in

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- (e)(6.2.2) during normal operation of the secondary air system. Executive Officer approval shall be granted if the manufacturer submits data and/or engineering analysis adequately demonstrating that the monitoring system is capable of detecting malfunctions meeting the malfunction criteria in section (e)(6.2.1) during normal operation of the secondary air system and is capable of detecting malfunctions meeting the malfunction criteria in section (e)(6.2.2) during an intrusive operation of the secondary air system later in the same driving cycle.
- (6.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(6.2) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(6.2) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).
- (6.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).
- (7.0) FUEL SYSTEM MONITORING
- (7.1) Requirement: the diagnostic system shall monitor the fuel delivery system to determine its ability to provide compliance with emission standards.
- (7.1.1) For diesel vehicles and engines, the manufacturer shall monitor the performance of all electronic fuel system components to the extent feasible with respect to the malfunction criteria specified in section (e)(7.2) below.
- (7.2) Malfunction Criteria:
- (7.2.1) The OBD II system shall indicate a malfunction of the fuel delivery system (including adaptive feedback control based on a secondary oxygen sensor) when the fuel delivery system is unable to maintain a vehicle's emissions at or below 1.5 times any of the applicable FTP standards.
- (7.2.2) Except as provided for in section (b)(7.2.3) below, if the vehicle is equipped with adaptive feedback control, the OBD II system shall indicate a malfunction when the adaptive feedback control has used up all of the adjustment allowed by the manufacturer.
- (7.2.3) If the vehicle is equipped with adaptive feedback control that is based on a secondary oxygen (or equivalent) sensor, the OBD II system shall not be required to indicate a malfunction of the fuel system solely when the adaptive feedback control based on a secondary oxygen sensor has used up all of the adjustment allowed by the manufacturer. However, if a malfunction results in vehicle emissions that exceed the malfunction criteria in section (e)(7.2.1), the OBD II system shall be required to indicate a malfunction.
- (7.2.4) Manufacturers may adjust the criteria limit(s) for changes in altitude, for temporary introduction of large amounts of purge vapor, or for other similar identifiable operating conditions when they occur.
- (7.3) Monitoring Conditions: The fuel system shall be monitored continuously for the presence of a malfunction.

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## (7.4) MIL Illumination and Fault Code Storage:

- (7.4.1) For fuel systems with adaptive feedback capability, a pending fault code and freeze frame conditions shall be stored immediately upon the fuel system exceeding the malfunction criteria established pursuant to section (e)(7.2).
- (7.4.2) Except as provided below, if a pending fault code is stored, the OBD II system shall immediately illuminate the MIL and store a confirmed fault code if a malfunction is again detected during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see (c)(31.0)) to those that occurred when the pending fault code was stored are encountered.
- (7.4.3) The pending fault code and stored freeze frame conditions may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified fuel system malfunction criteria. The pending code and stored freeze frame conditions may also be erased if similar conditions are not encountered during the 80 driving cycles immediately after the initial detection of a malfunction for which the pending code was set.
- (7.4.4) If freeze frame conditions are stored for a malfunction other than misfire (see section (e)(4.0)) or fuel system malfunction when a pending fault code is stored as specified in section (e)(7.4.1) above, the stored freeze frame information shall be replaced with freeze frame information regarding the fuel system malfunction.
- (7.4.5) Storage of fuel system conditions for similar conditions determination. Upon detection of a fuel system malfunction under section (e)(7.2), manufacturers shall store the engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.
- (7.4.6) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without a malfunction of the fuel system.

## (8.0) OXYGEN SENSOR MONITORING

### (8.1) Requirement:

- (8.1.1) The diagnostic system shall monitor the output voltage, response rate, and any other parameter which can affect emissions, of all primary (fuel control) oxygen ( $\lambda$ ) sensors for malfunction. Both the lean-to-rich and rich-to-lean response rates shall be monitored.
- (8.1.2) The diagnostic system shall also monitor all secondary oxygen sensors (fuel trim control or use as a monitoring device) for proper output voltage, activity, and/or response rate.
- (8.1.3) For vehicles equipped with heated oxygen sensors, the diagnostic system shall monitor the heater for proper performance.

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- (8.1.4) For other types of sensors (e.g., wide range or universal lambda sensors, etc.), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. Such plan shall be accompanied by data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for conventional sensors under this section.
- (8.2) Malfunction Criteria:
  - (8.2.1) Primary Sensors:
    - (A) The OBD II system shall indicate a malfunction of the oxygen sensor voltage, response rate, amplitude, or other characteristic(s) (including drift or bias corrected for by secondary sensors) prior to emissions from a vehicle equipped with the sensor(s) exceeding 1.5 times any of the applicable FTP standards.
    - (B) The OBD II system shall detect malfunctions of the oxygen sensor caused by a lack of circuit continuity or out of range values.
    - (C) The OBD II system shall indicate a malfunction of the oxygen sensor when a sensor malfunction causes the fuel system to stop using that sensor as a feedback input (e.g., causes default or open loop operation).
  - (8.2.2) Secondary Sensors:
    - (A) The OBD II system shall indicate a malfunction of the oxygen sensor when the sensor output voltage, activity, or other characteristics are no longer sufficient for use as a diagnostic system monitoring device (e.g., for catalyst efficiency monitoring).
    - (B) The OBD II system shall detect malfunctions of the oxygen sensor caused by a lack of circuit continuity or out of range values.
  - (8.2.3) Sensor Heaters:
    - (A) The OBD II system shall indicate a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Subject to Executive Officer approval, other malfunction criteria for heater performance malfunctions may be used provided the manufacturer submits data and/or an engineering evaluation adequately showing monitoring reliability and timeliness to be equivalent to the stated criteria in this paragraph.
    - (B) The OBD II system shall detect malfunctions of the heater circuit including open or short circuits.
- (8.3) Monitoring Conditions:
  - (8.3.1) Primary Sensors
    - (A) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(8.2.1)(A) (e.g., proper response rate) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(8.2.1)(A) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).

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- (B) Monitoring for malfunctions identified in sections (e)(8.2.1)(B) and (C) (e.g., circuit continuity, out-of-range, and open-loop malfunctions) shall be conducted continuously.
  - (8.3.2) Secondary Sensors
    - (A) Manufacturers shall define monitoring conditions for malfunctions identified in section (e)(8.2.2)(A) (e.g., proper sensor activity) in accordance with the general requirements set forth in section (d)(3.1).
    - (B) Monitoring for malfunctions identified in section (e)(8.2.2)(B) (e.g., circuit continuity and out-of-range malfunctions) shall be conducted continuously.
  - (8.3.3) Sensor Heaters
    - (A) Manufacturers shall define monitoring conditions for malfunctions identified in section (e) (8.2.3)(A) (e.g., sensor heater performance) in accordance with the general requirements set forth in section (d)(3.1).
    - (B) Monitoring for malfunctions identified in section (e)(8.2.3)(B) (e.g., circuit malfunctions) shall be conducted continuously.
  - (8.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).
- (9.0) EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING
- (9.1) Requirement:
    - (9.1.1) The diagnostic system shall monitor the EGR system on vehicles so-equipped for low and high flow rate malfunctions.
  - (9.2) Malfunction Criteria: The OBD II system shall indicate a malfunction of the EGR system when one or both of the following occurs:
    - (9.2.1) Any component of the system fails to perform within manufacturer specifications;
    - (9.2.2) The EGR flow rate increases or decreases from the manufacturer's specified flow rate such that a vehicle exceeds 1.5 times any of the applicable FTP emission standards.
  - (9.3) Monitoring Conditions:
    - (9.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(9.2.1) in accordance with the general requirements set forth in sections (d)(3.1).
    - (9.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(9.2.2) (e.g., flow rate) in accordance with the general requirements set forth in sections (d)(3.1) and (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(9.2.2) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).
    - (9.3.3) Manufacturers may request Executive Officer approval to temporarily disable the EGR system check under specific conditions (e.g., when freezing may affect performance of the system) provided the manufacturer submits data and/or an engineering evaluation which adequately



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demonstrate that a reliable check cannot be made when these conditions exist.

- (9.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (10.0) POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM MONITORING

(10.1) Requirement: Consistent with the phase-in requirements in Title 13, CCR, section 1968.1 (b)(10.1), on 60 percent of 2003 and 100 percent of all 2004 and subsequent model year vehicles, manufacturers shall monitor the PCV system on vehicles so-equipped for system integrity. The phase-in percentages shall be based on the manufacturer's projected sales volume for all vehicles and engines subject to the requirements of this section. Small volume manufacturers shall not be required to meet the phase-in percentage in the 2003 model year but must meet the requirements of this section on all 2004 and subsequent model year vehicles. A manufacturer may use an alternate phase-in in lieu of the percentages identified in this section if the alternate phase-in provides for equivalent emission reductions to the phase-in specified in title 13, section 1968.1 (b)(10.1).

(10.2) Malfunction Criteria:

(10.2.1) Except as provided below, the OBD II system shall indicate a malfunction of the PCV system when disconnection occurs between either the crankcase and the PCV valve, or between the PCV valve and the intake manifold.

(10.2.2) If the PCV system is designed such that the PCV valve is fastened directly to the crankcase in a manner which makes it significantly more difficult to remove the valve from the crankcase rather than disconnect the line between the valve and the intake manifold (taking aging effects into consideration), the Executive Officer shall exempt the manufacturer from detection of disconnection between the crankcase and the PCV valve.

(10.2.3) Subject to Executive Officer approval, system designs that utilize tubing between the valve and the crankcase shall also be exempted from this portion of the monitoring requirement detection of disconnection between the crankcase and the PCV valve provided the manufacturer submits data and/or engineering evaluation which adequately demonstrate that the connections between the valve and the crankcase are resistant to deterioration or accidental disconnection, are significantly more difficult to disconnect than the line between the valve and the intake manifold, and are not subject to disconnection per manufacturer's repair procedures for non-PCV system repair work.

(10.2.4) Manufacturers shall not be required to detect disconnections between the PCV valve and the intake manifold if said disconnection (1) causes the vehicle to stall immediately during idle operation; or (2) is unlikely due to a PCV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses).

(10.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(10.2) in accordance with the general requirements set forth in sections (d)(3.1).

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(10.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0). The stored fault code need not specifically identify the PCV system (e.g., a fault code for idle speed control or fuel system monitoring can be stored) if the manufacturer demonstrates that additional monitoring hardware would be necessary to make this identification, and provided the manufacturer's diagnostic and repair procedures for the indicated fault include directions to check the integrity of the PCV system.

## (11.0) ENGINE COOLING SYSTEM MONITORING

### (11.1) Requirement:

(11.1.1) The OBD II system shall monitor the thermostat on vehicles so-equipped for proper operation.

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

### (11.2) Malfunction Criteria:

#### (11.2.1) Thermostat

(A) The thermostat shall be considered malfunctioning if, within an Executive Officer approved time interval after starting the engine, either of the following two conditions occur:

(i) The coolant temperature does not reach the highest temperature required by the OBD II system to enable other diagnostics;

(ii) The coolant temperature does not reach a warmed-up temperature within 20 degrees Fahrenheit of the manufacturer's nominal thermostat regulating temperature. Subject to Executive Officer approval, a manufacturer may utilize lower temperatures for this criterion if it can adequately 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 50 or more percent of any of the applicable standards (e.g., 50 degree Fahrenheit emission test, etc.).

(B) Executive Officer approval of the time interval after engine start shall be granted based on data and/or engineering evaluation submitted by the manufacturer to support specified times.

(C) With Executive Officer approval, a manufacturer may use alternate malfunction criteria and/or monitoring conditions (see section (e)(11.3)) that are a function of temperature at engine start on vehicles that do not reach the temperatures specified in the malfunction criteria when the thermostat is functioning properly. Executive Officer approval shall be based on the manufacturer submitting data that demonstrates that a properly operating system does not reach the specified temperatures, that the monitor is capable of meeting the specified malfunction criteria at engine start temperatures greater than 50°F, and that the overall effectiveness of the monitor is comparable to a monitor meeting these thermostat monitoring requirements at lower temperatures.

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- (D) With Executive Officer approval, manufacturers may omit this monitor. Executive Officer approval shall be granted if the manufacturer adequately demonstrates that a malfunctioning thermostat cannot cause a measurable increase in emissions during any reasonable driving condition nor cause any disablement of other monitors.

## (11.2.2) ECT Sensor

- (A) Circuit Continuity. The OBD II system shall indicate a malfunction when a lack of circuit continuity or out-of-range values occur.
- (B) Time to Reach Closed-Loop Enable Temperature.
  - (i) The OBD II system shall indicate a malfunction if the ECT sensor does not achieve the stabilized minimum temperature which is needed for the fuel control system to begin closed-loop operation (closed-loop enable temperature) within an Executive Officer approved time interval after starting the engine. For diesel applications, the minimum temperature needed for warmed-up fuel control to begin shall be used instead of the closed-loop enable temperature.
  - (ii) The time interval shall be a function of starting ECT and/or a function of intake air temperature and, except as noted below, shall not exceed two minutes for engine start temperatures up to 15 degrees Fahrenheit below the closed-loop enable temperature and five minutes for engine start temperatures between 15 and 35 degrees Fahrenheit below the closed-loop enable temperature.
  - (iii) Executive Officer approval of the time interval shall be based on data and/or engineering evaluation submitted by the manufacturer to support specified times. The Executive Officer shall allow longer time intervals provided a manufacturer submits data and/or an engineering evaluation which adequately demonstrate that the vehicle requires a longer time to warm up under normal conditions.
  - (iv) The Executive Officer shall exempt manufacturers from the requirement of section (e)(11.2.2)(B) if the manufacturer does not utilize ECT to enable closed loop fuel control.
- (C) Stuck in Range Below the Highest Minimum Enable Temperature. The OBD II system shall indicate a malfunction if the ECT sensor continuously indicates a fixed temperature below the highest minimum enable temperature required by the OBD II system to enable other diagnostics. Manufacturers shall be exempted from this requirement for temperature regions monitored by the OBD II system under the requirements of sections (e)(11.2.1) or (e)(11.2.2)(B).
- (D) Stuck in Range Above the Lowest Maximum Enable Temperature. The OBD II system shall indicate a malfunction if the ECT sensor continuously indicates a temperature above the lowest maximum enable temperature required by the OBD II system to enable other diagnostics. Manufacturers shall be exempted from this requirement for temperature regions monitored by the OBD II system under the requirements of sections (e)(11.2.1), (e)(11.2.2)(B), (e)(11.2.2)(C) for ECT or thermostat malfunctions or (d)(2.2) for default mode operation (e.g., overtemperature

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protection strategies). Manufacturers shall be exempted from this requirement for vehicles that have a temperature gauge (not a warning light) on the instrument panel and utilize the same ECT sensor for input to the OBD II system and the temperature gauge.

## (11.3) Monitoring Conditions:

### (11.3.1) Thermostat

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(11.2.1) in accordance with the general requirements set forth in sections (d)(3.1).

(B) Manufacturers may disable thermostat monitoring at ambient engine starting temperatures below 20 degrees Fahrenheit.

### (11.3.2) ECT Sensor

(A) Monitoring for malfunctions identified in sections (e)(11.2.2)(A), (C), and (D) (e.g., circuit continuity, out of range, and stuck sensor) shall be conducted continuously.

(B) Except as provided for in section (e)(11.3.2)(C), monitoring for malfunctions identified in section (e)(11.2.2)(B) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates a temperature lower than the closed loop enable temperature at engine start.

(C) Manufacturers may suspend or delay the time to reach closed loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 to 75 percent of the warm-up time).

(11.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (12.0) COLD START EMISSION REDUCTION STRATEGY MONITORING

(12.1) Requirement: On all 2005 and subsequent model year vehicles certified to a Low Emission Vehicle II standard, if the emission control system incorporates a specific engine control strategy to reduce cold start emissions, the key control or feedback parameters (other than secondary air) used to effect that strategy (e.g., engine speed, mass air flow, etc.) shall be monitored (either directly or indirectly) while the control strategy is active to ensure proper operation of the control strategy. The secondary air system shall be monitored under the provisions of section (e)(6.0).

(12.2) Malfunction Criteria: The OBD II system shall indicate a malfunction before any of the individual components associated with the cold start emission reduction control strategy cause a vehicle's emissions to exceed 1.5 times the applicable FTP standards. Manufacturers shall:

(12.2.1) Establish the malfunction criteria based on data from on one or more representative vehicle(s).

(12.2.2) Provide an engineering evaluation for establishing the malfunction criteria for the remainder of the manufacturer's product line. The Executive Officer shall waive the evaluation requirement each year if, in

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the judgement of the Executive Officer, technological changes do not affect the previously determined malfunction criteria.

(12.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(12.2) in accordance with the general requirements set forth in sections (d)(3.1).

(12.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (13.0) AIR CONDITIONING SYSTEM COMPONENT MONITORING

(13.1) Requirement: If a manufacturer alters off-idle fuel and/or spark control when the A/C system is on, the diagnostic system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control while the A/C system is on or invoke the alternate control while the A/C system is off.

(13.2) Malfunction Criteria:

(13.2.1) The OBD II system shall indicate a malfunction of a component of the air conditioning system prior to its failure or deterioration causing emissions to exceed 1.5 times any of the appropriate applicable emission standards or if it effectively disables any other monitored system or component covered by this regulation. For malfunctions that result in the alternate control being erroneously invoked while the A/C system is off, the appropriate emission standards shall be the FTP emission standards. For malfunctions that result in the alternate control failing to be invoked while the A/C system is on, the appropriate emission standards shall be the SC03 emission standards.

(13.2.2) If no single component malfunction causes emissions to exceed 1.5 times any of the appropriate applicable emission standards as defined above in section (e)(13.2.1) or effectively disables any other monitored system or component, manufacturers shall not be required to monitor any air conditioning system component for purposes of section (e)(13.0).

(13.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(13.2) in accordance with the general requirements set forth in sections (d)(3.1).

(13.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (14.0) VARIABLE VALVE TIMING AND/OR CONTROL (VVT) SYSTEM MONITORING

(14.1) Requirement: On all 2005 and subsequent model year Low Emission Vehicle II applications, the diagnostic system shall monitor the VVT system on vehicles so-equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors, etc.) that are used in the VVT system shall be monitored in accordance with the comprehensive components requirements in section (e)(17.0). VVT systems on Low Emission Vehicle I and 2003 or 2004 model year Low Emission Vehicle II applications shall be monitored in accordance with the comprehensive components requirements in section (e)(17.0).

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## (14.2) Malfunction Criteria:

(14.2.1) Target Error. The OBD II system shall indicate a malfunction if the VVT system cannot achieve the commanded valve timing within a manufacturer specified crank angle tolerance such that a vehicle would exceed 1.5 times any of the applicable FTP emission standards.

(14.2.2) Slow Response. The OBD II system shall indicate a malfunction if the VVT system cannot achieve the commanded valve timing within a manufacturer specified time such that a vehicle would exceed 1.5 times any of the applicable FTP emission standards.

(14.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(14.2) in accordance with the general requirements set forth in sections (d)(3.1) and, if applicable, (d)(3.2). For vehicles not equipped with a separate EGR system, manufacturers shall report VVT system monitor performance in lieu of EGR system monitor performance under section (d)(3.2). For purposes of reporting as required in section (d)(3.2), all monitors used to identify malfunctions identified in section (e)(14.2) shall be tracked separately but reported as a single set of values as specified in section (d)(3.2.2)(A)(iii).

(14.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (15.0) DIRECT OZONE REDUCTION (DOR) SYSTEM MONITORING

(15.1) Requirement: The diagnostic system shall monitor the DOR system on vehicles so-equipped for malfunctions that reduce the ozone reduction performance of the system.

(15.1.1) For 2003 and 2004 model year vehicles, manufacturers may request to be exempted from DOR system monitoring. The Executive Officer shall approve the exemption upon the manufacturer:

(A) Agreeing that the DOR system shall receive only 50 percent of the NMOG credit assigned to the DOR system as calculated under ARB Manufacturers Advisory Correspondence (MAC) No. 99-06, December 20, 1999, which is hereby incorporated by reference herein.

(B) Providing data and/or engineering evaluation that adequately demonstrate that no monitoring technology is currently available for implementation of the requirement in the 2003 and 2004 model years but will likely be available for implementation in the 2005 model year.

(C) Identifying the DOR system component(s) as an emission control device on both the underhood emission control label and a separate label as specified below. The DOR system shall be included in the list of emission control devices on the underhood emission control label and be identified as a "DOR system" or other equivalent SAE J1930 term. A separate label shall be located on or near the DOR system component(s) in a location that is visible to repair technicians prior to the removal of any parts necessary to replace the DOR system component(s) and shall identify the components as a "DOR system" or other equivalent SAE J1930 term.

## (15.2) Malfunction Criteria:

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- (15.2.1) For vehicles in which the NMOG credit assigned to the DOR system, as calculated in accordance with ARB MAC No. 99-06, is less than or equal to 50 percent of the applicable FTP NMOG emission standard, the OBD II system shall indicate a malfunction when the monitoring system is unable to detect some degree of ozone reduction.
- (15.2.2) For vehicles in which the NMOG credit assigned to the DOR system, as calculated in accordance with ARB MAC No. 99-06, is greater than 50 percent of the applicable FTP NMOG emission standard, the OBD II system shall indicate a malfunction when the ozone reduction performance of the DOR system deteriorates to a point where the difference between the NMOG credit assigned to the properly operating DOR system and the NMOG credit calculated for a DOR system performing at the level of the malfunctioning system exceeds 50 percent of the applicable FTP NMOG emission standard.
- (15.2.3) For vehicles equipped with a DOR system, the manufacturer may modify any of the applicable NMOG malfunction criteria in sections (e)(2.0)-(4.0), (e)(6.0)-(9.0), (e)(12.0), (e)(14.0), and (e)(18.0) by adding the NMOG credit assigned to the DOR system to the required NMOG malfunction criteria (e.g., a malfunction criteria of 1.5 x NMOG standard would be modified to (1.5 x NMOG standard) + DOR system NMOG credit).
- (15.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(15.2) in accordance with the general requirements set forth in sections (d)(3.1).
- (15.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).
- (16.0) PARTICULATE MATTER (PM) TRAP MONITORING
  - (16.1) Requirement: On all 2004 and subsequent model year diesel passenger cars, light-duty trucks, and medium-duty passenger vehicles (see (c)(21.1)) and all 2005 and subsequent model year medium-duty vehicles, manufacturers shall monitor the PM trap on vehicles so-equipped for proper performance.
  - (16.2) Malfunction Criteria:
    - (16.2.1) For 2004 and subsequent model year diesel passenger cars, light-duty trucks, and medium-duty passenger vehicles, the PM trap shall be considered malfunctioning when its capability decreases to the point that emissions exceed 1.5 times the applicable standards.
    - (16.2.2) For 2005 and 2006 model year diesel medium-duty vehicles and engines (except medium-duty passenger vehicles), the PM trap shall be considered malfunctioning when catastrophic failure occurs. The Executive Officer shall exempt vehicles from this PM trap monitoring requirement if the manufacturer can demonstrate with data and/or engineering evaluation that catastrophic failure of the PM trap will not cause emissions to exceed 1.5 times the applicable standards.
    - (16.2.3) For 2007 and subsequent model year diesel medium-duty vehicles and engines, the PM trap shall be considered malfunctioning when its

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capability decreases to the point that emissions exceed 1.5 times the applicable standards.

(16.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(16.2) in accordance with the general requirements set forth in sections (d)(3.1).

(16.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).

## (17.0) COMPREHENSIVE COMPONENT MONITORING

### (17.1) Requirement:

(17.1.1) Except as provided in section (e)(17.1.3), the OBD II system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (e)(2.0) through (e)(16.0) that either provides input to (directly or indirectly) or receives commands from the on-board computer, and: (1) can affect emissions during any reasonable in-use driving condition, or (2) is used as part of the diagnostic strategy for any other monitored system or component.

(A) Input Components: Input components required to be monitored may include, but are not limited to, the vehicle speed sensor, crank angle sensor, knock sensor, throttle position sensor, coolant temperature sensor, cam position sensor, fuel composition sensor (e.g. flexible fuel vehicles), transmission electronic components such as sensors, modules, and solenoids which provide signals to the powertrain control system.

(B) Output Components: Output components required to be monitored may include, but are not limited to, the idle speed control valve or motor, automatic transmission solenoids or controls, heated fuel preparation systems, the wait-to-start lamp on diesel applications, and a warm-up catalyst bypass valve.

(17.1.2) For purposes of criteria (1) in section (e)(17.1.1) above, the manufacturer shall determine whether a powertrain input or output component can affect emissions. If the Executive Officer reasonably believes that a manufacturer has incorrectly determined that a component cannot affect emissions, the Executive Officer shall require the manufacturer to provide emission data showing that such a component, when malfunctioning and installed in a suitable test vehicle, does not have an emission effect. Emission data may be requested for any reasonable driving condition.

(17.1.3) Manufacturers shall only be required to monitor for malfunction electronic powertrain input or output components/systems associated with an electronic transfer case if the transfer case component or system is used as part of the diagnostic strategy for any other monitored system or component.



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## (17.2) Malfunction Criteria:

### (17.2.1) Input Components:

- (A) The OBD II system shall detect malfunctions of input components caused by a lack of circuit continuity, out of range values, and, where feasible, rationality faults. To the extent feasible, the rationality fault diagnostics shall verify that a sensor output is neither inappropriately high nor inappropriately low (e.g., “two-sided” diagnostics).

### (17.2.2) Output Components:

- (A) Output components/systems shall be considered malfunctioning when proper functional response to computer commands does not occur. Should a functional check for malfunction not be feasible, then an output component/system shall be considered malfunctioning when, at a minimum, lack of circuit continuity or manufacturer-specified out-of-range values occur. Manufacturers shall not be required to activate an output component when it would not normally be active exclusively for the purposes of performing functional monitoring of output components as required in this section.
- (B) The idle speed control system shall be monitored for proper functional response to computer commands. For strategies based on deviation from target idle speed, a fault shall be indicated when the idle speed control system cannot achieve the target idle speed within 200 revolutions per minute (rpm) above the target speed or 100 rpm below the target speed. The Executive Officer shall allow larger engine speed tolerances provided a manufacturer submits data and/or an engineering evaluation which adequately demonstrate that the tolerances can be exceeded without a malfunction present.
- (C) Glow plugs shall be monitored for proper functional response to computer commands. The glow plug circuit(s) shall be monitored for proper current and voltage drop. The Executive Officer shall approve other monitoring strategies based on manufacturer’s data and/or engineering analysis demonstrating equally reliable and timely indication of malfunctions. Manufacturers shall indicate a malfunction when a single glow plug no longer operates within the manufacturer’s specified limits for normal operation. If a manufacturer demonstrates that a single glow plug failure cannot cause a measurable increase in emissions during any reasonable driving condition, the manufacturer shall indicate a malfunction for the minimum number of glow plugs needed to cause an emission increase. Further, on all new design engines and to the extent feasible on existing engine designs (without adding additional hardware for this purpose), the stored fault code shall identify the specific malfunctioning glow plug(s).

## (17.3) Monitoring Conditions:

### (17.3.1) Input Components:

- (A) Input components shall be monitored continuously for proper range of values and circuit continuity.
- (B) For rationality monitoring (where applicable), manufacturers shall define appropriate operating conditions subject to Executive Officer approval

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during which monitoring shall occur. Additionally, the monitoring conditions shall be encountered at least once during the first engine start portion of the applicable FTP test. For 2003 and 2004 model year vehicles, rationality monitoring shall occur at least once per driving cycle when the monitoring conditions are met. For all 2005 and subsequent model year vehicles, rationality monitoring shall occur continuously during the driving cycle when the monitoring conditions are met.

(17.3.2) Output Components:

- (A) Monitoring for circuit continuity and proper range of values (if applicable) shall be conducted continuously.
- (B) For functional monitoring, manufacturers shall define appropriate operating conditions subject to Executive Officer approval during which monitoring shall occur. Additionally, the monitoring conditions shall be encountered at least once during the first engine start portion of the applicable FTP test. Functional monitoring shall occur at least once per driving cycle during which the monitoring conditions are met.
- (C) With Executive Officer approval, manufacturers may be exempted from conducting functional monitoring during the FTP test if the manufacturer provides data and/or an engineering evaluation which adequately demonstrate that the component does not normally function, or monitoring is otherwise not feasible, during an applicable FTP test.

(17.4) MIL Illumination and Fault Code Storage:

- (17.4.1) Except as provided in section (e)(17.4.2) below, general requirements for MIL illumination and fault code storage are set forth in section (d)(2.0).
- (17.4.2) Exceptions to general requirements for MIL illumination. MIL illumination is not required in conjunction with storing a confirmed fault code if the component or system, when malfunctioning, could not cause vehicle emissions to increase by 15 percent or more of the FTP standard and is not used as part of the diagnostic strategy for any other monitored system or component.

(18.0) OTHER EMISSION CONTROL DEVICE MONITORING

- (18.1) Requirement: For other emission control devices that are: (1) not identified or addressed in sections (e)(2.0) through (e)(17.0) (e.g., hydrocarbon traps, NOx storage devices), or (2) identified or addressed in section (e)(17.0) but not corrected or compensated for by the adaptive fuel control system (e.g., swirl control valves), manufacturers shall submit a plan for Executive Officer approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production vehicle. Executive Officer approval shall be based on the effectiveness of the monitoring strategy, the malfunction criteria utilized, and the monitoring conditions required by the diagnostic.

(19.0) EXCEPTIONS TO GENERAL APPLICABILITY REQUIREMENTS

- (19.1) Except as provided below, upon request of a manufacturer or upon the best engineering judgment of the ARB, the Executive Officer may revise the

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emission threshold for a malfunction on any check on a Low Emission Vehicle I or Low Emission Vehicle II if the most reliable monitoring method developed requires a higher threshold to prevent significant errors of commission in detecting a malfunction.

- (19.1.1) For all vehicles certified to the PC/LDT SULEV II emission standards, the Executive Officer shall approve a malfunction criteria of 2.5 times the applicable FTP standards in lieu of 1.5 wherever required in section (e).
- (19.1.2) For 2003 and 2004 model year PC/LDT SULEV II vehicles only, the Executive Officer shall approve monitors with thresholds that exceed 2.5 times the applicable FTP standard if the manufacturer demonstrates that a higher threshold is needed given the state of development of the vehicle and that the malfunction criteria and monitoring approach and technology (e.g., fuel system limits, percent misfire, monitored catalyst volume, etc.) are at least as stringent as comparable ULEV (not ULEV II) vehicles.
- (19.2) Whenever the malfunction criteria in section (e) of this regulation requires that a malfunction be indicated before an emission threshold has been exceeded (e.g., emissions in excess of 1.5 times the standard) except for sections (e)(2.5.2)(A)(ii) and (iii), (e)(2.5.2)(B)(ii) and (iii), (e)(2.5.2)(C)(ii) and (iii), and (e)(16.2.2), the manufacturer shall perform a functional check (see (c)(15.0)) of the specific component or system in lieu of meeting the applicable malfunction criteria in section (e) if a malfunction of such component or system could not cause the vehicle's emissions to exceed the specified emission threshold.
- (19.3) Manufacturers may request Executive Officer approval to disable a diagnostic system at ambient engine starting temperatures below twenty degrees Fahrenheit (20°F) (low ambient temperature conditions may be determined based on intake air or engine coolant temperature at engine starting) or at elevations above 8000 feet above sea level. The Executive Officer shall approve such requests upon the manufacturer providing data and/or an engineering evaluation that demonstrates that monitoring during such conditions would be unreliable. A manufacturer may further request, and the Executive Officer shall approve, that a diagnostic system be disabled at other ambient engine starting temperatures upon the manufacturer demonstrating with data and/or an engineering evaluation that misdiagnosis would occur at such ambient temperatures because of its effect on the component itself (e.g., component freezing).
- (19.4) Manufacturers may request Executive Officer approval to disable monitoring systems that can be affected by running out of fuel (e.g., misfire detection) when the fuel level is 15 percent or less of the nominal capacity of the fuel tank. The Executive Officer shall approve the request upon the manufacturer submitting data and/or an engineering evaluation that adequately demonstrates that monitoring at such fuel levels would be unreliable.
- (19.5) A manufacturer may disable affected monitoring systems in vehicles designed to accommodate the installation of Power Take-Off (PTO) units (as defined in section (c)), provided disablement occurs only while the PTO unit is active, and the OBD II readiness status is cleared by the on-board

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computer (i.e., all monitors set to indicate “not complete”) while the PTO unit is activated (See section (f)(3.1) below). If such disablement occurs, the readiness status may be restored to its state prior to PTO activation when the disablement ends.

## (f) STANDARDIZATION REQUIREMENTS

### (1.0) Diagnostic Connector:

A standard data link connector based on SAE J1962 “Diagnostic Connector” specifications, incorporated by reference, shall be incorporated in each vehicle.

- (1.1) The connector shall be located in the driver’s side foot-well region of the vehicle interior in the area bound by the driver’s side of the vehicle and the driver’s side edge of the center console (or the vehicle centerline if the vehicle does not have a center console) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position. The connector shall not be located on or in the center console (i.e., neither on the horizontal faces near the floor-mounted A/T gear selector, parking brake lever, or cup-holders nor on the vertical faces near the car stereo, climate system, or navigation system controls). The location of the connector shall be capable of being easily identified by a “crouched” technician entering the vehicle from the driver’s side.
- (1.2) If the connector is covered, the cover must be removable by hand without the use of any tools and be labeled to aid technicians in identifying the location of the connector. Access to the diagnostic connector shall not require the removal of any storage accessory (e.g., ashtray, coinbox, etc.). The label shall be submitted to the Executive Officer for review and approval, at or before the time the manufacturer submits its certification application. The Executive Officer shall approve the label if it clearly identifies that the connector is located behind the cover and is consistent with language and/or symbols commonly used in the automotive industry.
- (1.3) Any pins in the connector that provide electrical power shall be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes and shall not exceed 20.0 Volts DC regardless of the nominal vehicle system or battery voltage (e.g., 12V, 24V, 42V, etc.).

### (2.0) Communications to a Scan Tool:

Manufacturers shall use one of the following standardized protocols for communication of all required emission related messages from on-board to off-board network communications to a scan tool meeting SAE J1978 “OBD II Scan Tool” specifications, incorporated by reference:

- (2.1) SAE J1850 “Class B Data Communications Network Interface,” incorporated by reference. All required emission related messages using this protocol shall use the Cyclic Redundancy Check and the three byte header, shall not use inter-byte separation or checksums, and shall not require a minimum delay of 100 ms between SAE J1978 scan tool requests. However, this protocol shall not be used on any 2008 or newer model year vehicle.

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- (2.2) ISO 9141-2 “Road Vehicles-Diagnostic Systems-CARB Requirements for Interchange of Digital Information,” incorporated by reference. However, this protocol shall not be used on any 2007 or newer model year vehicle.
  - (2.3) ISO 14230-4 “Road Vehicles-Diagnostic Systems-KWP 2000 Requirements for Emission-related Systems,” incorporated by reference. However, this protocol shall not be used on any 2007 or newer model year vehicle.
  - (2.4) ISO 15765 “Road Vehicles – Diagnostics on Controller Area Network (CAN) - Part 4: Requirements for emission-related systems,” November 30, 1999, incorporated by reference. However, this protocol shall not be used on any 2002 or older model year vehicle. If the CAN protocol is used, manufacturers shall also use ISO 15031-5 “Road Vehicles - Communication between vehicle and external test equipment for emission-related diagnostics - Part 5: Emission-related diagnostic services,” December 1, 1999, incorporated by reference, in lieu of SAE J1979 for all required functions identified in section (f). All required emission-related messages using this protocol shall use a 500 kbps baud rate.
- (3.0) Required Emission Related Functions:  
The following standardized functions shall be implemented in accordance with the specifications in SAE J1979 “E/E Diagnostic Test Modes”, incorporated by reference, to allow for access to the required information by a scan tool meeting SAE J1978 specifications:
- (3.1) Readiness Status: In accordance with SAE J1979 specifications, the on-board diagnostic system shall indicate “complete” or “not complete” for each of the installed monitored components and systems identified in section (e)(2.0) through (e)(9.0) since the fault memory was last cleared. All components or systems that are monitored continuously shall always indicate “complete”. Those components or systems that are not subject to continuous monitoring shall immediately indicate “complete” upon the respective diagnostic(s) being fully executed and determining that the component or system is not malfunctioning. A component or system shall also indicate “complete” if after the requisite number of decisions necessary for determining MIL status have been fully executed, the monitor indicates a malfunction for the component or system. The status for each of the monitored components or systems shall indicate “not complete” whenever fault memory has been cleared or erased by a means other than that allowed in section (d)(2.0). Normal vehicle shut down (i.e., key off, engine off) shall not cause the status to indicate “not complete”.
  - (3.1.1) Subject to Executive Officer approval, if monitoring is disabled for a multiple number of driving cycles due to the continued presence of extreme operating conditions (e.g., cold ambient temperatures, high altitudes, etc), readiness status for the subject monitoring system may be set to indicate “complete” without monitoring having been completed. Executive Officer approval shall be based on the conditions for monitoring system disablement and the number of driving cycles specified without completion of monitoring before readiness is indicated as “complete”.

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- (3.1.2) For the evaporative system monitor, the readiness status shall be set in accordance with section (f)(3.1) when both the functional check of the purge valve and the 0.020 inch leak detection monitor indicate that they are complete. For vehicles with both 0.040 inch and 0.020 inch leak detection monitors, the readiness status may be set when both the functional check of the purge valve and the 0.040 inch leak detection monitor indicate that they are complete.
- (3.1.3) If the manufacturer elects to additionally indicate readiness status through the MIL in the key on, engine off position as provided for in section (d)(2.5), the readiness status shall be indicated in the following manner: 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 15-20 seconds. If the readiness status for one or more of the monitored components or systems is “not complete”, after 15-20 seconds of operation in the key on, engine off position with the MIL illuminated continuously, the MIL shall blink once per second for 5-10 seconds. The data stream value for MIL status (section (f)(3.2)) shall indicate “commanded off” during this sequence unless the MIL has also been “commanded on” for a detected fault.
- (3.2) Data Stream: The following signals shall be made available on demand through the standardized data link connector in accordance with SAE J1979 specifications. The actual signal value shall always be used instead of a default or limp home value.
  - (A) For all vehicles and engines: calculated load value, number of stored confirmed fault codes, engine coolant temperature, ignition timing advance, engine speed, absolute throttle position, vehicle speed, and MIL status (i.e., commanded-on or commanded-off).
  - (B) For all vehicles and engines so equipped: fuel control system status (e.g., open loop, closed loop, etc.), fuel trim, fuel pressure, intake air temperature, manifold air pressure, air flow rate from mass air flow sensor, secondary air status (upstream, downstream, or atmosphere), oxygen sensor output, air/fuel ratio sensor output.
  - (C) For all 2005 and subsequent model year vehicles, the following signals shall also be made available: absolute load, fuel level, relative throttle position, barometric pressure (directly measured or estimated), engine control module system voltage, commanded equivalence ratio, catalyst temperature (directly measured or estimated for purposes of enabling the catalyst monitor(s)), monitor status (i.e., disabled for the rest of this driving cycle, complete this driving cycle, or not complete this driving cycle) since last engine shut-off for each monitor used for readiness status, time elapsed since engine start, distance elapsed while MIL illuminated, distance elapsed since fault memory last cleared, and number of warm-up cycles since fault memory last cleared.
  - (D) For all 2005 and subsequent model year vehicles so equipped: ambient air temperature, evaporative system vapor pressure, commanded purge valve duty cycle/position, commanded EGR valve duty cycle/position,

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EGR error between actual and commanded, PTO status (active or not active), redundant absolute throttle position (for electronic throttle or other systems that utilize two or more sensors), absolute pedal position, redundant absolute pedal position, and commanded throttle motor position.

## (3.3) Freeze Frame.

(3.3.1) "Freeze frame" information required to be stored pursuant to section (d)(2.7.1) shall be made available on demand through the standardized data link connector in accordance with SAE J1979 specifications.

(3.3.2) "Freeze frame" conditions shall include all of the signals required in section (f)(3.2) except: number of stored confirmed fault codes, oxygen sensor output, air/fuel ratio sensor output, MIL status, monitor status since last engine shut off, and distance elapsed since MIL illuminated and shall include the fault code which caused the data to be stored.

(3.3.3) Only one frame of data is required to be recorded. Manufacturers may choose to store additional frames provided that at least the required frame can be read by a scan tool meeting SAE J1978 specifications.

## (3.4) Fault Codes

(3.4.1) For all monitored components and systems, stored pending and confirmed fault codes shall be made available through the diagnostic connector in accordance with SAE J1979 specifications. Standardized fault codes based on SAE J2012, "Recommended Format and Messages for Diagnostic Trouble Codes," incorporated by reference, shall be employed.

(3.4.2) The stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. Manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different. In general, rationality and functional diagnostics shall use different fault codes than the respective circuit continuity diagnostics. Additionally, input component circuit continuity diagnostics shall use different fault codes for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit, etc.).

(3.4.3) Manufacturers shall use appropriate SAE-defined fault codes of J2012 (e.g., P0xxx, P2xxx) whenever possible. With Executive Officer approval, manufacturers may use manufacturer-defined fault codes in accordance with SAE J2012 specifications (e.g., P1xxx, P3xxx). Factors to be considered by the Executive Officer for approval shall include the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code shall be used to represent the same failure mode) across a manufacturer's entire product line.

(3.4.4) A fault code (pending and/or confirmed, as required in sections (d) and (e)) shall be stored and available to a SAE J1978 scan tool within 10

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seconds after a diagnostic has determined that a malfunction has occurred.

## (3.4.5) Pending fault codes:

- (A) On all 2003 and subsequent model year vehicles, pending fault codes for all continuously and non-continuously monitored components and systems shall be made available through the diagnostic connector in accordance with SAE J1979 specifications (i.e., Mode \$07).
- (B) On all 2005 and subsequent model year vehicles, a pending fault code(s) shall be stored and available through the diagnostic connector for all currently malfunctioning monitored component(s) or system(s), regardless of the MIL illumination status or confirmed fault code status.

## (3.5) Test Results

- (3.5.1) For all monitored components and systems identified in section (e)(2.0) through (e)(9.0) except misfire detection and fuel system monitoring, results of the most recent monitoring of such components and systems and the test limits established for monitoring the respective components and systems shall be stored and available through the data link in accordance with SAE J1979 specifications.
- (3.5.2) The OBD II system shall store unique test results for each diagnostic (e.g., an evaporative system 0.040" leak diagnostic shall separately report test results from a 0.020" leak diagnostic).
- (3.5.3) The test results shall be reported such that properly functioning components and systems (e.g., "passing" systems) do not store a test value outside of the established test limits.
- (3.5.4) The test results shall be stored until updated by a more recent valid test result or the fault memory of the on-board diagnostic system computer is cleared. Upon fault memory being cleared, the test results shall be initialized to values that do not indicate a failure (i.e., a test value which is outside of the test limits).
- (3.5.5) For vehicles using CAN (see section (f)(2.4)) as the communication protocol:
  - (A) The test results and limits shall be made available in the standardized format specified in ISO 15031-x for the CAN protocol.
  - (B) Test limits shall include both minimum and maximum acceptable values and shall be reported for all monitored components and systems identified in sections (e)(2.0) through (e)(9.0), except fuel system monitoring. The test limits shall be defined so that a test result equal to either test limit is a "passing" value, not a "failing" value.
  - (C) Misfire monitoring test results shall indicate the number of counted misfire events for each cylinder in a standardized format. The test results shall be formatted so that the cumulative number of detected misfires per cylinder during the last nine driving cycles plus the current driving cycle can be determined.
  - (D) Monitors that have not yet completed since the last time the fault memory was cleared shall report values of zero for the test result and test limits.



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- (E) All test results and test limits shall always be reported and the test results shall be stored until updated by a more recent valid test result or the fault memory of the on-board diagnostic system computer is cleared.
- (3.6) Software Calibration Identification: On all 2003 and subsequent model year vehicles, a software calibration identification number (CAL ID) for the diagnostic or emission critical powertrain control unit(s) shall be made available through the standardized data link connector in accordance with the SAE J1979 specifications. A unique CAL ID shall be used for every emission-related calibration and/or software set having at least one bit of different data from any other emission-related calibration and/or software set. Control units coded with multiple emission or diagnostic calibrations and/or software sets shall indicate a unique CAL ID for each variant in a manner that enables an off-board device to determine which variant is being used by the vehicle.
- (3.7) Software Calibration Verification Number
- (3.7.1) All 2005 and subsequent model year vehicles shall use an algorithm to calculate a calibration verification number (CVN) that verifies the on-board computer software integrity in diagnostic or emission critical electronically reprogrammable powertrain control units. The CVN shall be made available through the standardized data link connector in accordance with the SAE J1979 specifications. The CVN shall be capable of being used to determine if the emission-related software and/or calibration data are valid and applicable for that vehicle and CAL ID.
- (3.7.2) Manufacturers shall request Executive Officer approval of the algorithm used to calculate the CVN. Executive Officer approval of the algorithm shall be based on the complexity of the algorithm and the difficulty in achieving the same CVN with modified calibration values.
- (3.7.3) The CVN shall be calculated at least once per driving cycle and stored until the CVN is subsequently updated. Except for immediately after a reprogramming event or a non-volatile memory clear, the stored value shall be made available through the data link connector to a generic scan tool in accordance with SAE J1979 specifications. The stored CVN value shall not be erased when fault memory is erased by a generic scan tool in accordance with SAE J1979 specifications or during normal vehicle shut down (i.e., key off, engine off).
- (3.7.4) 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 allows for off-board verification that the CVN is valid and appropriate for a specific vehicle and CAL ID.
- (3.8) Vehicle Identification Number: All 2005 and subsequent model year vehicles shall have the vehicle identification number (VIN) available in a standardized format through the standardized data link connector in accordance with Mode \$09 of the SAE J1979 specifications. Only one electronic control unit per vehicle shall report the VIN to a SAE J1978 scan tool.

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## (4.0) In-use Performance Tracking Requirements

(4.1) For each monitor required in section (e) to separately report frequency of in-use operation, manufacturers shall implement software algorithms to report a numerator and denominator in the standardized format specified below and in accordance with Mode \$09 of the SAE J1979 specifications.

### (4.2) Numerical Value Specifications:

#### (4.2.1) For the numerator, denominator, and ignition cycle counter:

- (A) Each number shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.
- (B) Each number shall be reset to zero only when a non-volatile memory reset occurs (e.g., reprogramming event, etc.) and shall not be reset to zero under any other circumstances including when a scan tool command to clear fault codes is received.
- (C) If either the numerator or denominator for a specific component reaches the maximum value of 65,535, both numbers shall be divided by two before either is incremented again to avoid overflow problems.
- (D) If the ignition cycle counter reaches the maximum value of 65,535, the ignition cycle counter shall be reset to one before it is incremented again to avoid overflow problems.
- (E) If a vehicle is not equipped with a component (e.g., oxygen sensor bank 2, secondary air system), the corresponding numerator and denominator for that specific component shall always be reported as zero.

#### (4.2.2) For the ratio:

- (A) The ratio shall have a minimum value of zero and a maximum value of 7.99527 with a resolution of 0.000122.
- (B) A ratio for a specific component shall be considered to be zero whenever the corresponding numerator is equal to zero and the corresponding denominator is not zero.
- (C) A ratio for a specific component shall be considered to be the maximum value of 7.99527 if the corresponding denominator is zero or if the actual value of the numerator divided by the denominator exceeds the maximum value of 7.99527.

## (5.0) Service Information:

(5.1) Motor vehicle manufacturers shall be required to provide the aftermarket service and repair industry emission-related service information for all 1994 and subsequent model year vehicles equipped with OBD II systems as set forth in sections (f)(5.3) through (5.8). The requirements of section (f) shall supersede the service information requirements set forth in section 1968.1, Title 13, CCR.

(5.2) The Executive Officer shall waive the requirements of sections (f)(5.3) through (5.8) if the ARB or U.S. EPA adopt a service information regulation or rule that is in effect and operative and requires motor vehicle manufacturers to provide emission-related service information:

- (A) of comparable or greater scope than required under these provisions;
- (B) in an easily accessible format and in a timeframe that is equivalent to or

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- exceeds the timeframes set forth below; and  
(C) at fair and reasonable cost.
- (5.3) For all 1994 and subsequent model year vehicles equipped with an OBD II system, manufacturers shall make readily available, at a fair and reasonable price to the automotive repair industry, vehicle repair procedures which allow effective emission-related diagnosis and repairs to be performed using only the SAE J1978 generic scan tool and commonly available, non-microprocessor based tools.
  - (5.4) As an alternative to publishing repair procedures using only the SAE J1978 generic scan tool, manufacturers may publish repair procedures referencing the use of manufacturer-specific or enhanced equipment provided the manufacturers make available to the aftermarket scan tool industry the information needed to manufacture scan tools to perform the same emission-related diagnosis and repair procedures (excluding any reprogramming) in a comparable manner as the manufacturer-specific diagnostic scan tool.
  - (5.5) For all 1996 and subsequent model year vehicles, manufacturers shall make available information to utilize the test results reported as required in section (f)(3.5) (or section 1968.1 (l)(3.0) of Title 13, CCR, for 1996 through 2002 model year vehicles). Such information shall include a description of the test and test result, associated fault codes with the test result, and scaling, units, and conversion factors necessary to convert the results to engineering units.
  - (5.6) For all 1996 and subsequent model year vehicles, manufacturers shall make available a generic description of each of the diagnostics used to meet the requirements of this regulation. Such generic description shall include a text description of how the diagnostic is performed, typical enable conditions, typical malfunction thresholds, typical monitoring time, fault codes associated with the diagnostic, and test results (section (f)(3.5)) associated with the diagnostic. Vehicles that have diagnostics not adequately represented by the typical values identified above shall be specifically identified along with the appropriate typical values.
  - (5.7) Manufacturers shall make available information necessary to execute each of the diagnostics used to meet the requirements of sections (e)(2.0) through (e)(9.0). Such information shall either include a description of sample driving patterns designed to be operated in-use or a written description of the conditions the vehicle needs to operate in to execute each of the diagnostics necessary to change the readiness status from not complete to complete for all monitors. The information shall be able to be used to exercise all necessary monitors in a single driving cycle as well as be able to be used to exercise the monitors to individually change the readiness status for each specific monitor from “not complete” to “complete”.
  - (5.8) Standardized Format of Service Information (SAE J2008): Beginning January 1, 2002, manufacturers shall make available at a fair and reasonable price, all 2002 and subsequent model year vehicle emission-related diagnosis and repair information provided to the manufacturer’s franchised dealers (e.g., service manuals, technical service bulletins, etc.) in the electronic format specified in SAE J2008 Draft Technical Report, “Recommended Organization

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of Service Information”, November, 1995. The information shall be made available within 30 days of its availability to franchised dealers. Small volume manufacturers shall be exempted indefinitely from the J2008 formatting requirement.

## (g) MONITORING SYSTEM DEMONSTRATION REQUIREMENTS

### (1.0) General.

- (1.1) Certification shall require that manufacturers submit emission test data from one or more certification emission durability demonstration test vehicles (test vehicles). For applications certified on engine dynamometers, engines may be used instead of vehicles.
- (1.2) The Executive Officer may approve other demonstration protocols if the manufacturer can provide comparable assurance that the malfunction criteria are chosen based on meeting emission requirements and that the timeliness of malfunction detection is within the constraints of the applicable monitoring requirements.
- (1.3) For flexible fuel vehicles capable of operating on more than one fuel or fuel combinations, the manufacturer shall submit a plan for providing emission test data to the Executive Officer for approval. The Executive Officer shall approve the plan if it is determined to be representative of expected in-use fuel or fuel combinations and provides accurate and timely evaluation of the monitored systems.

### (2.0) Selection of Test Vehicles:

- (2.1.1) The ARB shall determine the test group(s) for which manufacturers shall provide emission test data. Prior to submitting any applications for certification each model year, a manufacturer shall notify the Executive Officer of the test groups planned for a particular model year to allow selection of the test group(s) to be demonstrated.
- (2.1.2) A manufacturer certifying one to five test groups in a model year shall provide emission test data from a test vehicle from one test group. A manufacturer certifying six to ten test groups in a model year shall provide emission test data from test vehicles from two test groups. A manufacturer certifying eleven or more test groups in a model year shall provide emission test data from test vehicles from three test groups. The Executive Officer may waive the data requirement for submittal of data from one or more of the test groups if data has been previously submitted for all of the test groups.
- (2.1.3) If an emission durability test vehicle is not available for a test group designated for OBD II monitoring system demonstration testing, the Executive Officer shall permit a manufacturer to satisfy this requirement with data from a representative high mileage vehicle(s) or from a vehicle(s) aged to the end of the full useful life using an ARB-approved alternative durability procedure (ADP).

### (3.0) Required Testing:

Except as provided below, the manufacturer shall perform single-fault testing based on the applicable FTP-test cycle with the following components/systems

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set at their malfunction criteria limits as determined by the manufacturer for meeting the requirements of section (e):

- (3.1) Oxygen Sensors: The manufacturer shall perform a test with all primary oxygen sensors used for fuel control simultaneously possessing a response rate deteriorated to the malfunction criteria limit. Manufacturers shall also perform a test for any other oxygen sensor parameter that can cause vehicle emissions to exceed 1.5 times the applicable standards (e.g., shift in air/fuel ratio at which oxygen sensor switches, decreased amplitude, etc.). When performing additional test(s), all primary and secondary (if applicable) oxygen sensors used for fuel control shall be operating at the malfunction criteria limit for the applicable parameter only. All other primary and secondary oxygen sensor parameters shall be with normal characteristics.
  - (3.1.1) For vehicles utilizing sensors other than oxygen sensors for primary fuel control (e.g., linear air fuel ratio sensors, universal sensors, etc.), the manufacturer shall submit, for Executive Officer approval, a demonstration test plan to perform testing of all of the sensor parameters that can cause vehicle emissions to exceed 1.5 times the applicable standards. The Executive Officer shall approve the plan if it is determined that it will provide data that will assure proper performance of the diagnostics of such sensors, consistent with the intent of this section.
- (3.2) EGR System: The manufacturer shall perform a test at the low flow limit.
- (3.3) Fuel System:
  - (3.3.1) For vehicles with adaptive feedback, the manufacturer shall perform a test at the rich limit(s) and a test at the lean limit(s) established by the manufacturer in section (e)(7.2) to indicate a malfunction before emissions exceed 1.5 times the applicable standards.
  - (3.3.2) For other fuel metering or control systems, the manufacturer shall perform a test at the criteria limit(s).
  - (3.3.3) For purposes of fuel system testing, the fault(s) induced may result in a uniform distribution of fuel and air among the cylinders. Non-uniform distribution of fuel and air used to induce a fault shall not cause an indication of misfire. In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate that the computer modification produce test results equivalent to an induced hardware malfunction.
- (3.4) Misfire: The manufacturer shall perform a test at the malfunction criteria limit specified in (e)(4.2.2). Such testing is not required for diesel applications.
- (3.5) Secondary Air System: The manufacturer shall perform a test at the low flow limit. Manufacturers performing only a functional check in accordance with the provisions of section (e)(6.2.1) or (e)(19.2) shall perform a test at the functional check flow malfunction criteria.
- (3.6) Catalyst System: The manufacturer shall perform a test using a catalyst system deteriorated to the malfunction criteria using methods established by the manufacturer in accordance with section (e)(2.2.4).
- (3.7) Heated Catalyst Systems: The manufacturer shall perform a test at the

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- malfunction criteria limit established by the manufacturer in section (e)(3.2).
- (3.8) Other systems: The manufacturer shall conduct demonstration tests for all other emission control components designed and calibrated to a malfunction criteria of 1.5 times any of the applicable emission standards (e.g., hydrocarbon traps, adsorbers, etc.) under the provisions of section (e)(18.0).
- (3.9) The manufacturer may electronically simulate deteriorated components but may not make any vehicle control unit modifications (unless otherwise excepted above) when performing demonstration tests. All equipment necessary to duplicate the demonstration test must be made available to the ARB upon request.
- (4.0) Testing Protocol:
- (4.1) Preconditioning: The manufacturer shall use the first engine start portion of an applicable FTP cycle (or Unified Cycle, if approved) for preconditioning test vehicles prior to conducting each of the above emission tests. If a manufacturer provides data and/or an engineering evaluation that adequately demonstrates that additional preconditioning is necessary to stabilize the emission control system, the Executive Officer shall allow the manufacturer to perform a single additional preconditioning cycle, identical to the initial preconditioning cycle, or a Federal Highway Fuel Economy Driving Cycle, following a ten minute (20 minutes for medium duty engines certified on an engine dynamometer) hot soak after the initial preconditioning cycle. The manufacturer shall not require the test vehicle to be cold soaked prior to conducting preconditioning cycles in order for the monitoring system testing to be successful.
- (4.2) Test Sequence:
- (4.2.1) The manufacturer shall set the system or component on the test vehicle for which detection is to be tested at the criteria limit(s) prior to conducting the applicable preconditioning cycle(s). If a second preconditioning cycle is permitted in accordance with section (g)(4.1) above, the manufacturer may adjust the system or component to be tested before conducting the second preconditioning cycle. The manufacturer shall not replace, modify, or adjust the system or component after the last preconditioning cycle has taken place.
- (4.2.2) After preconditioning, the test vehicle shall be operated over the first engine start portion of the applicable FTP test (or Unified Cycle, if approved) to allow for the initial detection of the tested system or component malfunction. This driving cycle may be omitted from the testing protocol if it is unnecessary. If required by the designated monitoring strategy, a cold soak may be performed prior to conducting this driving cycle.
- (4.2.3) The test vehicle shall then be operated over the complete applicable FTP test. If monitoring during the Unified Cycle is approved, a second Unified Cycle may be conducted prior to the FTP test.
- (4.3) A manufacturer required to test more than one test vehicle (section (g)(2.1.2)) may utilize internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers, etc.)

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instead of official FTP test procedures to obtain the emission test data required in section (g) for all but one of the required test vehicles. The manufacturer may elect this option if the data from the alternative test procedure are representative of official FTP emission test results. Manufacturers using this option shall still be responsible for meeting the malfunction criteria specified in section (e) on emission tests performed in accordance with official FTP test procedures.

(5.0) Evaluation Protocol:

- (5.1.1) For all tests conducted under this section, the MIL shall be illuminated upon detection of the tested system or component malfunction before the hot start portion of the complete FTP test (or before the hot start portion of the last Unified Cycle, if applicable) in accordance with requirements of section (e).
- (5.1.2) If the MIL illuminates prior to emissions exceeding the applicable malfunction criteria specified in section (e), no further demonstration shall be required. With respect to the misfire monitor demonstration test, if a manufacturer has elected to use the minimum misfire malfunction criteria of one percent as allowed in (e)(4.2.2)(A), no further demonstration shall be required if the MIL illuminates with misfire implanted at the malfunction criteria limit.
- (5.1.3) If the MIL does not illuminate when the systems or components are set at their limit(s), the criteria limit or the OBD system is not acceptable.
  - (A) Except for testing of the catalyst system, if the MIL first illuminates after emissions exceed the applicable malfunction criteria specified in section (e), the test vehicle shall be retested with the tested system or component adjusted so that the MIL will illuminate before emissions exceed the applicable malfunction criteria specified in section (e). If the component cannot be adjusted to meet this criterion because a default fuel or emission control strategy is used when a malfunction is detected (e.g., open loop fuel control used after an O<sub>2</sub> sensor malfunction is determined, etc.), the test vehicle shall be retested with the component adjusted to the worst acceptable limit (i.e., the applicable monitor indicates the component is performing at or slightly better than the malfunction criteria). For the OBD II system to be approved, the MIL shall not illuminate during this test and the vehicle emissions must be below the applicable malfunction criteria specified in section (e).
  - (B) In testing the catalyst system, if the MIL first illuminates after emissions exceed the applicable emission threshold(s) specified in section (e), the tested vehicle shall be retested with the average FTP conversion capability of the monitored portion of the catalyst system increased by no more than five percent (i.e., five percent more engine out applicable pollutants are converted). Upon retesting, for the OBD II system to be approved, the emission levels of the tested vehicle must not exceed the emission levels specified in the malfunction criteria in section (e) and the MIL shall not illuminate.
- (5.1.4) If an OBD system is determined unacceptable by the above criteria, the

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manufacturer may recalibrate and retest the system on the same test vehicle. In such a case, the manufacturer must confirm, by retesting, that all systems and components that were tested prior to recalibration and are affected by the recalibration function properly under the OBD system as recalibrated.

(6.0) Confirmatory Testing:

- (6.1) The ARB may perform confirmatory testing of manufacturers' diagnostic systems for compliance with the requirements of section (g) and the malfunction criteria identified in section (e). Confirmatory testing to verify that the malfunction criteria are set for compliance with emission requirements of sections (e) and (g) shall be limited to vehicles in test groups derived from the demonstration vehicle(s).
- (6.2) The ARB or its designee may install appropriately deteriorated or malfunctioning components in an otherwise properly functioning test vehicle of a test group represented by the demonstration test vehicle(s) (or simulate a deteriorated or malfunctioning component) in order to test any of the components or systems required to be tested in section (g). Upon request by the Executive Officer, the manufacturer shall make available a vehicle and all test equipment (e.g., malfunction simulators, deteriorated components, etc.) necessary to duplicate the manufacturer's testing.
- (6.3) Vehicles with diagnostic systems represented by the demonstration vehicle(s) may be recalled for corrective action if a representative sample of vehicles uniformly fails to meet the requirements of section (g).

(h) CERTIFICATION DOCUMENTATION:

- (1.0) When submitting an application for certification of a test group, the manufacturer shall submit the following documentation. If any of the items listed below are standardized for all of a manufacturer's test groups, the manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its test groups.
  - (1.1) For the required documentation not standardized across all test groups, the manufacturer may propose to the Executive Officer that documentation covering a specified combination of test groups be used. These combinations shall be known as "OBD II groups". Executive Officer approval shall be granted for those groupings that include test groups using the same OBD II strategies and similar calibrations. If approved by the Executive Officer, the manufacturer may submit one set of documentation from one or more representative test group(s) that are a part of the OBD II group. The manufacturer shall receive Executive Officer approval as to whether a selected test group(s) is representative of the OBD II group as a whole. To be approved as representative, the test group(s) must possess the most stringent emission standards and OBD II monitoring requirements and cover all of the emission control devices within the OBD II group.
  - (1.2) With Executive Officer approval, one or more of the documentation requirements specified in this section may be waived or modified if the



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information required would be redundant or unnecessarily burdensome to generate.

- (2.0) The following information shall be submitted as “Part 1” of the certification application. Except as provided below for demonstration data, the Executive Officer will not issue an Executive Order certifying the covered vehicles without the information having been provided:
  - (2.1) A written description of the functional operation of the diagnostic system.
  - (2.2) A table providing the following information for each monitored component or system (either computer-sensed or -controlled) of the emission control system:
    - (A) corresponding fault code
    - (B) monitoring method or procedure for malfunction detection
    - (C) primary malfunction detection parameter and its type of output signal
    - (D) fault criteria limits used to evaluate output signal of primary parameter
    - (E) other monitored secondary parameters and conditions (in engineering units) necessary for malfunction detection
    - (F) monitoring time length and frequency of checks
    - (G) criteria for storing fault code
    - (H) criteria for illuminating malfunction indicator light
    - (I) criteria used for determining out of range values and input component rationality checks
  - (2.3) A logic flowchart describing the general method of detecting malfunctions for each monitored emission-related component or system. To the extent possible, abbreviations in Society of Automotive Engineers' (SAE) J1930 "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms", May, 1998, shall be used. J1930 is incorporated by reference herein.
  - (2.4) Emission test data, a description of the testing sequence (e.g., the number and types of preconditioning cycles), approximate time (in seconds) of MIL illumination during the test, and a description of the modified or deteriorated components used for fault simulation with respect to the demonstration tests specified in section (g). With Executive Officer approval, a test group may be granted a conditional certification prior to the submittal of this data for ARB review and approval. Factors to be considered by the Executive Officer for approval shall include the ability of the manufacturer to anticipate the cause for the delay in the data collection, the length of time until data will be available, and the demonstrated previous success of the manufacturer in submitting the data prior to certification.
  - (2.5) Data supporting the misfire monitor, including:
    - (2.5.1) The established percentage of misfire that can be tolerated without damaging the catalyst over the full range of engine speed and load conditions.
    - (2.5.2) Data demonstrating the probability of detection of misfire events of the misfire monitoring system over the full engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the

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malfunction criteria established in (e)(4.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

- (2.5.3) Data identifying all disablement of misfire monitoring that occurs during the FTP and US06 test cycles. For every disablement that occurs during the test cycles, the data should identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement.
- (2.6) Data supporting the limit for the time between engine starting and attaining the designated heating temperature for after-start heated catalyst systems.
- (2.7) A listing of all electronic powertrain input and output signals.
- (2.8) A written description of all parameters and conditions necessary to begin closed loop operation.
- (2.9) A summary table identifying every test group and each of the OBD II phase-in requirements that apply to each test group.
- (2.10) A written identification of the communication protocol utilized by each test group for communication with an SAE J1978 scan tool.
- (2.11) Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this section.
- (3.0) "Part 2". The following information shall be submitted by January 1<sup>st</sup> of the applicable model year:
  - (3.1) A listing and block diagram of the input parameters used to calculate or determine calculated load values and the input parameters used to calculate or determine fuel trim values.
  - (3.2) A scale drawing of the MIL and the fuel cap indicator light, if present, which specifies location in the instrument panel, wording, color, and intensity.
- (4.0) "Part 3". The following information shall be submitted upon request of the Executive Officer:
  - (4.1) Data supporting the criteria used to indicate a malfunction when catalyst deterioration causes emissions to exceed the applicable malfunction criteria specified in section (e).
  - (4.2) Data supporting the criteria used to detect evaporative system leaks.
  - (4.3) Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this section.

## (i) DEFICIENCIES

- (1.0) For 2003 and subsequent model year vehicles, the Executive Officer, upon receipt of an application from the manufacturer, may certify vehicles even though said vehicles may not comply with one or more of the requirements of section 1968.2 of Title 13, CCR. In granting such certification, the Executive Officer shall consider the following factors: the extent to which the requirements of section 1968.2 are satisfied overall on the vehicle applications in question, the relative performance of the resultant diagnostic system compared to systems fully compliant with the requirements of section 1968.2, Title 13, CCR, and a demonstrated good-faith effort to: (1) meet the requirements in full by evaluating and considering the best available monitoring technology; and (2) come into

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compliance as expeditiously as possible. The Executive Officer shall not grant certification to a vehicle in which the reported noncompliance for which a deficiency is sought would be subject to ordered recall pursuant to section 1968.5 (c)(3)(A).

- (2.0) Manufacturers of non-complying systems shall be subject to fines pursuant to section 43016 of the California Health and Safety Code. The specified fines shall apply to the third and subsequently identified deficiencies, with the exception that fines shall apply to all monitoring system deficiencies wherein a required monitoring strategy is completely absent from the OBD system.
- (3.0) The fines shall be in the amount of \$50 per deficiency per vehicle for non-compliance with any of the monitoring requirements specified in subsections (e)(2.0) through (e)(9.0), (e)(12.0), (e)(14.0) through (e)(16.0), and (e)(18.0), and \$25 per deficiency per vehicle for non-compliance with any other requirement of section 1968.2. In determining the identified order of deficiencies, deficiencies subject to a \$50 fine shall be identified first. Total fines per vehicle under this section shall not exceed \$500 per vehicle and shall be payable to the State Treasurer for deposit in the Air Pollution Control Fund.
- (4.0) Manufacturers must re-apply for Executive Officer approval of a deficiency each model year. In considering the request to carry-over a deficiency, the Executive Officer shall consider the factors identified in section (i)(1.0) including the manufacturer's progress towards correcting the deficiency. The Executive Officer shall not allow manufacturers to carry over monitoring system deficiencies for more than two model years unless it can be adequately demonstrated that substantial vehicle hardware modifications and additional lead time beyond two years would be necessary to correct the deficiency, in which case the Executive Officer shall allow the deficiency to be carried over for three model years.
- (5.0) Except as allowed in section (i)(6.0), deficiencies shall not be retroactively granted after certification.
- (6.0) Request for retroactive deficiencies
  - (6.1) Manufacturers may request that the Executive Officer grant a deficiency and amend a vehicle's certification to conform to the granting of such deficiencies during the first 120 days after commencement of normal production for each aspect of the monitoring system: (a) identified by the manufacturer (during testing required by section (j)(2) or any other testing) to be functioning different than the certified system or otherwise not meeting the requirements of any aspect of section 1968.2; and (b) reported to the Executive Officer. If the Executive Officer grants the deficiencies and amended certification, their approval would be retroactive to the start of production.
  - (6.2) Executive Officer approval of the request for a retroactive deficiency shall be granted provided that the conditions necessary for a pre-certification deficiency determination are satisfied (see section (i)(1.0)) and the manufacturer could not have reasonably anticipated the identified problem before commencement of production.

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- (6.3) In granting the amended certification, the Executive Officer shall include any approved post-production deficiencies together with all previously approved deficiencies in computing fines in accordance with section (i)(2.0).
- (7.0) Any OBD II system installed on a production vehicle that fails to conform with the certified OBD II system for that vehicle or otherwise fails to meet the requirements of section 1968.2 and has not been granted a deficiency pursuant to the provisions of section (i)(1.0) through (i)(6.0) shall be considered non-compliant. Such vehicles shall be subject to enforcement pursuant to applicable provisions of the Health and Safety Code and section 1968.5 of Title 13, CCR.

## (j) PRODUCTION VEHICLE EVALUATION TESTING

### (1.0) Verification of Standardized Requirements

- (1.1) Requirement: Manufacturers shall perform testing to verify the vehicle meets the requirements of section (f)(2.0) and (f)(3.0) relevant to proper communication of required emission-related messages to a J1978 scan tool.
- (1.2) Selection of Test Vehicles: Every model year, manufacturers shall perform this testing on one production vehicle from every unique calibration within 30 days of the start of production for that calibration.
- (1.3) Required Testing: The testing shall verify the vehicle can:
  - (1.3.1) Properly establish communications between all emission-related on-board computers and a J1978 scan tool designed to adhere strictly to the communication protocols allowed in section (f)(2.0);
  - (1.3.2) Properly communicate to a J1978 scan tool the readiness status in accordance with J1979 and section (f)(3.1) while the engine is running;
  - (1.3.3) Properly communicate to a J1978 scan tool the actual MIL command status in accordance with J1979 and section (f)(3.2) while the engine is running and in accordance with J1979 and sections (d)(2.5) and (f)(3.1.2) during the MIL functional check while the engine is off;
  - (1.3.4) Properly identify as supported (J1979 Mode \$01 PID 00) and communicate to a J1978 scan tool all data stream parameters required in section (f)(3.2) in accordance with J1979;
  - (1.3.5) Properly communicate to a J1978 scan tool the (if applicable) CAL ID, CVN, and VIN in accordance with J1979;
  - (1.3.6) Properly communicate to a J1978 scan tool emission-related fault codes (both confirmed and pending) in accordance with J1979 and section (f)(3.4);
  - (1.3.7) Properly communicate to a J1978 scan tool all test results in accordance with J1979 and section (f)(3.5);
  - (1.3.8) Properly respond to a J1978 scan tool request to clear emission-related fault codes and reset readiness status.
  - (1.3.9) Properly communicate and respond to a J1978 scan tool any other required function or parameter used in an Inspection and Maintenance (I/M) program.
- (1.4) Reporting of Results:
  - (1.4.1) The manufacturer shall notify the Executive Officer within 30 days of identifying any vehicle that does not meet the requirements of section

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(h)(1.3). The manufacturer shall submit a written report of the problem identified and propose corrective action (if any) to remedy the problem to the Executive Officer for approval. Factors to be considered by the Executive Officer for approval shall include 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, and the impact on equipment and tool manufacturers.

(1.4.2) Upon request of the Executive Officer, manufacturers shall submit a report of the results of any testing conducted pursuant to section (h) to the Executive Officer for review.

## (2.0) Verification of Monitoring Requirements

(2.1) Within the first four months after production begins, manufacturers shall conduct a complete evaluation of the diagnostic system of one production vehicle per test group selected for monitoring system demonstration in section (g) and submit the results of the evaluation to the Executive Officer.

### (2.2) Evaluation requirements:

(2.2.1) The evaluation shall demonstrate the ability of the diagnostic system on the selected production vehicle to indicate a malfunction when a malfunction is present and the monitoring conditions have been satisfied for each individual diagnostic required by section 1969.1.

(2.2.2) The evaluation shall verify that malfunctions detected by non-MIL illuminating diagnostics of components used to enable any other OBD II system diagnostic (e.g., fuel level sensor) will not inhibit the ability of other OBD II system diagnostics to properly identify malfunctions.

(2.2.3) On vehicles so equipped, the evaluation shall verify that the software used to track the numerator and denominator for purposes of determining in-use monitoring frequency correctly increments as required in section (d)(3.2).

(2.2.4) Malfunctions may be mechanically implanted or electronically simulated but internal on-board computer hardware or software changes may not be used to simulate malfunctions. Emission testing to confirm that the malfunction is indicated before the appropriate emission standards are exceeded shall not be required.

(2.2.5) Manufacturers shall submit a proposed test plan for Executive Officer approval prior to evaluation testing being performed. The test plan shall identify the method used to induce a malfunction in each diagnostic. If the Executive Officer determines that the requirements of section (j)(2) are satisfied, the proposed test plan shall be approved.

(2.2.6) Subject to Executive Officer approval, manufacturers may omit demonstration of specific diagnostics. Executive Officer approval shall be granted if the demonstration cannot be reasonably performed without causing physical damage to the vehicle (e.g., on-board computer internal circuit faults).

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- (2.3) In accordance with section (i)(6), manufacturers may request Executive Officer approval for a retroactive deficiency to be granted for items identified during this testing.
- (3.0) Verification and Reporting of In-use Monitoring Performance
  - (3.1) Manufacturers shall be required to collect and report in-use monitoring performance data representative of every test group certified by the manufacturer and equipped with in-use monitoring performance tracking software in accordance with section (d)(3) to the ARB within six months after the start of production.
  - (3.2) For each test group, the data shall include all of the in-use performance tracking data reported through Mode \$09 of J1979 (e.g., all numerators and denominators and the ignition cycle counter), the date the data was collected, the vehicle VIN, and the ECM software calibration identification number.
  - (3.3) Manufacturers shall submit a plan to the Executive Officer for review and approval of the sampling method, number of vehicles to be sampled, time line to collect the data, and reporting format. The Executive Officer shall approve the plan if it provides for effective collection of data from a representative sample of vehicles that, at a minimum, is at least half of the number of vehicles ARB would be required to test under the provisions of Title 13, CCR, section 1968.5 (b)(3)(C), will likely result in the collection and submittal of data within the required six month time frame, will generate data that is representative of California drivers and temperatures, and does not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles with the highest in-use performance ratios.

## **APPENDIX B**

Modifications to Enforcement of Malfunction and Diagnostic System Requirements for 2003 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines, Section 1968.5, Title 13, California Code of Regulations.

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## **§ 1968.5 Enforcement of Malfunction and Diagnostic System Requirements.**

### **(a) General**

- (1) Applicability. These procedures shall apply to all 2003 and subsequent model year vehicles equipped with OBD II monitoring systems that have been certified for sale in California.
- (2) Purpose. The purpose of this section is to clarify the enforcement protocol that shall be used by the ARB to assure that vehicles certified for sale in California are equipped with OBD II systems that properly function and meet the asserted purposes set forth in section 1968.2 of title 13, California Code of Regulation: that such systems monitor exhaust emission systems under conditions which may reasonably be expected to be encountered in-use for the actual life of the vehicle in which they are installed and are capable of detecting malfunctions of the monitored emission systems, illuminating a MIL that notifies the vehicle operator of detected malfunctions, and storing fault codes and freeze-frame data identifying detected malfunctions.
- (3) The definitions applicable to these rules include those set forth at Title 13, California Code of Regulations, sections 1900(b) and 1968.2(b), which are incorporated by reference herein. The following definitions are specifically applicable to this section and take precedence over any contrary definitions in Title 13, California Code of Regulations.
  - (A) “Days”, when computing any period of time, means normal working days in which a manufacturer is open for business, unless otherwise noted.
  - (B) “Executive Officer” means the Executive Officer of the Air Resources Board or his or her authorized representative.
  - (C) “Major Monitor” means those monitors covered by the requirements set forth in Title 13, CCR section 1968.2(c)(2.0) through (c)(9.0), (c)(12.0) through (c)(15.0), and (c)(17.0).
  - (D) “Motor Vehicle Class” means a group or set of vehicles or engines determined by the Executive Officer to be classified together because they share common or similar hardware, software, OBD II monitoring strategy, or emission control strategy. A motor vehicle class may extend beyond an emission test group, OBD II test group, or a specific make and model of a manufacturer.
  - (E) “Motor Vehicle Manufacturer” means the manufacturer granted certification for a motor vehicle.
  - (F) “Nonconforming OBD II System” means an OBD II system on a production vehicle that has been determined not to conform with the OBD II system that has been certified by the ARB for use in a motor vehicle class that includes the production vehicle model or that is not in compliance with Title 13, CCR, section 1968.2. For purposes of enforcement, a motor vehicle class shall be considered



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nonconforming, irrespective of whether the motor vehicle class covered by the certification(s), on average, fails to meet applicable tailpipe or evaporative emission standards for that motor vehicle class.

- (G) “Ordered OBD II-Related Recall” means an inspection, repair, adjustment, or modification program required by the ARB and conducted by the manufacturer or its agent or representative to remedy any nonconforming OBD II system for which direct notification of vehicle owners is necessary.
- (H) “Quarterly Reports” refer to the following calendar periods: January 1 – March 31; April 1 – June 30; July 1 – September 30; October 1 – December 31.
- (I) “Test Sample Group” means a group of production vehicles in a motor vehicle class equipped with OBD II systems that are selected and tested as part of the ARB in-use testing program set forth in section (b).
- (J) “Voluntary OBD II-Related Recall” means an inspection, repair, adjustment, or modification program voluntarily initiated and conducted by a manufacturer or its agent or representative to remedy any nonconforming OBD II system for which direct notification of vehicle owners is necessary.

## **(b) In-Use Testing Procedures**

- (1) Purpose: To assure that OBD II systems on production motor vehicles and engines conform with motor vehicles and engines certified by the ARB and comply with the requirements of section 1968.2, the ARB will periodically evaluate a test sample group of vehicles and engines from a motor vehicle class.
- (2) Selection of Motor Vehicles in a Test Sample Group
  - (A) In conducting in-use testing, the ARB will determine the appropriate size of the test sample group based upon the nature of the noncompliance and the scope of the motor vehicle class. In some cases (e.g., common software strategy defects, improper diagnostic connector location, etc.), the appropriate sample group may be as few as two test vehicles.
  - (B) The ARB shall not include any vehicle as part of a test sample group that:
    - (i) Is not designed to meet the California OBD II standards.
    - (ii) Has evidence that it has been tampered with or has been equipped with add-on or modified parts that would cause the OBD II system not to comply with the requirements of Title 13, CCR section 1968.2.
    - (iii) For purposes of determining compliance with the applicable FTP emission thresholds (e.g., 1.5 times the FTP standard), is outside the defined full useful life period for the vehicle.
    - (iv) Has a detected or known malfunction(s) unrelated to the monitor

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or system being evaluated. At its discretion, the ARB may elect to repair a vehicle with a detected or known malfunction prior to including the vehicle in the test sample group.

- (v) For purposes of determining if a test sample group meets the minimum acceptable frequency ratios established in Title 13, CCR section 1968.2 (d), has a applicable denominator indicating less than approximately six months of collected data on vehicle operation. For purposes of this requirement, catalyst, oxygen sensor, or EGR denominators less than 300 shall be considered to have less than six months of collected data. Evaporative system and secondary air system denominators less than 150 shall be considered to have less than six months of collected data.

### (3) In-Use Testing

(A) After the test sample group has been selected, the ARB may replace components monitored by the OBD II system with components that are sufficiently deteriorated or simulated to cause malfunctions that exceed the malfunction criteria established pursuant to Title 13, CCR section 1968.2(e) in a properly operating system.

(B) The ARB shall conduct one or more of the following tests:

- (i) Dynamometer testing over the applicable FTP.
- (ii) On-road testing with vehicles. During the on-road test, one or more of the monitors of the OBD II system will be tested, with the vehicle being driven in a manner that will reasonably assure that all of the monitoring conditions disclosed in the manufacturer's certification application for the tested monitor are encountered.
- (iii) Data collection from test vehicles in accordance with the sampling procedures identified below in section (b)(3)(C) for purposes of determining compliance with the minimum acceptable frequency ratios established in Title 13, CCR section 1968.2 (d).

(C) For purposes of determining if a test sample group meets the minimum acceptable frequency ratios established in Title 13, CCR section 1968.2 (d), the ARB shall use the following non-random sampling procedure:

- (i) As a first evaluation, data from at least 20 vehicles from a test sample group shall be collected.
- (ii) If the data from the initial sample of vehicles indicates the test sample group, on average (e.g., the sum of the EGR ratios from all vehicles divided by the number of vehicles), fails to meet any one of the minimum acceptable frequency ratios, further testing may be conducted.
- (iii) If further testing is conducted, data from an additional 40 or more vehicles from the test sample group shall be collected.
- (iv) If the data from the second sample of vehicles indicates 90% of the test sample group fails to meet any one of the minimum acceptable frequency ratios (e.g., 90% of the number of vehicles

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sampled indicate a frequency below the minimum acceptable ratio), the Executive Officer may pursue remedial action as specified in section (c).

- (v) The manufacturer may, at its discretion, elect to collect data from additional vehicles to refute the Executive Officer's findings. If choosing to do so, the manufacturer shall, within the time frame established in the preliminary notice notifying the manufacturer of the test results as required in section (b)(4)(A), submit a plan for review and approval by the Executive Officer detailing the data collection method, time frame, vehicle recruitment method, and sample size (i.e., number of vehicles) for data collection. In general, the Executive Officer shall approve the plan if it: is not designed in a manner that (intentionally or unintentionally) specifically excludes vehicles that otherwise meet the criteria used by the Executive Officer (section (b)(2)); will result in a sample that is representative of in-use driving in California: includes a sample size of at least three times the number of vehicles sampled by the ARB; and will be completed within 90 days after the approval of the plan.
- (vi) The Executive Officer shall take the results of the manufacturer's testing into consideration, in addition to all previously conducted testing, when deciding what, if any, remedial action under section (c) is applicable.

#### (4) Notification of In-Use Test Results

- (A) The Executive Officer shall issue a preliminary notice to the manufacturer, in writing, that initial in-use test results from a test sample group indicate a possible nonconforming OBD II system.
  - (i) With the preliminary notice, the ARB shall include all relevant supporting test data that it relied upon in making its determination of a suspected nonconformance. It shall also provide the manufacturer with a time not less than 60 days from the date that the preliminary notice is issued for the manufacturer to respond to the preliminary notice.
  - (ii) The preliminary notice shall include a statement that the motor vehicle class represented by the test sample group with the suspected nonconforming OBD II system may be subject to appropriate remedial action, including recall.
- (B) Within the time period set by the Executive Officer in section (b)(4)(A)(i), the manufacturer shall provide to the ARB any test results or other data that may rebut the results of the ARB testing. If the manufacturer objects to the size of the test sample group used by the Executive Officer, the manufacturer shall set forth what it considers to be the appropriate size for the test sample group. The Executive Officer shall consider such information in determining appropriate remedial action.

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- (C) After receipt of any information submitted by the manufacturer pursuant to paragraph (B) above, the Executive Officer may conduct any additional in-use testing that he or she believes is necessary.
- (i) At the Executive Officer's discretion, he or she may request that the manufacturer, within a reasonable period of time, make available to the ARB, at the manufacturer's expense, a reasonable number of vehicles up to but no more than the number of vehicles set forth by the manufacturer in section (b)(4)(B) above as the appropriate size for the test sample group.
  - (ii) If requested, the manufacturer shall make such vehicles available for testing within the time period prescribed in the Executive Officer's request.
  - (iii) It shall be presumed for purposes of this section that the subject motor vehicle class is nonconforming if the manufacturer refuses to provide the requested vehicles within the time provided by the Executive Officer.
- (D) Upon request of the manufacturer, the Executive Officer may for good cause extend the time requirements set forth in sections (b)(4)(B) and (C) above. In granting additional time, the Executive Officer shall consider, among other things, any documentation submitted by the manufacturer regarding the time that it reasonably believes is necessary to conduct its own testing and what effect undue delay may have on proper enforcement.
- (E) Within 60 days after completing any additional testing that the Executive Officer deemed necessary under paragraph (C) above, the Executive Officer, upon considering all of the information collected and received, including all information received from the manufacturer pursuant to paragraph (B), shall issue a determination as to whether the OBD II system of the subject motor vehicle class is nonconforming. The Executive Officer shall immediately notify the manufacturer of the determination. The notice shall include a description of each class of vehicles or engines that has been determined to have a nonconforming OBD II system, shall set forth the factual bases for the determination. The Executive Officer may for good cause extend the timeframe for making a final determination.

## **(c) Remedial Action**

### **(1) General.**

- (A) Upon being notified by the Executive Officer, pursuant to section (b)(4)(E), that a motor vehicle class is equipped with a nonconforming OBD II system, the manufacturer may, within 30 days from the date of service of such notification, voluntarily elect to recall and repair the nonconforming OBD II systems. Upon such an election, the manufacturer shall follow the procedures set forth below in sections (c)(2) and (d).

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- (B) If a manufacturer does not take voluntary action under section (c)(1)(A) above, the Executive Officer may order the manufacturer to undertake appropriate remedial action, including but not limited to, the recall and repair of the nonconforming OBD II systems or providing affected vehicle and engine owners with extended warranties or manufacturer financed service campaigns. The Executive Officer may also seek appropriate monetary penalties against the manufacturer in addition to or in lieu of any remedial actions that may be ordered.
- (2) Voluntary OBD II-Related Recalls.
  - (A) When any manufacturer initiates a voluntary OBD II-related recall campaign, the manufacturer shall notify the Executive Officer of the recall at least 45 days before owner notification is to begin. The manufacturer shall also submit a voluntary recall plan for approval, as prescribed under section (d)(1) below.
  - (B) A voluntary recall plan submitted under section (c)(2)(A) above shall be approved by the Executive Officer pursuant to section (d)(1)(B) below.
- (3) Ordered Remedial Action.
  - (A) The Executive Officer shall order the recall of a nonconforming OBD II system in a motor vehicle class and assess appropriate monetary penalties if in-use testing indicates that:
    - (i) A major monitor operates during in-use driving, as measured by the ratios established in Title 13, CCR, 1968.2, at or below a ratio of the applicable minimum acceptable ratio in Title 13, CCR, 1968.2 (d) less 0.15 (e.g., if the required ratio is 0.25, at or below a ratio of 0.10)
    - (i) A major monitor (other than those specifically referenced below), when tested on-road and driven so as to encounter all monitoring conditions disclosed in the manufacturer's certification application, is unable to detect deterioration of the monitored component that, when tested on a dynamometer using an appropriate FTP driving cycle, causes FTP tailpipe emissions to exceed the malfunction criteria by an additional amount equal to 1.0 times the applicable FTP standard (e.g. if the malfunction criteria is 1.5 times the applicable FTP standard, recall would be required when emissions exceed 2.5 times the applicable FTP standard).
    - (ii) The monitor for misfire causing catalyst damage is unable to properly detect misfire rates equal to or greater than 20 percent above the misfire rates disclosed by the manufacturer in its certification application as causing catalyst damage.
    - (iii) The evaporative system monitor, when tested on-road and driven so as to encounter all monitoring conditions disclosed in the manufacturer's certification application, is unable to detect a leak in the evaporative system equivalent in physical size to a square

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- edge orifice with a diameter of at least 1.5 times the diameter of the required leak size.
- (iv) During in-use driving, the OBD II system cannot detect a malfunction of a non-major monitor component that effectively disables a major monitor.
  - (v) The motor vehicle class cannot be tested so as to obtain valid test results in accordance with the procedures of the California Inspection & Maintenance (I/M) program applicable at the time of vehicle certification due to the nonconforming OBD II system.
- (B) If the Executive Officer determines an OBD II system to be nonconforming for reasons other than those set forth in paragraph (A) above, he or she may require the manufacturer to undertake appropriate remedial action as set forth in section (c)(1)(B) above, and/or may assess appropriate monetary penalties. For purposes of this section, "problems" means any noncompliance with the requirements of section 1968.2. In making his or her finding regarding appropriate remedial action and penalties, the Executive Officer shall consider all relevant circumstances, including, but not limited to, the following:
- (i) Whether the manufacturer identified and informed the ARB about a problem(s) with a nonconforming OBD II system or whether the ARB identified the problem(s) prior to being informed by manufacturer.
  - (ii) The number of monitors (major and non-major) that fail to meet the requirements of Title 13, CCR, 1968.2.
  - (iii) If the identified problem(s) is with a major monitor(s), the nature and extent of the problem(s), including, but not limited to, the degree to which the frequency of operation during in-use driving, as measured by the ratios established Title 13, CCR, 1968.2, is below the minimum acceptable ratio specified in Title 13, CCR, section 1968.2 (d), and the number of monitors that cannot detect malfunctions prior to emissions exceeding the established malfunction criteria set forth in Title 13, CCR, section 1968.2(e) and the amount of such exceedances.
  - (iv) If the identified problem(s) is with a non-major monitor the nature and extent of the problem(s), including, but not limited to, the number of monitors that cannot detect malfunctions prior to exceeding the established malfunction criteria set forth in Title 13, CCR, section 1968.2(e), the degree to which the monitored component must be deteriorated or malfunctioning before a fault is indicated, and the effect that the problem(s) has on the operation of a major monitor(s).
  - (v) The impact of the noncompliance on vehicle owners (e.g., cost of future repairs, driveability, etc.) and the ability of the service and repair industry to make effective repairs (e.g., difficulty in

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- accessing fault information, diagnosing the root cause of a failure, etc.).
- (vi) The degree to which the identified problem(s) complicates, interferes with, disrupts, or hampers a service technicians ability to follow California I/M testing protocol when performing a California I/M inspection.
  - (vii) The data link connector of the motor vehicle class fails to meet the requirements of sections 1968.2(f)(1.1) through (f)(1.3).
  - (viii) The PCV system in a motor vehicle class does not comply with the requirements of section 1968.2 (e)(10.0).
  - (ix) The cooling system monitor in a motor vehicle class does not properly verify that the cooling system reaches the highest enable temperature used for any other monitor when the vehicle is operated in the monitoring conditions disclosed in the manufacturer's certification application or otherwise fails to comply with any requirement in section 1968.2(e)(11.0).
  - (x) The estimated frequency that a MIL falsely illuminates when the conditions for illumination, as set forth in the manufacturer's approved certification application, have not been satisfied and/or no faulty or deteriorated monitored component is present.
  - (xi) The estimated frequency that a monitor fails to detect a malfunction (i.e., falsely passes) when the conditions for illumination, as set forth in the manufacturer's approved certification application, have been satisfied and a faulty or deteriorated monitored component is present.
  - (xii) The manufacturer submitted false, inaccurate, or incomplete documentation at the time of certification that it knew or should have known to be material in the granting of certification. For purposes of this subparagraph, it shall be presumed that a manufacturer knew or should have known about all acts or omissions of its employees and subcontractors.
- (C) Assessment of Monetary Penalties. In determining the amount of a penalty to assess under paragraphs (A) and (B) above, the Executive Officer shall consider all relevant circumstances, including, but not limited to, the following:
- (i) Whether the nonconformity was self-reported by the manufacturer or was independently identified by the ARB or other governmental enforcement agency.
  - (ii) The nature and degree of the nonconformity and whether the manufacturer should reasonably have discovered the nonconformity and taken corrective action by voluntary recall or running changes during the production year.
  - (iii) The manufacturer's history of compliance with the OBD II requirements.
  - (iv) The preventative efforts taken by the manufacturer to avoid

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- noncompliance, including any programs followed by the manufacturer to ensure compliance.
- (v) The manufacturer's efforts to correct the nonconformity once it was identified.
  - (vi) The innovative nature and magnitude of effort, including the cost of any other proposed remedial action, necessary to correct the nonconformity.
  - (vii) The cooperation of the manufacturer during the course of the investigation and any action taken by the manufacturer, including the nature, extent, and time of response of any action taken to mitigate the violation.
- (D) Notice to Manufacturer.
- (i) The Executive Officer shall immediately notify the manufacturer upon the Executive Officer determining that a motor vehicle class should be recalled or other appropriate remedial action taken and/or that monetary penalties should be assessed.
  - (ii) The notice shall specifically set forth the remedial action that is to be taken, state whether the manufacturer shall be required to offer vehicle and engine owners incentives (e.g., free tune-up, oil changes) to assure a successful campaign response, include a description of each class of vehicles or engines that has been determined to have a nonconforming OBD II system, set forth the factual bases for the determination, and designate a date at least 45 days from the date of receipt of such notice by which the manufacturer shall submit a plan, pursuant to section (d)(1) below, outlining the remedial action to be undertaken consistent with the Executive Officer's order. Except as provided in paragraph (E)(ii) below, all plans shall be submitted to the Chief, Mobile Source Operations Division, 9528 Telstar Avenue, El Monte, California 91731, within the time limit specified in the notice. The Executive Officer may grant the manufacturer an extension of time for good cause.
- (E) Availability of Public Hearing.
- (i) Within 45 days from the date of receipt of the notice that is required under paragraph (D), the manufacturer may request a public hearing pursuant to the procedures set forth in section 60055, et seq., title 17, California Code of Regulations to contest the findings of nonconformity, the necessity for, or the scope of any ordered remedial action.
  - (ii) If a manufacturer requests a public hearing pursuant to subsection (i) above and if the Executive Officer's determination of nonconformity is confirmed at the hearing, the manufacturer shall submit the required remedial action plan in accordance with



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section (d)(1) below within 30 days after receipt of the Board's decision.

## **(d) Requirements for Implementing Remedial Actions**

### **(1) Remedial Action Plans.**

- (A) A manufacturer initiating a remedial action campaign (voluntary or ordered) shall develop a remedial action plan that contains the following information, unless otherwise specified:
- (i) A description of each motor vehicle class covered by the remedial action, including the number of vehicles or engines, the engine families, test groups, or subgroups within the identified class(es), the make(s), model(s), and model years of the covered vehicles and engines, and such other information as may be required to identify the covered vehicles or engines.
  - (ii) A description of the nonconforming OBD II system and, in the case of a voluntary or ordered recall, the specific modifications, alterations, repairs, adjustments, or other changes to correct the nonconforming OBD II system, including data and/or engineering evaluation supporting the specific corrections.
  - (iii) A description of the method and schedule that the manufacturer will use to determine the names and addresses of vehicle or engine owners and to notify them of the remedial action.
  - (iv) A copy of all instructions that the manufacturer will use to notify service facilities about the required remedial action and the specific corrections, if any, that will be required to be made to the nonconforming OBD II systems.
  - (v) A description of the procedure to be followed by vehicle or engine owners to obtain remedial action for the nonconforming OBD II system. This shall include the date, on or after which the owner can have required remedial action performed, the time reasonably necessary to perform the labor to remedy the nonconformity, and the designation of facilities at which the nonconformity can be remedied.
  - (vi) If some or all of the nonconforming OBD II systems are to be remedied by persons other than dealers or authorized warranty agents of the manufacturer, a description of such class of service agents and what steps, including a copy of all instructions mailed to such service agents, the manufacturer will take to assure that such agents are prepared and equipped to perform the proposed remedial action.
  - (vii) A copy of the letter of notification to be sent to vehicle or engine owners.
  - (viii) A description of the incentives (e.g., tune-ups, oil changes, etc.), if any, that the manufacturer will offer, in a good faith effort, to

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- induce vehicle or engine owners to bring their vehicles or engines in for remedial action.
- (ix) A proposed schedule for implementing the remedial action, including identified increments of progress towards full implementation.
  - (x) A description of the method that the manufacturer will use to assure that an adequate supply of parts will be available to initiate the remedial action campaign on the date set by the manufacturer and that an adequate supply of parts will continue to be available throughout the campaign.
  - (xi) A description and test data of the emission impact, if any, that the proposed remedial action may cause to a representative vehicle or engine from the motor vehicle class to be remedied.
  - (xii) A description of the impact, if any, and supporting data and/or engineering evaluation, that the proposed remedial action will have on fuel economy, driveability, performance, and safety of the motor vehicle class covered by the remedial action.
  - (xiii) Any other information, reports, or data which the Executive Officer may reasonably determine to be necessary to evaluate the remedial action plan.
- (B) Approval and Implementation of Remedial Action Plans.
- (i) If the Executive Officer finds that the remedial action plan is designed effectively to address the required remedial action and complies with the provisions in section (d)(1)(A) above, he or she shall notify the manufacturer in writing within 30 days of receipt of the plan that the plan has been approved.
  - (ii) The Executive Officer shall approve a voluntary or ordered remedial action plan if the plan contains the information specified in section (d)(1)(A) above and is designed to notify the vehicle or engine owner and implement the remedial action in an expeditious manner.
  - (iii) In disapproving an ordered remedial action plan, the Executive Officer shall notify the manufacturer in writing of the disapproval and the reasons for the determination. The manufacturer shall have 10 days to resubmit a revised remedial action plan that fully addresses the reasons for the Executive Officer's disapproval.
  - (iv) Upon receipt of the approval notice from the Executive Officer, the manufacturer shall, within 45 days of receipt of the notice, begin to notify vehicle or engine owners and implement the remedial action campaign.
  - (v) If the Executive Officer disapproves a voluntary remedial action plan, the manufacturer may either accept the proposed modifications to the plan as suggested by the Executive Officer or be subject to an Executive Officer order that the manufacturer

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undertake appropriate remedial action pursuant to section (c)(1)(B) above.

- (2) Eligibility for Remedial Action.
  - (A) The manufacturer shall not condition a vehicle or engine owner's eligibility for remedial action required under section 1968.5 on the proper maintenance or use of the vehicle or engine.
  - (B) Subject to Executive Officer approval, the manufacturer shall not be obligated to perform the remedial action on a vehicle which has been modified or altered such that the remedial action cannot be performed without additional cost.
- (3) Label Indicating that Recall Repairs Have Been Performed.
  - (A) If the required remedial action involves recall of the motor vehicle class, the manufacturer shall require those who perform inspections and/or recall repairs to affix a label to each vehicle or engine that has been inspected and/or repaired.
  - (B) The label shall be placed in a location approved by the Executive Officer and shall be fabricated of a material suitable for such location in which it is installed and which is not readily removable.
  - (C) The label shall contain the remedial action campaign number and a code designating the facility at which the remedial action or inspection to determine the need for remedial action was performed.
- (4) Proof of Performance of Remedial Action Certificate. If the required remedial action involves a recall, the manufacturer shall provide, through its service agents, to owners of vehicles or engines that have had the remedial action performed, a certificate that confirms that the vehicle has been recalled and that required inspection and/or repairs have been performed. The certificate shall be in a format prescribed by the Executive Officer.
- (5) Notice to Owners.
  - (A) The manufacturer shall notify owners of vehicles or engines in the motor vehicle class covered by the remedial order. The notice shall be made by first-class mail or by such other means as approved by the Executive Officer. When necessary, the Executive Officer may require the use of certified mail to assure effective notification.
  - (B) The manufacturer shall use all reasonable means necessary to locate vehicle or engine owners including motor vehicle registration lists available from the California Department of Motor Vehicles and commercial sources such as R.L. Polk & Co.
  - (C) The notice shall contain the following:
    - (i) A statement: "The California Air Resources Board has determined that your vehicle (is or may be) equipped with an improperly functioning on-board emission-related diagnostic system that violates established standards and regulations that were adopted to protect your health and welfare from the dangers of air pollution."

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- (ii) A statement that “the (name of motor vehicle manufacturer) will, at its expense, be taking the following remedial action (describe) to redress the problems that have been identified with the improperly functioning emission control system.”
- (iii) A statement that eligibility for remedial action may not be denied solely on the basis that the vehicle or engine owner used parts not manufactured by the original equipment vehicle manufacturer, or had repairs performed by outlets other than the vehicle or engine manufacturer’s franchised dealers.
- (iv) Instructions to the vehicle or engine owners on how to obtain remedial action, including instructions on whom to contact (i.e., a description of the facilities where the vehicles or engines should be taken for the remedial action), the first date that a vehicle or engine may be brought in for remedial action, and the time that it will reasonably take to correct the nonconformity.
- (v) The statement: “In order to assure your full protection under the emission warranty provisions, it is recommended that you have the required remedial action performed on your (vehicle or engine) (at the time and date indicated or, in the case of recall, as soon as possible). Failure to do so could be determined as lack of proper maintenance of your (vehicle or engine).”
- (vi) A telephone number for vehicle and engine owners to call to report difficulty in obtaining remedial action.
- (vii) A card to be used by a vehicle or engine owner in the event the vehicle or engine to be recalled has been sold. Such card should be addressed to the manufacturer, have postage paid, and shall provide a space in which the owner may indicate the name and address of the person to whom the vehicle or engine was sold or transferred.
- (viii) If the remedial action involves recall, the notice shall also provide:
  - a. A clear description of the components that will be affected by the remedial action and a general statement of the measures to be taken to correct the nonconformity.
  - b. A statement that such nonconformity, if not corrected, may cause the vehicle or engine to fail an emission inspection or I/M smog check test.
  - c. A statement describing the adverse effects, if any, of an uncorrected nonconforming OBD II system on the performance, fuel economy, or durability of the vehicle or engine.
  - d. A statement that after remedial action has been taken, the manufacturer will have the service facility issue a certificate showing that a vehicle has been corrected under the recall program, and that such a certificate will be required to be

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provided to the Department of Motor Vehicles as a condition for vehicle registration.

- (D) No notice sent pursuant to this section nor any other communication sent to vehicle or engine owners or dealers shall contain any statement, expressed or implied, that the OBD II system is compliant or that it will not degrade air quality.
- (E) The manufacturer shall be informed of any other requirements pertaining to the notification under this section which the Executive Officer has determined as reasonable and necessary to assure the effectiveness of the recall campaign.
- (6) Record Keeping and Reporting Requirements.
  - (A) The manufacturer shall maintain sufficient records to enable the Executive Officer to conduct an analysis of the adequacy of the remedial action.
  - (B) Unless otherwise specified by the Executive Officer, the manufacturer shall report on the progress of the remedial action campaign by submitting reports for eight consecutive quarters commencing with the quarter immediately after the recall campaign begins. Such reports shall be submitted no later than 25 days after the close of each calendar quarter to: Chief, Mobile Source Operations Division, 9528 Telstar Avenue, El Monte, California 91731. For each test group within the motor vehicle class subject to the emission recall campaign, the quarterly report shall contain the following:
    - (i) The remedial action campaign number designated by the manufacturer and a brief description of the nature of the campaign.
    - (ii) Date owner notifications began and date completed.
    - (iii) Number of vehicles or engines involved in the remedial action campaign.
    - (iv) Number of vehicles or engines known or estimated to be equipped with the nonconforming OBD II system and an explanation of the means by which this number was determined.
    - (v) Number of vehicles or engines inspected during the reporting period and during the campaign since its inception.
    - (vi) Number of vehicles or engines receiving remedial action during the reporting period and during the campaign since its inception.
    - (vii) Number of vehicles or engines determined to be unavailable for inspection or remedial action, during the most recent reporting period and during the campaign since its inception, due to exportation, theft, scrapping, or other reasons (specify).
    - (viii) Number of vehicles or engines, during the most recent reporting period and during the campaign since its inception, determined to be ineligible for remedial action under sections (d)(1)(B).
    - (ix) A list, using the following data elements and designated positions, indicating all vehicles or engines subject to recall that the manufacturer has not been informed of being corrected as of the

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end of the reporting period. The list shall be supplied in a standardized computer format to be specified by the Executive Officer. The date elements shall be written in "ASCII" code with a comma separating each element. For example: XTY32A7,1234,E-9456,1234,08-25-91,A. The add/delete flag (see below) should reflect changes in the quarterly updates. The frequency of this submittal may be changed by the Executive Officer depending on the needs of enforcement.

<u>Data Elements</u>	<u>Positions</u>
• File Code (designated by DMV)	1
• License Plate Number	2-8
• Last three VIN positions	9-11
• Recall ID Number	12-17
• Mfg. ID Number (Mfg. Occupational License Number)	18-22
• Recall Start Date (mmddyyyy)	23-30
• Add or Delete Flag (A/D)	31
• Complete VIN if personalized license plate (File Code "L" or "S")	32-48

- (x) A copy of any service bulletins issued during the reporting period by the manufacturer to franchised dealerships or other service agents that relate to the nonconforming OBD II system and the remedial action and have not previously been reported to the Executive Officer.
- (xi) A copy of all communications transmitted to vehicle or engine owners that relate to the nonconforming OBD II systems and the required remedial action and have not been previously reported to the Executive Officer.
- (C) If the manufacturer determines that any of the information submitted to the Executive Officer pursuant to section (d) has changed or is incorrect, the manufacturer shall submit the revised information, with an explanation.
- (D) The manufacturers shall maintain in a form suitable for inspection, such as computer information, storage devices, or card files, and shall make available to the Executive Officer or his or her authorized representative upon request, the names and addresses of vehicle or engine owners:
  - (i) To whom notification was sent;
  - (ii) Whose vehicles or engines were repaired or inspected under the recall campaign;
  - (iii) Whose vehicles or engines were determined not to be eligible for remedial action because the vehicles or engines were modified,

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- altered, or unavailable due to exportation, theft, scrapping, or other reason specified in the answer to sections (d)(8)(B)(vii) and (viii).
- (E) The information gathered by the manufacturer to compile the reports required by these procedures shall be retained for not less than one year beyond the useful life of the vehicles or engines and shall be made available to authorized personnel of the ARB upon request.
- (F) The filing of any report under the provisions of these procedures shall not affect the manufacturer's responsibility to file reports or applications, obtain approval, or give notice under any other provisions of law.

**(e) Penalties for Failing to Comply with the Requirements of Section 1968.5(d).**

- (1) In addition to the penalties that may be assessed by the Executive Officer pursuant to section 1968.5(c) because of a manufacturer's failure to comply with the requirements of section 1968.2, a manufacturer may be subject to penalties for failing to comply with the requirements of section 1968.5(d).
- (2) This section shall apply to manufacturers who volunteer to perform a remedial action pursuant to section (c)(2) or who are ordered to perform a remedial action pursuant to section (c)(3).
- (3) Failure to comply with the requirements of section 1968.5(d) shall be considered a violation of Health and Safety Code section 43105.