

APPENDIX C

PROPOSED REGULATON ORDER FOR OBD II REGULATION

Amend section 1968.2, title 13, California Code of Regulations, to read as follows:

(Note: The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the existing regulatory text. Various portions of the regulations that are not modified by the proposed amendments are omitted from the text shown and indicated with “* * * *”)

§1968.2. Malfunction and Diagnostic System Requirements--2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines

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(c) *Definitions.*

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“*Active off-cycle credit technology*” refers to a technology that generates off-cycle credits in accordance with title 13, CCR section 1961.3(a)(8) or 40 Code of Federal Regulations (CFR) §86.1869-12 as it existed on August 5, 2015, as applicable, and that must be activated by the vehicle or driver in order to provide a carbon dioxide (CO₂) reduction benefit. Examples of active off-cycle credit technologies include active aerodynamic features (e.g., grill shutters or ride height that is automatically adjusted by the vehicle control system based on vehicle speed or other conditions), active engine warmup technologies, and driver coaching and/or feedback systems that encourage the driver to alter his/her actions to maximize efficiency. Examples of off-cycle credit technologies that are not required to be tracked under section (g)(6) include non-active technologies such as solar glazing and solar reflective paint, thermal control technologies specified in title 13, CCR section 1961.3(a)(8)(A)1.a. or 40 CFR §86.1869-12(b)(1)(viii), as it existed on August 5, 2015, ~~engine idle stop-start systems~~, driver-activated technologies where the driver does not have a less efficient selectable option (e.g., high efficiency exterior lights), and technologies related solely to heating, ventilation, and air conditioning for vehicle cabin conditioning. For 2004 through 2021 model year vehicles, engine idle stop-start systems are not required to be tracked under section (g)(6). For 2022 and subsequent model year vehicles, engine idle stop-start systems are required to be tracked under section (g)(6).

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“*Emission Increasing Auxiliary Emission Control Device (EI-AECD)*” refers to any approved AECD that: reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use; and meets (1) or (2): (1) the need for the AECD is justified in terms of protecting the vehicle against damage or accident, or (2) for 2022 and subsequent model year medium-duty vehicles certified to an engine

dynamometer tailpipe emission standard, is related to adaptation or learning (e.g., selective catalytic reduction (SCR) system adaptation). For medium-duty vehicles certified to an engine dynamometer tailpipe emission standard, an AECD that is certified as an NTE deficiency shall not be considered an EI-AECD. An AECD that does not sense, measure, or calculate any parameter or command or trigger any action, algorithm, or alternate strategy shall not be considered an EI-AECD. An AECD that is activated solely due to any of the following conditions shall not be considered an EI-AECD: (1) operation of the vehicle above 8000 feet in elevation; (2) ambient temperature; (3) when the engine is warming up and is not reactivated once the engine has warmed up in the same driving cycle; (4) failure detection (storage of a fault code) by the OBD system; (5) execution of an OBD monitor; or (6) execution of an infrequent regeneration event.

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“Over-the-air reprogramming” refers to the remote reprogramming of a vehicle or engine controller using wireless technologies. No physical connection between any reprogramming equipment and the vehicle is made when using over-the-air reprogramming.

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(d) *General Requirements.*

Section (d) sets forth the general requirements of the OBD II system. Specific performance requirements for components and systems that shall be monitored are set forth in sections (e) and (f) below.

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(3) *Monitoring Conditions.*

Section (d)(3) sets forth the general monitoring requirements while sections (e) and (f) set forth the specific monitoring requirements as well as identify which of the following general monitoring requirements in section (d)(3) are applicable for each monitored component or system identified in sections (e) and (f).

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(3.2) As specifically provided for in sections (e) and (f), manufacturers shall define monitoring conditions in accordance with the criteria in sections (d)(3.2.1) through (3.2.3). The requirements of section (d)(3.2) shall be phased in as follows: 30 percent of all 2005 model year vehicles, 60 percent of all 2006 model year vehicles, and 100 percent of all 2007 and subsequent model year vehicles. Manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) with the exception that 100 percent of 2007 and subsequent model year vehicles shall comply with the requirements. Small volume manufacturers shall meet the requirements on 100 percent of 2007 and subsequent model year vehicles but shall not be required to meet the specific phase-in requirements for the 2005 and 2006 model years.

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(3.2.2) In addition to meeting the requirements of section (d)(3.2.1), manufacturers shall implement software algorithms in the OBD II system to individually track and report in-use performance of the following

- monitors in the standardized format specified in section (d)(5):
- a. Catalyst (section (e)(1.3) or, where applicable, (f)(1.3));
 - b. Oxygen/exhaust gas sensor (section (e)(7.3.1)(A) or, where applicable, (f)(5.3.1)(A));
 - c. Evaporative system (section (e)(4.3.2));
 - d. EGR system (section (e)(8.3.1)) and VVT system (section (e)(13.3) or, where applicable, (f)(6.3.1)(A), (f)(6.3.1)(B), (f)(6.3.2), (f)(6.3.3), (f)(6.3.4), and, (f)(13.3));
 - e. Secondary air system (section (e)(5.3.2)(B));
 - f. PM filter (section (f)(9.3.1) and (f)(9.3.2));
 - g. NOx adsorber (section (f)(8.3.1));
 - h. NOx catalyst (section (f)(2.3.1));
 - i. Secondary oxygen sensor (section (e)(7.3.2)(A));
 - j. Boost pressure control system (sections (f)(7.3.1), (f)(7.3.2), and (f)(7.3.3)); and
 - k. Fuel system (section (e)(6.3.2) or (f)(4.3.3)).

The OBD II system is not required to track or report in-use performance for monitors other than those specifically identified above.

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(4) *In-Use Monitor Performance Ratio Definition.*

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(4.3) Denominator Specifications

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(4.3.2) Specifications for incrementing:

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(G) For the following monitors, the denominator(s) shall be incremented by one during a driving cycle in which the following two criteria are met: (1) the requirements of section (d)(4.3.2)(B) have been met on at least one driving cycle since the denominator was last incremented, and (2) the number of cumulative miles of vehicle operation since the denominator was last incremented is greater than or equal to 500 miles. The 500-mile counter shall be reset to zero and begin counting again after the denominator has been incremented and no later than the start of the next ignition cycle.

- (i) Diesel NMHC converting catalyst (section (f)(1.2.2)) for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard and for 2004 through 2021 model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard
- (ii) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (f)(1.2.3)(B) and (f)(1.2.3)(D))
- (iii) Diesel PM filter NMHC conversion (section (f)(9.2.4)(A))
- (iv) Diesel PM filter filtering performance and missing substrate (sections (f)(9.2.1) and (f)(9.2.5)) for 2004 through 2018 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard and for 2004 through 2015

model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard

(v) Diesel PM filter feedgas generation (section (f)(9.2.4)(B)) for 2019 and subsequent model year vehicles

(vi) PM filter frequent regeneration (section (f)(9.2.2)) for 2022 and subsequent model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard

For the diesel NMHC converting catalyst monitor (section (f)(1.2.2)), as an alternative for 2004 through 2021 model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard, the manufacturer may use the criteria in section (d)(4.3.2)(I) in lieu of the criteria specified in section (d)(4.3.2)(G) above.

(H) For the following component monitors, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the equivalence of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above:

(i) Air conditioning system input components (section (e)(12))

(ii) Direct ozone reduction systems (section (e)(14))

(iii) "Other emission control or source devices" (sections (e)(16) and (f)(16))

(iv) Comprehensive component input components that require extended monitoring evaluation (sections (e)(15) and (f)(15)) (e.g., stuck fuel level sensor rationality)

(v) PM filter frequent regeneration (section (f)(9.2.2)) for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard and 2004 through 2021 model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard

(vi) PM sensor monitoring capability monitor (section (f)(5.2.2)(D))

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(I) For 2013 and subsequent model year vehicles, in addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to ten seconds:

(i) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (f)(1.2.3)(A) and (f)(1.2.3)(C))

(ii) PM filter incomplete regeneration (section (f)(9.2.3))

(iii) Diesel NMHC converting catalyst (section (f)(1.2.2)) for 2022 and subsequent model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard

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(6) *Malfunction Criteria Determination and Adjustment Factors for Diesel Vehicles.*

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(6.2) For 2007 and subsequent model year light-duty and medium-duty vehicles equipped with emission controls that experience infrequent regeneration events (e.g., active PM filter regeneration, NOx adsorber desulfation), a manufacturer shall adjust the emission test results that are used to determine the malfunction criterion for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold. Except as provided in section (d)(6.2.7), for each monitor on medium-duty vehicles using engines certified on an engine dynamometer, the manufacturer shall adjust the emission result using the procedure described in CFR title 40, part 86.004-28(i) (as it existed on January 25, 2018) on 2020 and earlier model year vehicles, or 1065.680 (as it existed on January 25, 2018) on 2021 and subsequent model year vehicles with the component for which the malfunction criteria is being established deteriorated to the malfunction threshold. For light-duty and medium-duty vehicles certified on a chassis dynamometer, the manufacturer shall submit a plan for Executive Officer approval to adjust the emission results using an approach similar to the procedure described in CFR title 40, part 86.004-28(i). Executive Officer approval shall be based on the effectiveness of the proposed plan to quantify the emission impact and frequency of regeneration events. The adjusted emission value shall be used for purposes of determining whether or not the specified emission threshold is exceeded (e.g., a malfunction must be detected before the adjusted emission value exceeds 1.5 times any applicable standard).

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(6.2.7) In lieu of using the procedure described in CFR title 40, part 86.004-28(i) and 1065.680, the manufacturer may submit an alternate plan to calculate the adjustment factors for determining the adjusted emission values to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing data and/or engineering evaluation demonstrating the procedure is consistent with good engineering judgment in determining appropriate modifications to the tailpipe certification adjustment factors.

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(6.4) For 2019 and subsequent model year vehicles equipped with emission controls that experience infrequent regeneration events, a manufacturer shall adjust the emission test results using the procedure described in CFR title 40, part 86.004-28(i); or 1065.680 as it they existed on August 5, 2015 January 25, 2018. The manufacturer shall conduct testing to determine the adjustment factors using the same deteriorated component(s) used to determine if the test-out criteria in the following sections are met:

(6.4.1) Section (f)(1.2.3)(B)

(6.4.2) Section (f)(1.2.3)(D)

(6.4.3) Section (f)(6.2.6)(C)

(6.4.4) Section (f)(9.2.4)

(6.4.5) Section (f)(15.1.2)

(6.4.6) Section (f)(15.2.2)(F)(ii)

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(f) *Monitoring Requirements for Diesel/Compression-Ignition Engines.*

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Table 3

LEV-III OBD II Diesel PM Filter Filtering Performance Monitor Threshold					
Exhaust Standards		PM Filter Filtering Performance Monitor Threshold			
Vehicle Type	Vehicle Emission Category	NMOG+NOx Mult. ¹	CO Mult. ¹	PM Mult.	PM THD (mg/mi)
Passenger Cars, Light-Duty Trucks, and Chassis Certified MDPVs	LEV160	1.50	1.50	N/A	17.50
	ULEV125				
	ULEV70	2.00			
	ULEV50				
	SULEV30	2.50	2.50		
	SULEV20 ⁴				
2016MY-2018MY Chassis Certified MDVs (except MDPVs)	All MDV Emission Categories	N/A	N/A	1.75 ²	17.50 ³
2019+MY Chassis Certified MDVs (except MDPVs)	All MDV Emission Categories	1.50	1.50	1.50 ²	17.50 ³

1. Applies to 2019 and subsequent model years

2. Applies to vehicles not included in the phase-in of the PM standards set forth in title 13, CCR sections 1961.2(a)(2)(B)2 and (a)(2)(D)3.

3. Applies to vehicles included in the phase-in of the PM standards set forth in title 13, CCR section 1961.2(a)(2)(B)2 or (a)(2)(D)3.

4. Manufacturer shall use the 2.50 times NMOG+NOx multiplier for vehicles not using the provisions of section (f)(17.1.7)

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(1) *Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring*

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(1.2) Malfunction Criteria:

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(1.2.3) Other Aftertreatment Assistance Functions. Additionally, for 2010 and subsequent model year vehicles, the catalyst(s) shall be monitored for other aftertreatment assistance functions:

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(B) For 2015 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 2015 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, except as provided for in sections (f)(1.2.3)(B)(i) through (iii) below, for catalysts used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO₂ concentration upstream of an SCR system), the OBD II system shall detect a malfunction when the catalyst is unable to generate the necessary feedgas constituents for proper SCR system operation. For purposes of this monitoring requirement, the manufacturer shall monitor feedgas generation performance of the NMHC catalyst either by itself or in combination with the catalyzed PM filter described under section (f)(1.2.3)(B).

(i) Catalysts are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyst's feedgas generation ability can cause emissions to increase by 25 percent or more for SULEV30 and SULEV20 vehicles, 20 percent or more for ULEV70 and ULEV50 vehicles, 30 percent or more for medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, and 15 percent or more for all other vehicles, where the percentage is based on the applicable full useful life NMHC, NO_x (or NMOG+NO_x, if applicable), CO, or PM standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyst's feedgas generation ability can cause emissions to exceed the applicable full useful life NMHC, NO_x (or NMOG+NO_x, if applicable), CO, or PM standard as measured from an applicable emission test cycle.

(ii) For purposes of using the monitoring exemption allowance above, the manufacturer shall submit a catalyst deterioration plan to the Executive Officer for review and approval. Executive Officer approval of the plan shall be based on the representativeness of the deterioration method to real world catalyst deterioration replicating a total loss of feedgas generation while still maintaining NMHC conversion capability (e.g., a catalyst loaded only with the production-level specification of palladium), and

(iii) For purposes of using the monitoring exemption allowance above, the manufacturer shall conduct the testing using the NMHC catalyst either by itself or in combination with the catalyzed PM filter described under section (f)(9.2.4)(B).

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(D) For catalysts located downstream of an SCR system (e.g., to prevent ammonia slip), the OBD II system shall detect a malfunction when the catalyst has no detectable amount of NMHC, CO, NO_x, or PM conversion capability. Catalysts are exempt from this monitoring if both of the following criteria are satisfied: (1) the catalyst is part of the SCR catalyst and monitored as part of the SCR system; and (2) the catalyst is aged as

part of the SCR system for the purposes of determining the SCR system monitor malfunction criteria under section (f)(2.2.2). For catalysts located outside the SCR system, except as provided for in section (f)(1.2.3)(D)(i), catalysts are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyst's conversion capability can cause emissions to increase by 15 percent or more of the applicable full useful life NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyst's conversion capability can cause emissions to exceed the applicable full useful life NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM standard as measured from an applicable emission test cycle.

(i) For 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, monitoring of the catalyst shall not be required if there is no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition where in which the catalyst is most likely to affect criteria pollutants (e.g., during conditions most likely to result in ammonia generation or excessive reductant delivery).

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(5) *Exhaust Gas Sensor Monitoring*

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(5.2) Malfunction Criteria:

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(5.2.2) NOx and PM sensors:

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(E) NOx sensor activity faults: For 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the OBD system shall detect a malfunction of the NOx sensor when the NOx sensor is not actively reporting NOx concentration data (i.e., the NOx sensor is not "active") under conditions when it is technically feasible for a properly-working NOx sensor to be actively reporting NOx concentration data. If the NOx sensor activity fault is caused by a malfunction of a component other than the NOx sensor (e.g., a component that is used as an input necessary to make the NOx sensor become "active"), the OBD system shall monitor the component and detect a malfunction that prevents the NOx sensor from being "active".

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(5.3) Monitoring Conditions:

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(5.3.1) Exhaust Gas Sensors

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(C) Except as provided in section (f)(5.3.1)(D), monitoring for malfunctions identified in sections (f)(5.2.1)(A)(ii), (5.2.1)(A)(iii), (5.2.1)(B)(ii),

(5.2.1)(B)(iii), (5.2.2)(B), ~~and (5.2.2)(C), and (5.2.2)(E)~~ (i.e., circuit continuity, out-of-range, ~~and open-loop malfunctions, and NOx sensor activity malfunctions~~) shall be conducted continuously.

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(6) *Exhaust Gas Recirculation (EGR) System Monitoring*

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(6.3) Monitoring Conditions:

(6.3.1) For malfunctions identified in sections (f)(6.2.1) and (f)(6.2.2) (i.e., EGR low and high flow) manufacturers shall:

(A) Define monitoring conditions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements) for 2004 through 2009 model year vehicles. Additionally, manufacturers shall track and report the in-use performance of the EGR system monitors under sections (f)(6.2.1) and (f)(6.2.2) in accordance with section (d)(3.2.2). For purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in sections (f)(6.2.1) and (f)(6.2.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2);

(B) Except as provided in section (f)(6.3.5), ensure that monitoring is conducted continuously for all 2010 and subsequent model year vehicles. Additionally, for all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, manufacturers shall define monitoring conditions for malfunctions identified in sections (f)(6.2.1) and (f)(6.2.2) that are continuous and in accordance with section (d)(3.2) (i.e., the minimum ratio requirements), and manufacturers shall track and report the in-use performance of the EGR system monitors under sections (f)(6.2.1) and (f)(6.2.2) in accordance with section (d)(3.2.2). For purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in sections (f)(6.2.1) and (f)(6.2.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

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(6.3.3) The OBD II system shall monitor continuously for malfunctions identified in section (f)(6.2.4) (i.e., EGR feedback control). Additionally, for all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, manufacturers shall define monitoring conditions for malfunctions identified in section (f)(6.2.4) that are continuous and in accordance with section (d)(3.2) (i.e., the minimum ratio requirements), and manufacturers shall track and report the in-use performance of the EGR system monitors under section (f)(6.2.4) in accordance with section (d)(3.2.2). For purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in section (f)(6.2.4) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

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(6.4) MIL Illumination and Fault Code Storage:

(6.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6.4.2) Additionally, for malfunctions identified in sections (f)(6.2.1) and (f)(6.2.2) (i.e., EGR low and high flow) on all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

(A) A pending fault code shall be stored immediately upon the EGR flow failing the malfunction criteria established pursuant to section (f)(6.2.1) or (f)(6.2.2).

(B) 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 section (c)) to those that occurred when the pending fault code was stored are encountered. Additionally, the pending fault code shall continue to be stored in accordance with section (g)(4.4.5).

(C) The pending fault code shall be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified EGR system malfunction criteria. The pending code 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.

(D) Storage of EGR system conditions for determining similar conditions of operation.

(i) Upon detection of a EGR system malfunction under section (f)(6.4.2), the OBD II system shall store the engine speed, load, and warm-up status of the first EGR system malfunction that resulted in the storage of the pending fault code.

(ii) The manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent robustness in detection of EGR system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(E) 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 EGR system.

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(7) *Boost Pressure Control System Monitoring*

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(7.3) Monitoring Conditions:

(7.3.1) Except as provided in section (f)(7.3.4), the OBD II system shall monitor continuously for malfunctions identified in sections (f)(7.2.1), (7.2.2), and (7.2.5) (i.e., over and under boost, feedback control). Additionally, for all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, manufacturers shall define monitoring conditions for malfunctions identified in sections (f)(7.2.1), (7.2.2), and (7.2.5) that are continuous and in accordance with section (d)(3.2) (i.e., the minimum ratio requirements), and manufacturers shall track and report the in-use performance of the boost pressure control system monitors under sections (f)(7.2.1), (7.2.2), and (7.2.5) in accordance with section (d)(3.2.2). For purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in sections (f)(7.2.1), (7.2.2), and (7.2.5) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

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(7.4) MIL Illumination and Fault Code Storage:

(7.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(7.4.2) Additionally, for malfunctions identified in sections (f)(7.2.1) and (f)(7.2.2) (i.e., over and under boost on all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

(A) A pending fault code shall be stored immediately upon the fuel system exceeding the boost pressure malfunction criteria established pursuant to section (f)(7.2.1) or (7.2.2).

(B) 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 section (c)) to those that occurred when the pending fault code was stored are encountered. Additionally, the pending fault code shall continue to be stored in accordance with section (g)(4.4.5).

(C) The pending fault code shall be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified boost pressure control system malfunction criteria. The pending code 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.

(D) Storage of boost pressure control system conditions for determining similar conditions of operation.

(i) Upon detection of a boost pressure control system malfunction under section (f)(7.4.2), the OBD II system shall store the engine speed, load,

and warm-up status of the first boost pressure control system malfunction that resulted in the storage of the pending fault code.

(ii) The manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent robustness in detection of boost pressure control system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(E) 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 boost pressure control system.

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(9) *Particulate Matter (PM) Filter Monitoring*

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(9.2) Malfunction Criteria:

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(9.2.1) Filtering Performance:

(A) The OBD II system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause a vehicle's emissions to exceed:

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(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

a. 0.09 g/bhp-hr PM as measured from an applicable cycle emission test for 2004 through 2009 model year vehicles;

b. 0.07 g/bhp-hr PM as measured from an applicable cycle emission test for 2010 through 2012 model year vehicles; ~~and~~

c. 0.03 g/bhp-hr PM as measured from an applicable cycle emission test for 2013 ~~and subsequent~~ through 2021 model year vehicles; ~~and~~

d. the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test, or 0.03 g/bhp-hr PM as measured from an applicable cycle emission test on 2022 and subsequent model year vehicles.

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(9.2.4) Catalyzed PM Filter:

(A) NMHC conversion: For 2015 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 2015 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard with catalyzed PM filters that convert NMHC emissions:

- (i) The OBD II system shall monitor the catalyst function of the PM filter and detect a malfunction when the ~~NMHC~~-conversion capability decreases to the point that emissions exceed:
 - a. For non-Low Emission Vehicle III applications:
 - 1. 1.75 times the applicable FTP full useful life NMHC standards for passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard; or
 - 2. 2.0 times the applicable NMHC standards for 2015 through 2021 model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard; or
 - 3. the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test, or 2.0 times the applicable NMHC standards for 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard; or
 - (ii) If no failure or deterioration of the ~~NMHC~~-conversion capability could result in a vehicle's emissions exceeding the emission levels specified in section (f)(9.2.4)(A)(i), the OBD II system shall detect a malfunction when the system has no detectable amount of ~~NMHC~~-conversion capability.

* * * *

- (B) Feedgas generation: For 2016 and subsequent model year medium-duty vehicles (except MDPVs certified to a chassis dynamometer tailpipe emission standard) and 2019 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard with catalyzed PM filters used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO₂ concentration upstream of an SCR system), except as provided below in sections (f)(9.2.4)(B)(i) through (iii) below, the OBD II system shall detect a malfunction when the system is unable to generate the necessary feedgas constituents for proper SCR system operation. For purposes of this monitoring requirement, the manufacturer shall monitor feedgas generation performance of the catalyzed PM filter either by itself or in combination with the NMHC catalyst described under section (f)(9.2.4)(B).
 - (i) Catalyzed PM filters are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyzed PM filter's feedgas generation ability can cause emissions to increase by 30 percent or more for medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, and 15 percent or more for all other vehicles, where the percentage is based on ~~one of the applicable full useful life NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM~~ standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyzed PM filter's feedgas generation ability can cause emissions to exceed the

applicable full useful life NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM standard as measured from an applicable emission test cycle.

(ii) For purposes of using the monitoring exemption allowance above, the manufacturer shall submit a catalyzed PM filter deterioration plan to the Executive Officer for review and approval. Executive Officer approval of the plan shall be based on the representativeness of the deterioration method to real world catalyzed PM filter deterioration replicating a total loss of feedgas generation while still maintaining NMHC conversion capability (e.g., a catalyzed PM filter loaded only with the production-level specification of palladium).

(iii) For purposes of using the monitoring exemption allowance above, the manufacturer shall conduct the testing using the catalyzed PM filter either by itself or in combination with the NMHC catalyst described under section (f)(1.2.3)(B).

* * * *

(9.3) Monitoring Conditions:

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(9.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(9.2.2) through (9.2.6) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). Additionally, for all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, manufacturers shall track and report the in-use performance of the PM filter monitors under sections (f)(9.2.2), (f)(9.2.5), and (f)(9.2.6) in accordance with section (d)(3.2.2). For purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in sections (f)(9.2.2), (f)(9.2.5), and (f)(9.2.6) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

* * * *

(g) *Standardization Requirements*

(1) *Reference Documents:*

The following SAE International and International Organization for Standardization (ISO) documents are incorporated by reference into this regulation:

* * * *

(1.12) SAE J2534-1 – “Recommended Practice for Pass-Thru Vehicle Programming”, ~~October 2015~~December 2004 (SAE J2534-1).

* * * *

(4) Required Emission Related Functions:

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

* * * *

(4.2) 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.

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(4.2.2) Additionally, for all 2005 and subsequent model year vehicles using the ISO 15765-4 protocol for the standardized functions required in section (g), the following signals shall be made available:

* * * *

(B) For all vehicles so equipped:

* * * *

(iv) For all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard so equipped: DEF dosing mode (A, B, C, etc.), target ammonia storage level on SCR, modeled actual ammonia storage level on SCR, SCR intake temperature, SCR outlet temperature, NOx mass emission rate - engine out, NOx mass emission rate – tailpipe, stability of NOx sensor reading, EGR mass flow rate, hydrocarbon doser flow rate, hydrocarbon doser injector duty cycle, aftertreatment fuel pressure, charge air cooler outlet temperature, engine operating state, propulsion system active, distance since reflash or control module replacement, commanded/target fresh air flow, crankcase pressure sensor output, crankcase oil separator rotational speed, and evaporative system purge pressure sensor output.

(v) For all 2022 and subsequent model year medium-duty gasoline vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard so equipped: commanded DEF dosing, DEF dosing rate, and DEF usage for current driving cycle.

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(4.2.3) Additionally, for all 2010 and subsequent model year vehicles with a diesel engine:

* * * *

(l) For all 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard so equipped, distance since 3 most recent DPF regeneration events and lifetime counter of DPF regeneration events.

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(4.10) Erasure of Emission-Related Diagnostic Information:

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(4.10.4) A manufacturer may request Executive Officer approval for an alternate erasure protocol in cases where a malfunction activates a component-protection or safety-related default mode. The Executive Officer shall approve the request for an alternate erasure protocol upon determining that the manufacturer has demonstrated all of the following:

* * * *

(B) The alternate erasure protocol applies solely to control units that report supported readiness for only the comprehensive component readiness bit. All emission-related diagnostic information from all control units that report supported readiness for readiness bits other than comprehensive components shall be erased pursuant to (g)(40.4.10.2) or (g)(40.4.10.3) above,

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(6) *Vehicle Operation Tracking Requirements:*

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(6.1) For all 2010 and subsequent model year medium-duty vehicles equipped with diesel engines, manufacturers shall implement software algorithms to individually track and report in a standardized format the engine run time while being operated in the following conditions:

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(6.1.7) For 2022 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

(i) total run time with no delivery of reductant used to control NOx emissions (e.g., diesel exhaust fluid) due to insufficient exhaust temperature, and

(ii) total run time with exhaust temperature below 200 degrees Celsius as measured just upstream of the NOx converting catalyst. If an engine has more than one NOx converting catalyst, tracking shall be based on the temperature upstream of the catalyst that is closest to the engine.

(6.1.7.8) For 2010 through 2012 model year vehicles, manufacturers may define "idle" in section (g)(6.1.2) above as accelerator pedal released by driver, vehicle speed less than or equal to one mile per hour, and PTO not active.

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(6.6) Numerical Value Specifications:

(6.6.1) For each counter specified in sections (g)(6.1), and (g)(6.2), and (g)(6.12):

(A) Each number shall conform to the standardized format specified in SAE J1979.

(B) Each number shall be reset to zero only when a non-volatile memory reset occurs (e.g., reprogramming event). Numbers may not be reset to zero under any other circumstances including when a scan tool (generic or enhanced) command to clear fault codes or reset KAM is received.

(C) If any of the individual counters reach the maximum value, all counters shall be divided by two before any are incremented again to avoid overflow problems.

* * * *

(6.12) NOx Emission Tracking Requirements:

(6.12.1) For all 2022 and subsequent model year medium-duty vehicles equipped with diesel engines, manufacturers shall implement software algorithms to track and report in a standardized format the following parameters:

(A) NOx mass – engine out (g);

(B) NOx mass – tailpipe (g);

- (C) Engine output energy (kWh);
- (D) Distance traveled (km);
- (E) Engine run time (hours);
- (F) Vehicle fuel consumption (liters).

(6.12.2) The parameters in section (g)(6.12.1) shall be stored in the four data arrays described below. Data in each array shall be updated at a frequency of 1 Hertz.

(A) Active 100 Hour Array.

- (i) When the NOx sensors used to determine the NOx mass parameters listed in section (g)(6.12.1) are both reporting valid NOx concentration data, data for all parameters in section (g)(6.12.1) shall be stored in the Active 100 Hour Array.
- (ii) When the total engine run time value that is stored in Bin 1 (defined in section (g)(6.12.3)(A) below) of the Active 100 Hour Array reaches 100 hours, all stored data shall be transferred to the Stored 100 Hour Array described in section (g)(6.12.2)(B). All data in the Active 100 Hour Array shall be reset to zero and begin incrementing anew.

(B) Stored 100 Hour Array.

- (i) The Stored 100 Hour Array is a static repository for data stored by the Active 100 Hour Array. Stored 100 Hour Array data are overwritten with the data stored in the Active 100 Hour Array only when the total engine run time stored in Bin 1 (defined in section (g)(6.12.3)(A) below) of the Active 100 Hour Array reaches 100 hours.

(C) Lifetime Array.

- (i) When the NOx sensors used to determine the NOx mass parameters listed in section (g)(6.12.1) are both reporting valid NOx concentration data, data for all parameters in section (g)(6.12.1) shall be stored in the Lifetime Array.
- (ii) The Lifetime Array maintains a running total of parameter data for the actual life of the engine.

(D) Lifetime Engine Activity Array.

- (i) The parameters in section (g)(6.12.1)(C) through (F) are stored in the Lifetime Engine Activity Array whenever the engine is running regardless of NOx sensor status.
- (ii) The Lifetime Engine Activity Array maintains a running total of parameter data for the actual life of the engine.

(6.12.3) Each parameter in each array in section (g)(6.12.2) shall be stored in a series of bins that are defined as indicated below. References to "rated power" mean the engine's rated net brake power.

(A) "Bin 1" stores the total value of the parameter in a given array. The values in Bins 2 through 14 must sum to equal the value in Bin 1.

(B) "Bin 2" stores data when the vehicle speed is zero kilometers per hour (km/h) for any level of engine power output;

(C) Bins that store data when the engine power output is less than or equal to 25 percent of rated power:

- (i) “Bin 3” is for vehicle speeds greater than zero km/h and less than or equal to 16 km/h (10 mph);
 - (ii) “Bin 4” is for vehicle speeds greater than 16 km/h and less than or equal to 40 km/h (25 mph);
 - (iii) “Bin 5” is for vehicle speeds greater than 40 km/h and less than or equal to 64 km/h (40 mph);
 - (iv) “Bin 6” is for vehicle speeds greater than 64 km/h.
 - (D) Bins that store data when the engine power output is greater than 25 percent of rated power and less than or equal to 50 percent of rated power:
 - (i) “Bin 7” is for vehicle speeds greater than zero km/h and less than or equal to 16 km/h (10 mph);
 - (ii) “Bin 8” is for vehicle speeds greater than 16 km/h and less than or equal to 40 km/h (25 mph);
 - (iii) “Bin 9” is for vehicle speeds greater than 40 km/h and less than or equal to 64 km/h (40 mph);
 - (iv) “Bin 10” is for vehicle speeds greater than 64 km/h.
 - (E) Bins that store data when the engine power output is greater than 50 percent of rated power:
 - (i) “Bin 11” is for vehicle speeds greater than zero km/h and less than or equal to 16 km/h (10 mph);
 - (ii) “Bin 12” is for vehicle speeds greater than 16 km/h and less than or equal to 40 km/h (25 mph);
 - (iii) “Bin 13” is for vehicle speeds greater than 40 km/h and less than or equal to 64 km/h (40 mph);
 - (iv) “Bin 14” is for vehicle speeds greater than 64 km/h.
 - (F) “Bin 15” stores data only when the engine is operating within the NOx NTE control area and no exclusions apply.
 - (G) “Bin 16” stores data only when an active PM filter regeneration event is being commanded.
 - (H) Storage of data in Bins 1 through 14 occurs independently of data storage in Bins 15 and 16, and is not interrupted or otherwise affected by activity related to Bins 15 and 16.
- (6.12.4) The engine-out and tailpipe NOx mass parameters that are calculated by the OBD system to fulfill the requirements in section (g)(6.12) and data stream requirements in section (g)(4.2) must not have an error of more than 20 percent, or alternatively 0.10 g/bhp-hr when divided by the net brake work of the engine. This requirement applies only to the NOx mass parameters in sections (g)(6.12) and (g)(4.2). Manufacturers shall report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). The NOx mass values shall furthermore be calculated using the most accurate NOx concentration and exhaust flow rate values that are calculated within the applicable electronic control unit. Manufacturers shall not include a humidity correction factor when calculating NOx mass. Manufacturers shall not include a humidity correction factor when calculating NOx mass.

The Executive Officer shall determine compliance with this requirement by comparing data from the OBD system and the test facility that are submitted by the manufacturer as described in section (i)(2.32). Specifically, the Executive Officer shall compare the total tailpipe NOx mass calculated by the OBD system for the test cycle with the total NOx mass measured by the test facility and give consideration to the consistency of the behavior of the two sets of instantaneous NOx mass values over the test cycle.

* * * *

(8) Data Reporting Requirements for Over-the-Air Reprogramming

(8.1) For all 2022 and subsequent model year vehicles, if any of the data required to be stored and made available pursuant to sections (g)(5) and (g)(6) would be erased by an over-the-air reprogramming of any control module, the manufacturer shall collect all lifetime data stored in the vehicle pursuant to these sections using the over-air-network prior to their erasure.

(8.2) The manufacturer shall submit a report to the Executive Officer containing the average value and standard deviation of each collected parameters for each affected certified test group as specified in, "Data Record Reporting Procedures for Over-the-Air Reprogrammed Vehicles and Engines", dated August 16, 2018, and hereby incorporated by reference. The manufacturer shall submit the report within 60 calendar days of the availability of the calibration/software update to affected vehicles. The manufacturer shall submit a separate report for each unique calibration/software update.

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(h) Monitoring System Demonstration Requirements For Certification

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(2) Selection of Test Vehicles:

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(2.3) Except as provided in sections (h)(2.3.1) and (2.3.2) below, For the test vehicle(s), a manufacturer shall use a certification emission durability test vehicle(s), a representative high mileage vehicle(s), or a vehicle(s) aged to the end of the full useful life using an ARB-approved alternative durability procedure (ADP).

(2.3.1) For the gasoline evaporative system monitor testing, a manufacturer may use a production-representative vehicle in lieu of the vehicles specified above.

(2.3.2) For 2022 and subsequent model year medium-duty diesel vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the manufacturer shall use a test engine that meets the provisions specified under title 13, CCR section 1971.1(i)(2.3.4).

* * * *

(i) Certification Documentation

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- (2) 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. The information must include:

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- (2.30) For medium-duty diesel vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, a written description of all parameters and conditions that are technically necessary for each NOx sensor to begin reporting NOx concentration data after engine start and, if technically necessary, all parameters and conditions that cause each NOx sensor to subsequently cease or pause reporting NOx concentration data.
- (2.31) For 2022 and subsequent model year medium-duty diesel vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, data identifying the NOx sensor status (e.g., if the NOx sensor is actively reporting NOx concentration data, not reporting NOx concentration data due to low exhaust temperature, not reporting NOx concentration data due to sensor instability, etc.) for each NOx sensor during the FTP cycle and the SET cycle. The data shall also identify specifically which parameters and conditions documented in the certification application caused the NOx sensor to transition from one status to another (e.g., from not reporting NOx concentration data to actively reporting and from actively reporting to not reporting).
- (2.32) For 2022 and subsequent model year medium-duty diesel vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, data showing the instantaneous NOx mass emission rate determined using the test facility’s instrumentation and the instantaneous NOx mass emission rate determined by the engine controller that is responsible for NOx tracking (as required in section (g)(6.12)) during one hot-start emissions test using the FTP cycle. Data from the engine controller must include both engine-out and system-out (i.e., tailpipe) NOx mass emission rates and engine output energy. The test facility’s NOx mass emission rate data must not include a humidity correction. All data must be provided at a frequency of at least 1 Hertz in a CSV file and summed to show the total NOx mass and total engine output energy over the cycle. The system-out NOx mass and test facility NOx mass emission rate data must be plotted together in a graph versus time. The FTP cycle must be preceded by a warm-up FTP cycle without cycling the ignition to ensure that all sensors are reporting NOx data throughout the entire FTP cycle. A manufacturer may alternatively provide these data with vehicle-based testing using the EPA Urban Dynamometer Driving Schedule for Heavy-Duty Vehicles specified in 40 CFR Part 86, Appendix I as it existed on July 1, 2012.
- (2.3033) Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this regulation.

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- (j) *Production Vehicle Evaluation Testing.*

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(2) *Verification of Monitoring Requirements.*

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(2.3) Evaluation requirements:

(2.3.1) Except as provided for emissions neutral diagnostics in section (j)(2.3.1)(A) below, the evaluation shall demonstrate the ability of the OBD II system on the selected production vehicle to detect a malfunction, illuminate the MIL, and store confirmed and permanent fault codes when a malfunction is present, and the monitoring conditions have been satisfied for each individual diagnostic required by title 13, CCR section 1968.2. The manufacturer shall also verify the ability of the OBD II system to erase ~~all~~ permanent fault codes stored during testing under section (j)(2) ~~by the end of testing all diagnostics.~~

* * * *

(2.3.5) 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, including the permanent fault code storage/erasure test procedure. ~~If the Executive Officer shall approve the plan upon determining that the requirements of section (j)(2) are satisfied, and that the permanent fault code storage/erasure test procedure meets the following: the proposed test plan shall be approved.~~

(A) The procedure provides comprehensive testing coverage of at least one of each of the different "types" of monitors (fault codes) in each diagnostic or emission critical electronic control unit (e.g., monitors subject to the minimum ratio requirements of section (d)(3.2), monitors not subject to the minimum ratio requirements of section (d)(3.2), monitors that utilize an alternate MIL statistical MIL illumination and fault code storage protocol) and the different permanent fault code erasure protocols (e.g., "natural" erasure without a clearing of the fault information in the on-board computer, erasure after a battery disconnect, erasure after a scan tool code clear command, erasure after a reprogramming event).

(B) The procedure verifies that after a scan tool code clear command, all monitors can fully execute and determine that the respective components or systems are not malfunctioning, and

(C) The last procedure performed on a vehicle during testing under section (j)(2) verifies that any remaining permanent fault code(s) stored as a side effect of the testing is erased without requiring reprogramming of the diagnostic or emission critical electronic control unit.