DRAFT POTENTIAL

Regulation Order

New Regulations and Test Procedures for Off-Road and Marine Compression-Ignition Engines, Amendments to the Regulation for Off-Road Hydrogen Spark-Ignition Engines, and Amendments to the In -Use Off-Road Diesel-Fueled Fleet Regulation

Note: Current section 2422 is being deleted in its entirety, and a new section 2422 is being proposed. The new section is shown in normal text.

Note: Additions and modifications to the definitions in section 2449(c) are being proposed. The changes are shown in underline to indicate additions and ~~strikethrough~~ to indicate deletions from the existing regulatory text. Subsections for which no changes are currently proposed are indicated with "* * * * *".

The entire text of new sections 2112.1, 2113.1, 2114.1, 2116.1, 2118.1, 2121.1, 2122.1, 2124.1, 2125.1, 2126.1, 2127.1, 2128.1, 2130.1, 2136.1, 2137.1, 2138.1, 2139.1, 2140.1, 2141.1, 2143.1, 2420.1, 2421.1, 2423.05, 2423.1, 2423.2, 2424.1, 2425.2, 2425.3, 2425.4, 2427.1, 2430.1, and 2449.4 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

A Table of Contents and page numbers are included in this draft to assist reviewers with navigating the document. These items are not part of the proposed regulation and will not be included in the final Proposed Regulation Order.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

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Table of Contents

List of Sections Proposed for Adoption or Amendment

The following section of the California Code of Regulations, title 13, division 3, chapter 9, is being amended by this regulatory proposal.

Chapter 9. Off-Road Compression-Ignition Engines and Equipment

Section 2449. General Requirements for In-Use Off-Road Diesel-Fueled Fleets.

The following section of the California Code of Regulations, title 13, division 3, chapter 9, is being deleted by this regulatory proposal.

Chapter 9. Off-Road Compression-Ignition Engines and Equipment

Section 2422. [Reserved].

The following sections of the California Code of Regulations, title 13, division 3, chapter 2, are being proposed for adoption by this regulatory proposal.

Chapter 2. Enforcement of Vehicle Emission Standards and Surveillance Testing

Section 2112.1. Definitions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

Section 2113.1 Initiation and Approval of Voluntary and Influenced Emission-Related Recalls for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

Section 2114.1 Voluntary and Influenced Recall Plans for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

Section 2116.1. Repair Label for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

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This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

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Section 2140.1.	Notification and Use of Test Results for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2141.1.	General Provisions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2143.1.	Corrective Action Failure Thresholds for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

The following sections of the California Code of Regulations, title 13, division 3, chapter 9, are being proposed for adoption by this regulatory proposal.

Chapter 9. Off-Road Compression-Ignition Engines and Equipment

Section 2420.1.	Applicability for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2421.1.	Definitions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2422.	On-Board Diagnostics Requirements – 2036 and Subsequent Model Year Off-Road Engines Certified to the Tier 5 Final Emission Standards.
Section 2423.05.	Supplemental Exhaust Emission Standards and Test Procedures for Tier 4 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Less than 37 kW.
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Section 2423.2.	Exhaust Emission Standards and Test Procedures – 2031 and Subsequent Model Year Marine Compression-Ignition Engines Below 37 kW.
Section 2424.1.	Emission Control Labels – Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
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Section 2425.3.	Defect Investigation and Reporting Requirements for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2425.4.	Required Recall and Corrective Action for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2427.1.	Selective Enforcement Action for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.
Section 2430.1.	Applicability for Engines that are Designed to Operate Using Hydrogen as a Combustion Fuel Source.
Section 2449.4.	General Requirements for In-Use Off-Road Diesel-Fueled Fleets for Adding Vehicles that are not California-Certified.

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Text of Sections Proposed for Adoption or Amendment

Draft Potential Regulation Order

Title 13 California Code of Regulations (CCR)

Amend Section 2449; Delete Section 2422; and Adopt new Sections 2112.1, 2113.1, 2114.1, 2116.1, 2118.1, 2121.1, 2122.1, 2124.1, 2125.1, 2126.1, 2127.1, 2128.1, 2130.1, 2136.1, 2137.1, 2138.1, 2139.1, 2140.1, 2141.1, 2143.1, 2420.1, 2421.1, 2422, 2423.05, 2423.1, 2423.2, 2424.1, 2425.2, 2425.3, 2425.4, 2427.1, 2430.1, and 2449.4 of Title 13, CCR, to read as follows:

1. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2112.1 to read as follows:

Note: The entire text of section 2112.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2112.1. Definitions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The definitions in this section 2112.1 apply solely to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 for the purpose of implementing and enforcing the "Procedures for in-Use Vehicle Voluntary and Influenced Recalls" in title 13, CCR, Division 3, Chapter 2, Article 2.1.

(2) In case of discrepancy between the definitions set forth in title 13, CCR, section 2112 and this section 2112.1, the definitions in this section 2112.1 shall apply.

(3) The definitions in title 13, CCR, section 2112 apply to off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 for the purpose of implementing and enforcing the "Procedures for in-Use Vehicle Voluntary and Influenced Recalls" in title 13, CCR, Division 3, Chapter 2, Article 2.1.

(b) *Definitions*.

"Capture rate" means the percentage of in-use engines subject to recall which must be corrected to bring the class or category of engines into compliance. The

number of engines subject to recall shall be based on the actual number of engines in use in California as reported by the manufacturer.

“Days”, when computing any period of time, means normal working days on which a manufacturer is open for business, unless otherwise noted.

“Emission-Related Failure” means a failure of a component covered by emission-related warranty as described in Part III: 40 CFR PART 1039, Subpart B, section 1039.120(c) of the " Tier 5 Test Procedures."

“Emission Warranty Claim” means an adjustment, inspection, repair or replacement of a specific emission-related component for which the engine or equipment manufacturer is invoiced or solicited by a repairing agent for compensation pursuant to warranty provisions, regardless of whether compensation is actually provided.

“Executive Officer” means the Executive Officer of the California Air Resources Board or his or her authorized representative.

“Influenced Emission Recall” means an inspection, repair, adjustment, or modification program initiated and conducted by a manufacturer or its agent or representative as a result of in-use enforcement testing or other evidence of noncompliance provided or required by the Board, to remedy any nonconformity for which direct notification of engine or equipment owners is necessary.

“In-Use Compliance Testing” means emission testing of engines conducted under the In-Use Vehicle Enforcement Test Procedures as described in title 13, CCR, Division 3, Chapter 2, Article 2.3.

“Nonconformity” or “noncompliance” exists whenever:

(A) a substantial number of a class or category of engines or equipment, although properly maintained and used, experience a failure of the same emission-related component within their useful lives which, if uncorrected, results in the engines' or equipment‘s failure to meet the applicable standards,

(B) a class or category of engines, although properly maintained and used, fails to comply with the emission standards specified in title 13, CCR section 2423.1 or 2423.2, as applicable, or

(C) a class or category of engines exceeds the failure thresholds specified in title 13, CCR, section 2143.1, or fails to comply with the off-road on-board diagnostics (OR OBD) requirements specified in title 13, CCR section 2422, the in-use emissions compliance requirements specified in Part II: IN-USE EMISSIONS COMPLIANCE, Subpart A and Subpart B of the “Tier 5 Test Procedures,” incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A), the

requirements for inducements related to selective catalytic reduction in Part VI: ADDITIONAL CALIFORNIA TIER 5 REQUIREMENTS, Subpart A of the “Tier 5 Test Procedures,” incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A), or the requirements for automatic engine shutdown systems in Part VI, Subpart C, subsection 2 of the “Tier 5 Test Procedures.” An engine determined not to comply with any of the requirements specified in this subsection (C) shall be considered nonconforming irrespective of whether the engine meets applicable emission standards.

“Ordered Emission Recall” means an inspection, repair, adjustment, or modification program required by the Board and conducted by the manufacturer or its agent or representative to remedy any nonconformity for which direct notification of engine or equipment owners is necessary.

“Quarterly reports” refer to the following calendar periods: January 1 through March 31, April 1 through June 30, July 1 through September 30, October 1 through December 31.

“Ultimate purchaser” has the same meaning as defined in section 39055.5 of the Health and Safety Code.

“Useful life” is defined in Title 13, CCR, section 2421.1, subsection (b)(2), for the purposes of this article.

“Vehicle or engine manufacturer” means the manufacturer granted certification for an off-road vehicle or off-road engine that is certified to title 13, CCR section 2423.1 or a marine engine that is certified to title 13, CCR, section 2423.2.

“Voluntary Emission Recall” means an inspection, repair, adjustment, or modification program voluntarily initiated and conducted by a manufacturer or its agent or representative to remedy any nonconformity for which direct notification of engine or equipment owners is necessary.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39010, 39600, 39601, 43013, 43018, 43101, 43104, 43105, and 43806, Health and Safety Code; and Section 28114, Vehicle Code. Reference: Sections 38501, 38505, 38510, 38560, 39002, 39003, 39010, 39500, 39601, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43202, 43204, 43205, 43205.5, 43206, 43210, 43211, 43212, 43213, and 43806, Health and Safety Code; and Section 28114, Vehicle Code.

2. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2113.1 to read as follows:

Note: The entire text of section 2113.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2113.1. Initiation and Approval of Voluntary and Influenced Emission-Related Recalls for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Off-Road Compression-Ignition Engines*. Manufacturers that certify off-road compression-ignition engines to title 13, CCR section 2423 or section 2423.1 shall follow the requirements for voluntary and influenced emission-related recalls set forth at title 13, CCR, section 2113.

(b) *Marine Compression-Ignition Engines*. Manufacturers that certify marine compression-ignition engines to title 13, CCR, section 2423 or section 2423.2 shall follow the requirements for voluntary and influenced emission-related recalls set forth at section 2113.

(c) In case of a discrepancy between the requirements referenced in section 2113 and requirements in section 2114.1, the requirements in section 2114.1 control for off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 or marine compression-ignition engines that are certified to title 13, CCR, section 2423.2.

Note: Authority cited: Sections 28501, 38505, 38510, 38560, 39600, 39601, 43013, 43018. and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

3. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2114.1 to read as follows:

Note: The entire text of section 2114.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2114.1. Voluntary and Influenced Recall Plans for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for voluntary and influenced recall plans set forth in this section 2114.1 shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2114.

(2) The requirements for "Voluntary and Influenced Recall Plans" in title 13, CCR, section 2114 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2114.1.

(b) The recall plan for both voluntary and influenced recalls shall contain the following information unless otherwise specified:

(1) A description of each class or category of engine subject to recall including the number of engines to be recalled, the engine family, the model year, the make, the model, the types of equipment a recall engine is in, and such other information as may be required to identify the engines to be recalled.

(2) A description of the nonconformity and the specific modifications, alterations, repairs, adjustments, or other changes to be made to correct the engines.

(3) A description of the method by which the manufacturer will determine the names and addresses of engine or equipment owners and the manufacturer's method and schedule for notifying the service facilities and engine or equipment owners of the recall.

(4) A description of the procedure to be followed by engine or equipment owners to obtain correction of the nonconformity. This shall include the date on or after which the owner can have the nonconformity remedied, the time reasonably necessary to perform the labor to remedy the nonconformity, and the designation of facilities at which the nonconformity can be remedied.

(5) If some or all of the nonconforming engines are to be remedied by persons other than dealers or authorized warranty agents of the manufacturer, a description of such class of persons.

(6) A copy of the letter of notification to be sent to engine or equipment owners.

(7) A description of the system by which the manufacturer will assure that an adequate supply of parts will be available to perform the repair under the recall plan, including the date by which an adequate supply of parts will be available to initiate the repair campaign, and the method to be used to assure the supply remains both adequate and responsive to owner demand.

(8) A copy of all necessary instructions to be sent to those persons who are to perform the repair.

(9) A description of the impact of the proposed repairs or adjustments on fuel economy, driveability, performance and safety of each class or category of engines or equipment to be recalled and a brief summary of the data, technical studies, or engineering evaluations which support these descriptions.

(10) Under an influenced recall, an estimate of the capture rate from the proposed recall derived from actual data and/or manufacturer experience. A minimum of 60 percent capture rate shall be assigned for recalls based exclusively on noncompliance as defined in title 13, CCR, section 2112.1, subsection (A) of the definition of noncompliance.

(11) Under an influenced recall based on noncompliance as defined in title 13, CCR, section 2112.1, subsection (B) of the definition of noncompliance, a description of the impact of the proposed changes on the average emissions from the engines to be recalled. The description shall contain the following:

(A) Average noncompliance emission levels.

(B) Average emission reduction per pollutant resulting from the recall repair. These averages shall be verified by the manufacturer by applying the proposed recall repairs to two or more in-use engines representing the average noncompliance emission levels. Only those engines with baseline-emission levels within 25 percent of the average emission levels of noncomplying pollutant(s) established under the in-use enforcement test program may be used by manufacturers to verify proposed recall repairs. The Executive Officer may allow the use of engines exceeding these limits if none which meet the limits can be reasonably procured.

(C) An estimate of the average emission level per pollutant for the class or category of engines after repair as corrected by the estimated capture rate. The

estimated average emission level shall comply with the applicable emission standard. The Executive Officer may waive the requirement for average emission compliance with the standards provided the emission level per engine repaired is reduced to its new engine certification emission level at a minimum capture rate of 60 percent.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

4. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2116.1 to read as follows:

Note: The entire text of section 2116.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2116.1. Repair Label for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for repair labels set forth in this section 2116.1 shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2116.

(2) The requirements for "Repair Label" in title 13, CCR, section 2116 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2116.1.

(b) *Label Requirements*.

(1) The manufacturer shall require those who perform the repair to affix a label to each engine or piece of equipment repaired, or, when required, inspected, under the voluntary or influenced recall plan.

(2) The label shall be placed in a location approved by CARB and shall be fabricated of a material suitable for such location in which it is installed and which is not readily removable.

(3) The label shall contain the recall campaign number and a code designating the campaign facility at which the repair, or inspection for repair, was performed.

(4) Manufacturers are exempt from the label requirements of subsections (b)(1), (b)(2), and (b)(3) of this section 2116.1, if all of the following conditions are met:

(A) The recall shall involve only software or software calibration repairs or changes and does not involve hardware repairs or changes,

(B) Throughout the useful life of the engine, the manufacturer keeps and retains a record of the engine serial numbers of all pieces of equipment that were inspected or repaired, and

(C) Upon request from CARB, the manufacturer provides information within 14 calendar days about running changes, field fixes, service campaigns, and

recalls for any given engine serial numbers from all pieces of equipment affected by the nonconformity.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

5. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2118.1 to read as follows:

Note: The entire text of section 2118.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2118.1. Notification for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for notifications set forth in this section 2118.1 shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2118.

(2) The requirements for "Notification" in title 13, CCR, section 2118 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2118.1.

(b) The notification of engine and equipment owners shall contain the following:

(1) The statement: "Your engine (is or may be) releasing air pollutants which exceed (California or California and federal) standards," if applicable as determined by the Executive Officer.

(2) A statement that the nonconformity of any such engines will be remedied at the expense of the manufacturer.

(3) A statement describing the adverse effect, if any, of the uncorrected nonconformity on the performance, fuel economy, or durability of the engine.

(4) After the effective date of the recall enforcement program referred to in section 2117, a statement that a certificate showing that the engine has been repaired under the recall program shall be issued by the service facilities, and that such a certificate will be required as a condition of engine operation, as appropriate.

(5) A card to be used by an engine or equipment owner in the event the 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 engine was sold or transferred. For off-road compression-ignition engines that are certified to the exhaust emission standards in title 13, CCR, section 2423.1 or marine compression-ignition engines with a power rating below 37 kW that are certified to the exhaust emission

standards in title 13, CCR, section 2423.2, manufacturers may obtain new owner information electronically or using the postcard with postage paid.

(6) The statement: “In order to ensure your full protection under the emission warranty provisions, it is recommended that you have your (engine or equipment) serviced as soon as possible. Failure to do so could be determined as lack of proper maintenance of your (engine or equipment).”

(7) A telephone number provided by the manufacturer, which may be used to report difficulty in obtaining recall repairs.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

6. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.1, Section 2121.1 to read as follows:

Note: The entire text of section 2121.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2121.1. Penalties for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

Under the influenced recall, failure by a manufacturer to notify the engine or equipment owners and repair the engines in the manner specified in the plan shall constitute a violation of the Executive Officer's order approving the plan and a violation of Health and Safety Code section 43105. Notwithstanding the above, no penalty shall be imposed for a manufacturer's failure to meet the estimated capture rate except for an influenced recall when the 60-percent capture rate is required pursuant to title 13, CCR, section 2114, subsection (a)(10) for off-road compression-ignition engines and marine engines that are certified to title 13, CCR, section 2423 or pursuant to title 13, CCR, or to title 13, CCR, section 2114.1, subsection (b)(10), for off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and for marine engines that are certified to title 13, CCR, section 2423.2, in which case a recall pursuant to section 2123 may be ordered if the Executive Officer determines that the manufacturer did not show a good faith effort to achieve the capture rate set forth in the recall plan.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

7. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2122.1 to read as follows:

Note: The entire text of section 2122.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2122.1. General Provisions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) For off-road compression-ignition engines and marine compression-ignition engines that certify to title 13, CCR, section 2423, the provisions regarding applicability of the ordered recall procedures and the definitions shall be the same as those set forth in title 13, CCR, sections 2111 and 2112.

(b) For off-road compression-ignition engines that certify to title 13, CCR, section 2423.1 and marine compression-ignition engines that certify to title 13, CCR, section 2423.2, the provisions regarding applicability of the ordered recall procedures and the definitions shall be the same as those set forth in title 13, CCR, sections 2111 and 2112.1.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

8. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2124.1 to read as follows:

Note: The entire text of section 2124.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2124.1. Availability of Public Hearing for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) The manufacturer may request a public hearing pursuant to the procedures set forth in sections 60040 to 60053, Title 17, California Code of Regulations to contest the finding of nonconformity and the necessity for or the scope of any ordered corrective action.

(b) If a manufacturer requests a public hearing pursuant to subsection (a) above, and if the Executive Officer's determination of nonconformity is confirmed at the hearing, the manufacturer shall submit the recall plan required by title 13, CCR section 2125 for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 or title 13, CCR, section 2125.1 for off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 within 30 days after receipt of the Board's decision.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

9. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2125.1 to read as follows:

Note: The entire text of section 2125.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2125.1. Ordered Recall Plan for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Off-Road Compression-Ignition Engines*. Manufacturers that certify off-road compression-ignition engines to title 13, CCR section 2423 or section 2423.1 shall follow the requirements for ordered recall plans set forth at title 13, CCR, section 2125, except as follows in subsection (c).

(b) *Marine Compression-Ignition Engines*. Manufacturers that certify marine compression-ignition engines to title 13, CCR, section 2423 or section 2423.2 shall follow the requirements for ordered recall plans set forth at title 13, CCR, section 2125, except as follows in subsection (c).

(c) *References*.

(1) References to section 2112, subsection (a) in title 13, CCR section 2125, subsection (b)(6) shall mean "capture rate" in section 2112.1, subsection (b).

(2) References to section 2112, subsection (h)(1) in title 13, CCR section 2125, subsection (b)(6) shall mean subsection (A) of the definition of "nonconformity" in section 2112.1, subsection (b).

(3) References to section 2112, subsection (h)(2) in title 13, CCR section 2125, subsection (b)(12) shall mean subsection (B) of the definition of "nonconformity" in section 2112.1, subsection (b).

(4) References to "vehicles, engines, or trailers" shall mean "engines or equipment."

Note: Authority cited: Sections HSC 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

10. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2126.1 to read as follows:

Note: The entire text of section 2126.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2126.1. Approval and Implementation of Recall Plan for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines

(a) *Applicability*.

(1) The approval and implementation requirements in section 2126.1, subsections (b), (c), (d), and (e) apply solely to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 for the purpose of implementing and enforcing the "Procedures for In-Use Vehicle Ordered Recalls" in title 13, CCR, Division 3, Chapter 2, Article 2.2.

(2) In case of discrepancy between the definitions set forth in title 13, CCR, section 2126 and this section 2126.1, the requirements in this section 2126.1 shall apply.

(3) The approval and implementation requirements in title 13, CCR, section 2126 apply to off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 for the purpose of implementing and enforcing the "Procedures for in-Use Vehicle Ordered Recalls" in title 13, CCR, Division 3, Chapter 2, Article 2.2.

(b) If the Executive Officer finds that the recall plan is designed effectively to correct the nonconformity and complies with the provisions of section 2125.1, he or she will so notify the manufacturer in writing. Upon receipt of the approval notice from the Executive Officer, the manufacturer shall commence implementation of the approved plan. Notification of engine or equipment owners and the implementation of recall repairs shall commence within 45 days of the receipt of notice unless the manufacturer can show good cause for the Executive Officer to extend the deadline.

(c) If the Executive Officer does not approve the recall plan or the mitigation measures provided in section 2130.1 as submitted, the Executive Officer shall order modification of the plan or mitigation measures with such changes and additions as he or she determines to be necessary. The Executive Officer shall notify the manufacturer in writing of the disapproval and the reasons for the disapproval.

(d) The manufacturer may contest the Executive Officer's disapproval by requesting a public hearing pursuant to the procedures set forth in sections 60040 to 60053, title 17, California Code of Regulations. As a result of the hearing, the Board

may affirm, overturn or modify the Executive Officer's action. In its decision, affirming or modifying, the Board shall specify the date by which the manufacturer shall commence notifying engine or equipment owners and implementing the required recall repairs.

(e) If no public hearing is requested in accordance with (c) above, the manufacturer shall incorporate the changes and additions required by the Executive Officer and shall commence notifying engine or equipment owners and implementing the required recall repairs within 60 days of the manufacturer's receipt of the Executive Officer's disapproval.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

11. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2127.1 to read as follows:

Note: The entire text of section 2127.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2127.1. Notification of Owners of Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability.*

(1) The notification requirements set forth in this section 2127.1, subsection (b) apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in addition to the notification requirements set forth in title 13, CCR, section 2127, except as follows:

(A) The reference to section 2125, subsection (b)(8) in title 13, CCR, section 2127, subsection (f) shall mean title 13, CCR, section 2125.1.

(2) In case of discrepancy between the requirements set forth in title 13, CCR, section 2127 and this section 2127.1, the requirements in this section 2127.1 shall apply.

(b) *Notification Requirements*.

The notification of engine or equipment owners shall contain a card to be used by an engine or equipment owner in the event the engine or equipment 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 engine or equipment was sold. For off-road compression-ignition engines that are certified to the exhaust emission standards in title 13, CCR, section 2423.1 or marine compression-ignition engines with a power rating below 37 kW that are certified to the exhaust emission standards in title 13, CCR, section 2423.2, manufacturers may obtain new owner information electronically or using the postcard with postage paid.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

12. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2128.1 to read as follows:

Note: The entire text of section 2128.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2128.1. Repair Label for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for notifications set forth in this section 2128.1, subsection (b) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2128.

(2) The requirements for "Repair Label" in title 13, CCR, section 2128 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2128.1.

(b) *Repair Label Requirements*.

(1) The manufacturer shall require those who perform the repair under the recall plan to affix a label to each engine or equipment repaired or, when required, inspected under the recall plan.

(2) The label shall be placed in a location as approved by CARB and shall be fabricated of a material suitable for such location and which is not readily removable.

(3) The label shall contain the recall campaign number and a code designating the facility at which the repair, inspection for repair, was performed.

(4) For off-road compression-ignition engines that are certified to the exhaust emission standards in title 13, CCR, section 2423.1 or marine compression-ignition engines with a power rating below 37 kW that are certified to the exhaust emission standards in title 13, CCR, section 2423.2, manufacturers are exempt from the label requirements of subsections (b)(1), (b)(2), and (b)(3) of this section 2128.1 if all of the following conditions are met:

(A) The recall involves only software or software calibration repairs or changes and does not involve hardware repairs or changes,

(B) Throughout the useful life of the engine, the manufacturer keeps and retains a record of the engine serial numbers of all pieces of equipment that were inspected or repaired, and

(C) Within 14 calendar days of receiving a written request from CARB, the manufacturer provides a report that describes the repairs. The report must include running changes, field fixes, service campaigns, and recalls that have been implemented for each engine serial number for all pieces of equipment affected by the nonconformity.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

13. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2130.1 to read as follows:

Note: The entire text of section 2130.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2130.1. Capture Rates and Alternative Measures for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for capture rates and alternative measures set forth in this section 2130.1, subsection (b) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2130.

(2) The requirements for "Capture Rates and Alternative Measures" in title 13, CCR, section 2130 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2130.1.

(b) The manufacturer shall comply with the capture rate specified in the recall plan as determined pursuant to title 13, CCR, section 2125.1, within six consecutive quarters beginning with the quarter in which the notification of engine or equipment owners was initiated. If, after good faith efforts, the manufacturer cannot correct the percentage of engines or equipment specified in the plan by the applicable deadlines

and cannot take other measures to bring the engine family into compliance with the standards, the manufacturer shall propose mitigation measures to offset the emissions of the unrepaired engines within 45 days from the last report filed pursuant to title 13, CCR, section 2133, subsection (b)(3). The Executive Officer shall approve such measures provided that:

(1) the emission reductions from the recalled and repaired engines or equipment and the mitigation measures are equivalent to achieving the capture rate; and

(2) the emission reductions from the mitigation measures are real and verifiable; and

(3) the mitigation measures are implemented in a timely manner.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

14. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.2, Section 2136.1 to read as follows:

Note: The entire text of section 2136.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2136.1. General Provisions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

The provisions regarding applicability of the enforcement test procedures and the definitions shall be the same as those set forth in Title 13, California Code of Regulations, sections 2111 and 2112 for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 sections 2111 and 2112.1 for off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

15. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.3, Section 2137.1 to read as follows:

Note: The entire text of section 2137.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2137.1. Selection of Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for selection of engines for in-use compliance testing set forth in this section 2137.1, subsection (b) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2137.

(2) The requirements for "Vehicle, Engine, and Trailer Selection" in title 13, CCR, section 2137 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2137.1.

(b) *Selection Criteria*.

(1) Any engine used in a piece of equipment, manufactured for sale in California, shall be subject to these test procedures during its useful life. A minimum of ten (10) in-use engines determined by the California Air Resources Board (CARB) to be properly maintained and used will be procured and tested by CARB or its designated laboratory to represent the emission characteristics of the engine family or subgroup. CARB may test less than ten (10) in-use engines if the manufacturer notifies CARB in writing that the manufacturer will accept the results from less than ten (10) engines as being representative of the engine family or subgroup.

(2) No engine shall be accepted by CARB as a representative engine for enforcement testing unless the following criteria are met:

(A) California certified.

(B) Hour meter indication that engine age does not exceed the first 75 percent of the applicable useful life.

(C) No indication of abuse (e.g., overloading, misfueling, or other misuse), neglect, improper maintenance or other factors that would have a permanent effect on emission performance. For marine compression-ignition engines that certify to section 2423.2, "abuse" includes racing.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

(D) No major repair to engine or major repair of equipment resulting from collision.

(E) No indication of any problem that might jeopardize the safety of laboratory personnel.

(F) For off-road compression-ignition engines that are certified to the exhaust emission standards in title 13, CCR, section 2423.1 and are subject to recall testing, engines shall have an hour meter indication and engine age not exceeding the following periods:

1. For all engines rated under 19 kilowatts, and for constant-speed engines rated under 37 kilowatts with rated speeds greater than or equal to 3,000 revolutions per minute, 6 years or 2,250 hours of operation, whichever first occurs.

2. For all other engines rated at or above 19 kilowatts and under 37 kilowatts, 8 years or 3,750 hours of operation, whichever first occurs.

3. For all engines rated at or above 37 kilowatts, 11 years or 6,000 hours of operation, whichever first occurs.

(G) For marine compression-ignition engines rated below 37 kilowatts that are certified to the exhaust emission standards in title 13, CCR, section 2423.2 and are subject to recall testing, engines shall have an hour meter indication and engine age not exceeding the first 75 percent of the applicable useful life period of the engine as specified in Part VII: 40 CFR PART 1042, Subpart B, section 1042.101(e) of the "Tier 5 Test Procedures."

NOTE: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43016, 43018, 43101, 43104, 43105, 43106, 43107, 43154, 43204, 43205, and 43205.5, Health and Safety Code.

16. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.3, Section 2138.1 to read as follows:

Note: The entire text of section 2138.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2138.1. Restorative Maintenance for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for restorative maintenance set forth in this section 2138.1, subsection (b) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2138.

(2) The requirements for "Restorative Maintenance" in title 13, CCR, section 2138 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2138.1.

(b) *Restorative Maintenance Requirements*.

(1) Upon accepting an engine or equipment for testing, CARB or its designated laboratory will replace the fuel with certification test fuel.

(2) CARB or its designated laboratory shall perform the following diagnosis or restorative maintenance prior to enforcement testing:

(A) Identify part numbers of all essential emission control system components.

(B) Check air filter, all drive belts, all fluid levels, radiator cap, all vacuum hoses and electrical wiring related to emission control for integrity; check fuel metering and emission control system components for maladjustments and or tampering. Record all discrepancies.

(C) Check ignition system and replace any defective components; i.e., sensors, wires, etc.

(D) Check compression.

(E) Check and adjust engine parameters to manufacturer's specifications.

(F) For off-road compression-ignition engines that are certified to the Tier 5 final emission standards in section 2423.1, subsection (d)(1), check the OR OBD

system for proper operation. (This requirement does not apply to off-road compression-ignition engines that are certified to the Tier 5 interim emission standards in section 2423.1, subsection (d)(1) or to marine compression-ignition engines that certify to section 2423.2.)

(G) If the engine is within 15 hours of a scheduled maintenance service, that maintenance shall be performed.

Note: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

17. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.3, Section 2139.1 to read as follows:

Note: The entire text of section 2139.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2139.1. In-Use Compliance Testing for Off-Road Compression-Ignition Engines and for Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for in-use compliance testing set forth in this section 2139.1, subsections (b) and (c) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2139.

(2) The requirements for "Testing" in title 13, CCR, section 2139 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2139.1.

(b) *General Requirements*.

(1) CARB shall conduct in-use compliance testing on all off-road engines and on marine compression-ignition engines with a power rating below 37 kW using the applicable procedures, as specified below. CARB shall take corrective action against the manufacturers of such equipment and engines based on the results of this testing.

(2) In case of discrepancy between the requirements set forth in title 13, CCR, section 2139 and this section 2139.1, the requirements in this section 2139.1 shall apply.

(c) *Performance of Emission Testing*.

After the engines or pieces of equipment have been accepted and restorative maintenance, if any, has been performed, CARB or its designated laboratory shall perform the applicable emission tests pursuant to the following:

(1) For off-road engines that are certified to the emission standards in title 13, CCR, section 2423.1, in-use compliance testing on off-road engines shall be conducted in accordance with Part II of the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A), to identify equipment and engines that fail to conform to the applicable emission standards.

(2) For marine compression-ignition engines with a power rating below 37 kW that are certified to the emission standards in title 13, CCR, section 2423.2, in-use compliance testing on marine compression-ignition engines shall be conducted in accordance with Part II of the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A), to take corrective action against the manufacturers of such engines based on the results of this testing.

NOTE: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43016, 43018, 43101, 43104, and 43105, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38560, 39002, 39003, 43000, 43009.5, 43013, 43016, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43154, 43204, 43205, 43205.5, 43211, 43212, and 43213, Health and Safety Code.

18. Adopt new Title 13, CCR, Division 3, Chapter 2, Article 2.3, Section 2140.1 to read as follows:

Note: The entire text of section 2140.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2140.1. Notification and Use of Test Results for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The requirements for notification and use of test results set forth in this section 2140.1, subsections (b), (c), and (d) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in lieu of the requirements in title 13, CCR, section 2140.

(2) The requirements for "Notification and Use of Test Results" in title 13, CCR, section 2140 shall apply for off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 in lieu of the requirements in this section 2140.1.

(b) CARB shall notify the manufacturer in writing if the in-use engine or piece of equipment enforcement test results indicate that the test fleet contains three or more failures of the same emission-related component. Upon receipt of the notification, the manufacturer shall submit a report in accordance with Part V: 40 CFR PART 1068, Subpart F, section 1068.501 of the "Tier 5 Test Procedures" and title 13, CCR, section 2147. The engine family manufacturer shall be subject to recall when a specific emission-related failure occurred in three or more test engines or pieces of equipment, unless CARB determines from the emissions information report that a recall is unnecessary.

(c) If the results of the in-use engine or piece of equipment emission tests conducted pursuant to section 2139.1 indicate that the engine family fails to comply with the in-use emissions compliance requirements specified in Part II, Subpart B of the "Tier 5 Test Procedures," the entire engines or pieces of equipment population so represented shall be deemed to be noncompliant. CARB shall notify the manufacturer of the test results.

(d) The manufacturer shall have 45 days from the date of the CARB notification specified in subsection (b) to submit an influenced recall plan in accordance with sections 2113.1, 2114.1, 2115, 2116.1, 2117, 2118.1, 2119, 2120, and 2121.1, title 13, CCR. If no such recall plan is approved by CARB, CARB shall order corrective action including recall of the affected vehicles, pieces of equipment, or trailers in accordance

with sections 2122.1, 2123, 2124.1, 2125.1, 2126.1, 2127.1, 2128.1, 2129, 2130.1, 2131, 2132, 2133, 2134, and 2135, title 13, CCR.

NOTE: Authority cited: Sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43018, and 43105, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43016, 43018, 43101, 43104, 43105, 43106, 43107, 43154, 43204, 43205, 43205.5, 43211, 43212, and 43213, Health and Safety Code.

19. Adopt New Title 13, CCR, Chapter 2, Article 2.4, Section 2141.1 to read as follows:

Note: The entire text of section 2141.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2141.1. General Provisions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) For off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines that are certified to title 13, CCR, section 2423.1, the provisions regarding applicability of the failure reporting procedures and the definitions shall be the same as those set forth in title 13, California Code of Regulations, sections 2111 and 2112.1.

(b) For off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423, the provisions regarding applicability of the failure reporting procedures and the definitions shall be the same as those set forth in title 13, California Code of Regulations, sections 2111 and 2112.

Note: Authority cited: Sections 38501, 38505, 38510, 38560, 39500, 39600, 39601, 43000.5, 43013, 43105, 43204, 43205.5, and 43214 Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107, 43204, 43205, and 43205.5, Health and Safety Code.

20. Adopt New Title 13, CCR, Chapter 2, Article 2.4, Section 2143.1 to read as follows:

Note: The entire text of section 2143.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2143.1. Corrective Action Failure Thresholds for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

An off-road compression-ignition engine family and a marine compression-ignition engine family shall be subject to a corrective action when the number of failures of a specific emission-related component exceeds the failure threshold set forth below.

(a) For off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423, the "Failure Levels Triggering Recall and Corrective Action" requirements in title 13, CCR, section 2143 shall apply.

(b) For off-road compression-ignition engines that are certified to Tier 5 final exhaust emission standards in title 13, CCR, section 2423.1, subsection (d)(1)(A) and marine compression-ignition engines that are certified to the exhaust emission standards in title 13, CCR, section 2423.2, engines in an engine family shall be subject to corrective action, as specified in title 13, CCR, section 2425.2, at the following failure threshold: 4 percent of the entire engine family or 12 units (whichever is greater).

NOTE: Authority cited: Sections 38501, 38505, 38510, 38560, 39500, 39600, 39601, 43000.5, 43013, 43105, 43204, 43205.5, and 43214 Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38560, 43000, 43009.5, 43013, 43016, 43018, 43101, 43104, 43105, 43106, 43107, 43154, 43204, 43205, and 43205.5, Health and Safety Code.

21. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2420.1 to read as follows:

§ 2420.1. Applicability for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *General Provisions*.

(1) This article shall be applicable to new off-road compression-ignition engines, including all off-road alternate-fueled compression-ignition engines, marine compression-ignition engines, off-road engines derived from existing diesel cycle engines, and marine engines derived from existing diesel cycle engines (hereinafter, all such engines shall be referred to as compression-ignition engines) with the exception of all engines used in equipment that fall within the scope of the preemption of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)) and as defined by regulation of the U.S. Environmental Protection Agency.

(b) *Applicability for Engines that are Not Distinctly Compression-Ignition Engines or Spark-Ignition Engines.*

(1) For an engine that is not distinctly a compression-ignition engine nor derived from such, except as described in subsection (b)(2), below, the Executive Officer shall determine whether the engine shall be subject to these regulations, taking into consideration the relative similarity of the engine's torque-speed characteristics with those of compression-ignition engines. This provision also includes engines that have been designed to operate on alternate fuels, as defined in title 13, CCR, section 2421.1, subsection (b)(2).

(2) *Provisions for 2031 and Subsequent Model Year Hydrogen-Fueled Internal Combustion Engines (H_2-ICE), Except Marine Internal Combustion Engines with a Power Rating Below 37 kW*.

(A) Off-road engines designed to operate using hydrogen as a combustion fuel source, H_2-ICE, shall be subject to the compression-ignition standards and all the requirements as specified in subsections (b)(2)(B) and (b)(2)(C) if any of the following criteria apply:

1. The H_2-ICE employs boosted air induction, including turbochargers, superchargers, or any variant thereof, e.g., electric-turbo chargers.

2. The H_2-ICE is designed to operate in equipment previously powered with an off-road compression-ignition engine certified to the standards in title 13, CCR, section 2423 or 2423.1.

3. The H_2-ICE is derived from existing diesel cycle engines. For example, engines that share the same engine block configuration but utilize different

cylinder head designs to convert from compression-ignition diesel-fueled engine to spark-ignition hydrogen-fueled engine would be considered derived from existing diesel cycle engines.

(B) For 2031 through 2035 model years, H_2-ICE meeting any of the criteria specified in subsection (b)(2)(A) above may optionally comply with all of the requirements in title 13, CCR section 2423, Tier 5 interim requirements in title 13, CCR, section 2423.1, or Tier 5 final requirements in title 13, CCR, section 2423.1.

(C) For 2036 and subsequent model years, H_2-ICE meeting any of the criteria specified in subsection (b)(2)(A) above shall be subject to all the requirements in title 13, CCR, section 2423.1.

(3) *Provisions for 2031 and Subsequent Model Year Hydrogen-Fueled Marine Internal Combustion Engines with a Power Rating Below 37 kW*.

(A) Hydrogen-fueled marine internal combustion engines meeting the definition of spark-ignition marine engine in title 13, CCR, section 2441 shall be subject to all the requirements in title 13, CCR, sections 2440, 2441, 2442, 2443.1, 2443.2, 2443.3, 2444, 2444.1, 2444.2, 2445.1, 2445.2, 2446, 2447, and 2448.

(B) Hydrogen-fueled marine internal combustion engines meeting the definition of compression-ignition in Part VII: 40 CFR PART 1042, Subpart J, Section 1042.901 of the “Tier 5 Test Procedures” shall be subject to all the requirements in title 13, CCR, section 2423.2.

(c) Every new off-road compression-ignition engine that is manufactured for sale, sold, offered for sale, introduced or delivered for introduction into commerce, or imported into California and that is subject to any of the standards prescribed in this article and documents incorporated by reference therein, is required to be certified for use and sale by the manufacturer through the California Air Resources Board and covered by an Executive Order, issued pursuant to Chapter 9, Article 4, section 2423, section 2423.1, or section 2423.2, as applicable.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104, and 43105, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43102, 43104, 43105, 43150, 43151, 43152, 43153, 43154, 43205.5, 43210, 43210.5, 43211, and 43212, Health and Safety Code.

22. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2421.1 to read as follows:

Note: The entire text of section 2421.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2421.1. Definitions for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) For off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines that are certified to title 13, CCR, section 2423.2, the following definitions shall apply to title 13, CCR, Division 3, Chapter 9, Article 4, except that the definitions that apply to title 13, CCR, section 2422 are contained therein.

(A) The definitions in this section 2421.1, subsection (b)

(B) The definitions in the "California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts," which is incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A) and

(C) The definitions in title 13, California Code of Regulations (CCR), section 1900, subsection (b). In case of discrepancy between the definitions set forth in title 13, CCR, section 1900 and this section 2421.1, the definitions in this section 2421.1 shall apply.

(2) For off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423, the definitions in title 13, CCR, section 2421 shall apply to title 13, CCR, Division 3, Chapter 9, Article 4.

(b) In addition to the definitions incorporated under subsection (a), the following definitions shall govern the provisions of this Article;

(1) *Test Procedures.*

"Tier 5 Test Procedures" means the "California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts," which is incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A).

(2) *Definition of Terms.*

"*Applicable standard*" means an emission standard to which an engine is subject; or a family emission limit to which an engine is certified under title 13, CCR, section 2423.1 or 2423.2, as applicable.

"*Alternate fuel*" means any fuel that will reduce non-methane hydrocarbons (on a reactivity-adjusted basis), oxides of nitrogen (NOx), carbon monoxide (CO), and the potential risk associated with toxic air contaminants as compared to gasoline or diesel fuel and would not result in increased deterioration of the engine. Alternate fuels include, but are not limited to: methanol, ethanol, liquefied petroleum gas, compressed natural gas, hydrogen, and electricity.

"*Applicable steady-state duty cycle*" means the manufacturer's choice of Steady-State Duty Cycle (either the discrete-mode testing duty cycle or the ramped modal testing duty cycle).

"*Assembly-line tests*" are those tests or inspections that are performed on or at the end of the assembly-line.

"*Auxiliary emission-control device*" means any element of design that senses temperature, motive speed, engine speed, transmission gear, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of any part of the emission-control system.

"*Blue Sky Series engine*" means an off-road compression-ignition engine meeting the requirements of title 13, CCR, section 2423.1, subsection (d)(7).

"*Calendar year*" is defined as the twelve-month period commencing on January 1 through December 31.

"*California averaging, banking, and trading program*" (CA-ABT) means the voluntary program that allows a manufacturer to average, bank, and trade emission credits for purposes of certification to show compliance with the standards in title 13, CCR, section 2423.1. CA-ABT only applies to engines produced and delivered for sale in California.

"*California small-volume engine manufacturer*" means an engine manufacturer that meets all of the following criteria:

(A) The manufacturer sells a total of 200 or fewer engines in California annually (including engines that are exempt from California regulation under section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)) and that also sells a total of 60 or fewer engines in California annually that are subject to California emission standards. The number of engines shall be based on California-directed production volumes reported in accordance with Part III, Subpart C, section 1039.250 of the "Tier 5 Test Procedures." These totals include:

1. All new engines sold in a model year including those certified to the California Transition Program for Equipment Manufacturers requirements in title 13, CCR, section 2423.1, subsection (i) and those that do not meet the Tier 5 emission standards in title 13, CCR, section 2423.1, but are certified in California using the California Averaging, Banking, and Trading Program provisions in title 13, CCR, section 2423.1, subsection (g);

2. All new replacement engines produced under Part V: 40 CFR PART 1068, Subpart C, section 1068.240 of the "Tier 5 Test Procedures;" and

3. For manufacturers owned by a parent company, the total production volumes of the parent company and all its subsidiaries.

(B) The manufacturer has not previously certified Tier 5 engines as a non-California small-volume engine manufacturer.

"*CARB*" means California Air Resources Board.

"*CARB Enforcement Officer*" means any officer or employee of the California Air Resources Board so designated by the Executive Officer (or by their designee).

"*Category 1*" means relating to a marine engine with specific engine displacement below 7.0 liters per cylinder. See Part VII: 40 CFR PART 1042, Subpart G, section 1042.670 of the "Tier 5 Test Procedures" to determine equivalent per-cylinder displacement for nonreciprocating marine engines (such as gas turbine engines).

"*Certified configuration*" or "*certified emissions configuration*" means the assembled state of an engine that is equipped with a complete set of emission-related components and systems that are equivalent from an emissions standpoint (i.e., tolerances, calibrations, and specifications) to those components and systems that:

(A) were originally installed on the engine when it was issued an Executive Order,

(B) have been approved by the engine manufacturer to supersede any of the original emission-related components and systems for that engine, or

(C) are direct replacement parts equaling or exceeding the emissions-related performance of the original or superseded components and systems.

"*Commercial marine*" means relating to an engine or vessel that is not a recreational marine engine or a recreational vessel.

"*Compliance testing*" means CARB-directed emissions tests and inspections of production engines that are offered for sale, or manufactured for sale, in California in order to verify compliance with the applicable certification emission standards. The emissions tests may be conducted at CARB or contracted out facilities or at the

manufacturer's facility. The testing will be done at the expense of the manufacturer. Compliance testing shall be conducted in accordance with Part II, Subpart C of the "Tier 5 Test Procedures."

"*Compression-ignition engine*" means a type of engine with operating characteristics significantly similar to the theoretical Diesel combustion cycle. The non-use of a throttle to regulate intake flow for controlling power during normal operation is indicative of a compression-ignition engine. A compression-ignition engine may be petroleum-fueled (i.e., diesel-fueled) or alternate-fueled. All engines used in equipment that fall within the scope of the preemption of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. 7543(e)(1)) and as defined by regulation of the United States Environmental Protection Agency, are specifically not included within this category.

"*Conformity factor*" means the ratio of the in-use emission test result to the applicable regulatory standard.

"*Constant-speed engine*" means an off-road compression-ignition engine certified to operate only at constant speed, where constant-speed operation means engine operation with a governor that automatically controls the operator demand to maintain engine speed, even under changing load. Governors do not always maintain speed exactly constant. Typically, speed can decrease 0.1 percent to 10 percent below the speed at zero load, such that the minimum speed occurs near the engine's point of maximum power.

"*Confirmatory testing*" means CARB-directed emissions tests and inspections of the test engines and/or test vehicles used by the manufacturer to obtain test data for submittal with the certification application. The emissions tests may be conducted at CARB facilities, contracted out facilities, or at the manufacturer's facility. The testing will be done at the expense of the manufacturer.

"*Corrective action*" means any action taken by a manufacturer to remedy a noncompliance or nonconformity with the specified emission standard in title 13, CCR, section 2423.1 or 2423.2, performance standards in title 13, CCR, section 2143.1, off-road on-board diagnostics (OR OBD) requirements in title 13, CCR, section 2422, in-use emission compliance requirements in Part II: IN-USE EMISSIONS COMPLIANCE, Subpart A and Subpart B of the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A), or the requirements for inducements related to selective catalytic reduction in Part VI: ADDITIONAL CALIFORNIA TIER 5 REQUIREMENTS, Subpart A of the "Tier 5 Test Procedures," as applicable. Corrective action may include recall, extended warranty, or other action ordered by CARB. CARB shall require direct notification of corrective action to vehicle or engine owners.

"*Dealer*" means that person or entity engaged in the selling of new off-road compression-ignition engines, vehicles or equipment to ultimate purchasers.

"*Diesel Aftertreatment Rapid Aging Protocol (DARAP)*" means the method for generating durability cycles based on operational data inputs described in Part IV: 40 CFR PART 1065, Subpart L, sections 1065.1131 through 1065.1145, of the "Tier 5 Test Procedures."

"*Diesel cycle engine*" means a type of engine that operates according to the theoretical diesel combustion cycle. The primary means of controlling power output in a diesel cycle engine is by limiting the amount of fuel that is injected into the combustion chambers of the engine. A diesel cycle engine may be petroleum-fueled (i.e., diesel-fueled) or alternate-fueled.

"*Direct replacement part*" means a component that is identical in level of duty, function and design to the component it replaces, and can be fitted without making any additional modifications to the engine or to the equipment.

"*Emission-related component*" means an "emission-related part," as defined in title 13, CCR, section 1900, subsection (b)(3).

"*End of assembly line*" is defined as that place where the final inspection test or quality-audit test is performed.

"*Engine*" is defined in Part V: 40 CFR PART 1068, Subpart A, section 1068.30 of the "Tier 5 Test Procedures." This definition includes "compression-ignition engine," "off-road compression-ignition engine," and "marine compression-ignition engine."

"*Executive Officer*" means the Executive Officer of the California Air Resources Board or the Executive Officer's designee.

"*Exhaust emissions*" means substances emitted into the atmosphere from any opening downstream from the exhaust port of an off-road engine.

"*Exhaust port*" means the passage in the cylinder head which connects the exhaust valve and the exhaust manifold. The emissions from the exhaust port are commonly referred to as "engine-out" emissions.

"*Extended warranty*" means either of the following: 1) corrective action required by CARB that extends the warranty time periods in both hours and years for a specific emissions-related component pursuant to this article. The extended warranty shall be at a minimum equal to or more than the applicable certified useful life period of that vehicle or engine. Direct notification of corrective action to vehicle or engine owners shall be required, or 2) additional coverage provided by an engine manufacturer, equipment manufacturer, or dealer, typically at additional cost to the purchaser, for repairs and maintenance beyond the original factory or regulatory

base emissions warranty period(s). Extended warranties vary from the most comprehensive bumper-to-bumper coverage to more focused coverage including powertrains or aftermarket components.

"*Family emission limit*" (FEL) means an emission level that is declared by the manufacturer to serve in lieu of an emission standard for certification purposes for off-road compression-ignition engines under title 13, CCR, section 2423.1 or marine compression-ignition engines under title 13, CCR, section 2423.2 and for the California averaging, banking, and trading program for off-road compression-ignition engines, established in title 13, CCR, section 2423.1. A FEL must be expressed to the same number of decimal places as the applicable emission standard.

"*Final calendar quarter production*" means the calendar quarter in which the production of an engine family ends.

"*First calendar quarter production*" means the calendar quarter in which the production of an engine family begins.

"*40 CFR*" means Title 40, Code of Federal Regulations.

"*Fuel-fired heater*" means a fuel burning device that creates heat for the purpose of warming the passenger compartment of a piece of equipment but does not contribute to the propulsion of the piece of equipment.

"*Gross engine malfunction*" is defined as one yielding an emission value greater than the sum of the mean plus three (3) times the standard deviation. This definition shall apply only for determination of control limits.

"*Hand-startable engine*" means an engine that is started using a hand crank or pull cord.

"*Hybrid electric equipment"* means equipment that can draw energy from both of the following on-vehicle sources of stored energy: 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, or flywheel.

"*Incomplete rebuilt replacement engine*" means a rebuilt replacement engine that is sold or offered for sale in California without all the necessary components to enable engine operation including, but not necessarily limited to, the fuel system and the air system.

"*Manufacturer*" means:

(A) Any person who is engaged in the manufacturing or assembling of new off-road engines, vehicles, or equipment,

(B) Any person who is engaged in the manufacturing or assembling of new marine engines or vessels,

(C) Any person who is engaged in the importing of new off-road engines, vehicles, or equipment for resale and who has been granted certification, or any person who acts for and is under the control of a manufacturer in connection with the distribution of new off-road engines, vehicles, or equipment, or

(D) Any person who is engaged in the importing of new marine engines or vessels for resale and who has been granted certification, or any person who acts for and is under the control of a manufacturer in connection with the distribution of new marine engines or vessels.

This includes "Engine manufacturers," "Off-road equipment manufacturers," and "Vehicle manufacturers." "Manufacturer" does not include a dealer who receives new off-road engines, vehicles, or equipment for sale in commerce, nor any person engaging in the manufacturing or assembling of new off-road engines, vehicles, or equipment who does not install an engine as part of that manufacturing or assembling process. All off-road vehicle or equipment manufacturing entities that are under the control of the same person are considered to be a single off-road vehicle manufacturer or off-road equipment manufacturer.

"Non-integrated auxiliary marine compression-ignition engine" means a compression-ignition engine that is used on a marine vessel to provide power for onboard systems other than propulsion and is not part of the vessel's propulsion system or an integral part of the vessel, such as shared fueling, cooling, or exhaust systems. This definition includes portable auxiliary marine engines or generators.

"*Nonroad Compression-Ignition Composite Transient Cycle*" is defined in Part III: 40 CFR PART 1039, Appendix VI to Part 1039 – Nonroad Compression-Ignition Composite Transient Cycle of the "Tier 5 Test Procedures."

"*Normal production and inventory practices*" means those practices typically employed for similar engine families in years in which emission standards do not change.

"*Off-road compression-ignition engine*" means an engine that meets the definition of a "nonroad engine" in Part V: 40 CFR PART 1068, Subpart A, section 1068.30 of the "Tier 5 Test Procedures."

"*Off-road engine manufacturer*" means a manufacturer in connection with the distribution of new off-road engines.

"*Off-road equipment manufacturer*" means a manufacturer of new off-road equipment or importer of new off-road equipment.

"*Off-road vehicle*" or "Off-road equipment" means a vehicle or equipment that is powered by an off-road compression-ignition engine.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

"*Off-road vehicle manufacturer*" means a manufacturer of new off-road vehicles or equipment or importer of new off-road vehicles.

"*Otto cycle engine*" means a type of engine with operating characteristics that operates according to the theoretical Otto combustion cycle. The primary means of controlling power output in an Otto cycle engine is by limiting the amount of air and fuel that can enter the combustion chambers of the engine. Gasoline-fueled engines are Otto cycle engines.

"*Power category*" means a specific range of maximum power that defines the applicability of standards. For example, references to the 56-130 kW power category and 56 ≤ kW < 130 include all engines with maximum power at or above 56 kW but below 130 kW. Also references to 56-560 kW power categories or 56 ≤ kW ≤ 560 include all engines with maximum power at or above 56 kW, but at or below 560 kW, even though these engines span multiple power categories. Note that in some cases, FEL caps are based on a subset of a power category. The Tier 5 applicable power categories are defined as follows:

(A) Engines with maximum engine power below 8 kW.

(B) Engines with maximum engine power at or above 8 kW but below 19 kW.

(C) Engines with maximum engine power at or above 19 kW but below 56 kW.

(D) Engines with maximum engine power at or above 56 kW but below 130 kW.

(E) Engines with maximum engine power at or above 130 kW but at or below 560 kW.

(F) Engines with maximum engine power above 560 kW.

"*Quality-audit test*" is defined as the test performed on a sample of production engines produced for sale in California.

"*Rebuilder*" means any person who rebuilds engines for which the practices in title 13, CCR, section 2423.1, subsection (m)(1)(A) or title 13, CCR, section 2423.2, subsection (g) apply.

"Recall" means an inspection, repair, adjustment, or modification program initiated and conducted by a manufacturer or its agent or representative to remedy any nonconformity, pursuant to this article, for which direct notification of equipment or engine owners shall be required.

"*Replacement engine*" means a new compression-ignition off-road engine that is used to replace an engine that has already been placed into service (whether the previous engine is replaced in whole or in part with a new engine).

"*Representative engine sample*" means that the sample is typical of the engine family or engine family group as a whole (as defined in applicable test procedures).

"*Small off-road engine*" has the meaning specified in title 13, CCR, section 2401.

"*Small-volume engine manufacturer*" has the same meaning as a "California small-volume engine manufacturer," unless otherwise stated in the regulation.

"*Steady-state duty cycles*" are defined as follows:

(A) "Discrete-mode testing duty cycles" are contained in subparagraphs (a)(1), (b)(1), and (c)(1) of Appendix II to 40 CFR, Part 1039 of the "Tier 5 Test Procedures."

(B) "Ramped modal testing duty cycles" (RMC) are contained in subparagraphs (a)(2), (b)(2), and (c)(2) of Appendix II to 40 CFR, Part 1039 of the "Tier 5 Test Procedures."

"*Systemic failure*" means any emission-control component as defined in this article, found to have valid failures that exceed the thresholds specified in title 13, CCR, section 2143.1.

"*Tested engine configuration*" means an engine configuration selected for testing. Different configurations may be used for criteria pollutant emission testing. For criteria pollutant emission testing, the configuration with the highest volume of fuel injected per cylinder per combustion cycle at the point of maximum torque must be selected — unless good engineering judgment indicates that a different engine configuration is more likely to exceed (or have emissions nearer to) an applicable emission standard or FEL.

"*Tier 4 engine*" means an engine that is certified to the Tier 4 interim or Tier 4 final emission standards in title 13, CCR, section 2423, subsection (b)(1)(B).

"*Tier 5 engine*" means an engine that is certified to the Tier 5 interim or Tier 5 final emission standards in title 13, CCR, section 2423.1.

"*Transportation refrigeration unit*" means "transport refrigeration unit," as defined in title 13, CCR, section 2477.4.

"*Unscheduled maintenance*" means any inspection, adjustment, repair, removal, disassembly, cleaning, or replacement of components or systems that is performed to correct or diagnose a part failure that was not anticipated.

"*Useful life*" means:

(A) For Tier 5 interim engines, the period of use as defined in title 13, CCR, section 2421, subsection (a)(60).

(B) For Tier 5 final engines:

1. For all Tier 5 final engines rated under 19 kilowatts, and for constant-speed engines rated under 37 kilowatts with rated speeds greater than or equal to 3,000 revolutions per minute, a period of use of eight years or 3,000 hours of operation, whichever first occurs.

2. For all other Tier 5 final engines rated at or above 19 kilowatts and under 37 kilowatts, a period of use of 11 years or 5,000 hours of operation, whichever first occurs.

3. For all Tier 5 final engines rated at or above 37 kilowatts, a period of use of 15 years or 8,000 hours, whichever first occurs.

(C) For 2031 and subsequent model year marine compression-ignition engines below 37 kW, the period of use as defined in Part VII: 40 CFR, PART 1042, Subpart J, section 1042.901 of the "Tier 5 Test Procedures."

"*Variant engine configuration*" means an engine in the same engine family as the tested engine configuration, but which is calibrated differently such that greenhouse gas exhaust emissions may exceed the tested engine family's emissions levels.

"*Warrantable condition*" means any condition of an engine that triggers the responsibility of the manufacturer to take corrective action pursuant to title 13, CCR, section 2425.2.

"*Warranted part*" means:

(A) For an off-road compression-ignition engine that is certified to the Tier 5 emission standards in title 13, CCR, section 2423.1, any component covered by the emission-related warranty in accordance with Part III: 40 CFR PART 1039, Subpart B, section 1039.120 (c) of the " Tier 5 Test Procedures."

(B) For a 2031 and subsequent model year marine compression-ignition engine below 37 kW, any component covered by the emission-related warranty in accordance with Part VII: 40 CFR PART 1042, Subpart B, section 1042.120 (c) of the "Tier 5 Test Procedures."

"*Warranty period*" means the period of time, either in years or hours of operation, that the engine or part is covered by the warranty provisions pursuant to title 13, CCR, Section 2425.2.

"*Warranty station*" means a service facility authorized by the equipment or engine manufacturer to perform warranty repairs. This shall include all manufacturer distribution centers that are franchised to service the subject equipment or engines.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, and 43104, Health and Safety Code. Reference: Sections 43013, 43016, 43018, 43101, 43102, 43104, 43105, 43150, 43151, 43152, 43153, 43154, 43205.5, 43210, 43210.5, 43211, and 43212, Health and Safety Code.

23. Amend Title 13, CCR, Chapter 9, Article 4, Section 2422 to read as follows:

Note: Section 2422 does not currently contain any text. The current section number 2422 and title "[Reserved]" are being deleted in their entirety.

~~**§ 2422. [Reserved].**~~

3. Adopt new Title 13, CCR, Chapter 9, Article 4, Section 2422 to read as follows:

Note: The entire text of section 2422 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2422. On-Board Diagnostics Requirements – 2036 and Subsequent Model Year Off-Road Engines Certified to the Tier 5 Final Emission Standards.

(a) *Purpose*.

The purpose of this regulation is to reduce off-road engine emissions by establishing requirements for off-road on-board diagnostic (OR OBD) systems on engines certified for sale in off-road applications in California. The OR OBD systems, through the use of an on-board computer(s), shall function for the actual life of the engine, shall monitor emission systems in-use for the actual life of the engine, and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the equipment operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. Unless otherwise noted, all section references in this regulation refer to section 2422 of title 13, California Code of Regulations (CCR).

(b) *Applicability*.

(1) All 2036 and subsequent model year (MY) off-road engines that meet the criteria in sections (b)(1)(A) through (C) below shall be equipped with an OR OBD system that has been certified by the Executive Officer as meeting all applicable requirements of this regulation (title 13, CCR section 2422):

(A) Is certified to the Tier 5 Final emission standards in title 13, CCR section 2423.1(d)(1);

(B) Is equipped with an electronic control unit that controls fueling (e.g., fuel injection timing or quantity); and

(C) Is equipped with an electronic control unit that controls any of the following: intake air flow, exhaust gas recirculation flow, turbocharger boost level, diesel exhaust fluid (DEF) injection quantity, regeneration events, aftertreatment thermal management strategies, or catalyst operating conditions (e.g., air-fuel ratio).

(2) Manufacturers shall not sell, offer for sale, import, distribute, or enter into commerce in California any off-road engines described in section (b)(1) above unless they meet all requirements of this section.

(c) *Definitions*.

For the purposes of section 2422, the following definitions apply.

"*2B-MAW*" means 2-bin moving average window.

"*Actual life*" means the entire period that an engine is operated in California up to the time the engine is retired from use.

"*Applicable standards*" means the specific Tier 5 Final emission standards (transient test standard or steady-state test standard) or family emission limits (FEL) to which the engine is certified.

"*Auxiliary emission-control device (AECD)*" is defined in title 13, CCR section 2421.1(b)(2).

"*Calibration verification number (CVN)*" means a calculated number that is used to verify the integrity of the computer software and calibration information on an on-board electronic control unit.

"*Closed crankcase ventilation (CV) system*" means as a form of crankcase ventilation system that vents to the intake or the exhaust, but not to the atmosphere.

"*CO*" means carbon monoxide.

"*Confirmed fault code*," for purposes of engines using the International Organization for Standardization (ISO) 15765-4 protocol for the standardized functions required in section (e), means the diagnostic trouble code stored when an OR OBD system has confirmed that a malfunction exists (e.g., during the second operating cycle that the malfunction is detected) in accordance with the requirements of sections (e)(3) and (f).

"*CRC*" means the Cyclic Redundancy Check algorithm that is used by an on-board electronic control unit to calculate a checksum.

"*CRC-16*" means a CRC algorithm which produces a 16-bit checksum.

"*CRC-32*" means a CRC algorithm which produces a 32-bit checksum.

"*CV valve*" means as any form of valve, orifice, and/or filter/separator used to restrict, control, or alter the composition (e.g., remove oil vapor or particulate matter) of the crankcase vapor flow.

"*Continuously*," if used in the context of monitoring conditions for circuit malfunctions and out-of-range values, means monitoring is always enabled unless alternate enable conditions have been approved by the Executive Officer in accordance with section (f), and sampling of the signal used for monitoring occurs at a rate no less than two samples per second.

"*Deactivate*" means to turn-off, shutdown, desensitize, or otherwise make inoperable through software programming or other means during the actual life of the engine.

"*Diagnostic or emission critical electronic control unit (DEC ECU)*" means an on-board electronic control unit (e.g., the engine control module) that is field reprogrammable and satisfies any of conditions (1) through (3) below. For purposes of this definition, "primary control" over a monitor or diagnostic means the control unit does any of the following: (a) determines if any enable conditions are satisfied; (b) calculates all or part of the diagnostic decision statistic or metric by which pass or fail decisions are made (e.g., the comparison of a component's measured or calculated level of performance to a malfunction threshold); or (c) makes or processes pass or fail decisions (e.g., debounces diagnostic decision statistics or commands MIL illumination or fault code storage).

(1) Controls fuel injection timing or quantity, fuel pressure level, cylinder deactivation, variable valve timing or lift, exhaust gas recirculation (EGR) valve position, variable geometry turbocharger position, turbocharger boost level, DEF injection quantity, aftertreatment thermal management strategies, AECD operation, particulate matter (PM) filter regeneration, oxides of nitrogen (NOx) sensor functions, or PM sensor functions;

(2) Has primary control over a monitor or diagnostic required by section (f) except sections (f)(1)(G) and (f)(2)(G); or

(3) Has primary control over a rationality fault diagnostic or functional check for any input or output component required to be monitored by section (f)(1)(G) or (f)(2)(G).

"Engine output energy" in units of kilowatt-hours (kW-hr) means the integration of brake engine power output (in units of kW with all negative values set to zero) over time (in units of hr), where:

$$\begin{aligned} &Brake\ engine\ power\ output \\ &= Reference\ engine\ maximum\ torque \\ &\times \frac{(Actual\ indicated\ engine\ torque - Nominal\ engine\ friction\ torque)}{100} \\ &\times \frac{Engine\ speed}{9550} \end{aligned}$$

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

with “engine speed” in units of revolutions-per-minute (rpm)

“*Engine rating*” means a unique combination of displacement, rated power, and rated torque within an engine family. An engine rating may include multiple engine configurations with different software or calibrations.

“Engine start” means the point when the engine reaches a speed 150 revolutions-per-minute (rpm) below the normal, warmed-up idle speed.

“*Family Emission Limit (FEL)*” is defined in title 13, CCR section 2421.1(b)(2).

“*Field reprogrammable*” means capable of supporting a manufacturer service procedure intended to be executed in a dealership or other equipment service environment (e.g., by over-the-air reprogramming) that results in the downloading of new software and/or calibration data into the control unit or device.

“*Final inducement*” means the final derating of engine operation to idle only or engine shutdown that occurs if an engine’s selective catalytic reduction (SCR) system is not working properly consistent with the requirements of “Part VI: Additional California Tier 5 Requirements, Subpart A – Inducements Related to Selective Catalytic Reduction (SCR),” of the “Tier 5 Test Procedures,” incorporated by reference in title 13, CCR, section 2423.1(b)(1)(A).

“*Functional check*” for an output component or system under section (f)(1)(G) and (f)(2)(G) means a diagnostic that verifies proper response of the component and system to a computer command.

“*General denominator*” means a measure of the number of times an engine has been operated as defined in section (e)(2)(D)4.

“*Ignition cycle*” means a period of engine operation that begins with engine start, meets the engine start definition for at least two seconds plus or minus one second, and ends with engine shutoff.

“*Ignition cycle counter*” means a counter that indicates the number of ignition cycles an engine has experienced as defined in section (e)(2)(D)3.

“*Inducement*” means any strategy used on an engine to satisfy the requirements of “Part VI: Additional California Tier 5 Requirements, Subpart A – Inducements Related to Selective Catalytic Reduction (SCR),” of the “Tier 5 Test Procedures.”.

“*Infrequent,*” with regards to regeneration, means having an expected frequency of on average less than once over a transient or ramped-modal duty cycle, or on average less than once per mode in a discrete-mode test.

"*Intrusive diagnostic*" means an AECD that is activated for the purposes of determining whether or not a component or system is failing or for purposes of pinpointing the malfunction by the OR OBD system.

"*Malfunction*" means any deterioration or failure of a component or system that causes the performance to be outside of the applicable limits in section (f).

"*Malfunction preconditioning cycle*" means a test cycle that meets the requirements of section (g)(3)(D)2.b. or c.

"*Manufacturer*" means the holder of the Executive Order for the engine family.

"*MIL*" means malfunction indicator light.

"*MIL-on fault code*," for purposes of engines using the SAE International (SAE) J1939 protocol for the standardized functions required in section (e), means the diagnostic trouble code stored when an OR OBD system has confirmed that a malfunction exists (e.g., during the second operating cycle that the malfunction is detected) and has commanded the MIL on in accordance with the requirements of sections (e)(3) and (f).

"*NMHC*" means non-methane hydrocarbon.

"*Non-volatile random access memory (NVRAM)*" means a type of memory that retains its contents even when power to the on-board control unit is interrupted (e.g., battery disconnected, fuse to control unit removed). NVRAM is typically made non-volatile either by use of a back-up battery within the control unit or through the use of an electrically erasable and programmable read-only memory (EEPROM) chip.

"*NOx*" means oxides of nitrogen.

"*Operating cycle*" means a period of engine operation that consists of engine start and engine shutoff. For monitors/diagnostics that run during engine-off conditions, the period of engine off time following engine shutoff and up to the next engine start shall be considered part of the operating cycle. For equipment that employ engine shutoff strategies (e.g., engine shutoff at idle), the manufacturer may request Executive Officer approval to use an alternate definition for operating cycle (e.g., key on and key off). Executive Officer approval of the alternate definition shall be based on equivalence to engine start and engine shutoff signaling the beginning and ending of a single driving event for conventional equipment.

"*OR OBD data snapshot*" means all of the applicable data described in sections (e)(2)(C) through (e)(2)(F) and sections (e)(3)(B) through (e)(3)(F), obtained by a tool (e.g., scan tool) at one point in time.

"*Pending fault code*" means the diagnostic trouble code stored upon the initial detection of a malfunction (e.g., during the first operating cycle the malfunction is detected) prior to illumination of the MIL in accordance with the requirements of sections (e)(3) and (f).

"*PM*" means particulate matter.

"*Rationality fault diagnostic*" for an input component under section (f)(1)(G) and (f)(2)(G) means a diagnostic that verifies the accuracy of the input signal while in the range of normal operation and when compared to all other available information.

"*Regeneration*" means an event during which emissions levels change while the emission control performance is being restored by design. Regeneration events include, for example, PM filter soot oxidation, catalyst desulfurization, and decrystallization events.

"*Response rate*" for exhaust gas sensors means the delay from when the sensor is exposed to a different make-up of exhaust gas constituents until it outputs a signal reflecting the different make-up of exhaust gas constituents. For example, for NOx sensors, response rate is the delay from when the sensor is exposed to a different NOx exhaust gas level until it indicates the different NOx exhaust gas level.

"*So equipped*," if used in the context of data stream signals requirements under section (e), means the engine is equipped with a sensor, hardware, software, or control system that corresponds to, uses, or can calculate the data stream signal listed. For example, if an engine is equipped with a DEF dosing system, the data stream signal "DEF dosing rate" must be supported.

"*Start of engine production*" means the time when the manufacturer has produced two percent of the projected volume for the engine. In section (i), the start of engine production shall be based on the engine rating subject to the specific regulatory provision.

"*Start of equipment production*" means the time when the manufacturer has produced two percent of the projected volume for the equipment. In section (i), the start of equipment production shall be based on the engine rating and equipment combination for the engine rating subject to the specific regulatory provision.

"*Steady-state test*" means an exhaust emission test conducted according to the test procedures incorporated by reference in title 13, CCR section 2423.1(b)(1)(A) that is used to determine compliance with the steady-state test standard to which an engine is certified.

"*Discrete-Mode Cycle*" means the discrete-mode variant of the engine dynamometer schedules in 40 CFR appendix II of part 1039, entitled, "Steady-State Duty Cycles," as defined in title 13, CCR, section 2421.1, subsection (b)(2).

"*Ramped-Modal Cycle (RMC)*" means the ramped-modal variant of the engine dynamometer schedules in 40 CFR appendix II of part 1039, entitled, "Steady-State Duty Cycles," as defined in title 13, CCR, section 2421.1, subsection (b)(2).

"*Steady-state test standard*" means the certification exhaust emission standards and test procedures applicable to the RMC or discrete-mode cycle incorporated by reference in title 13, CCR section 2423.1(d)(1) to which the engine is certified.

"*Tailpipe NOx sensor*" means an exhaust gas sensor that measures oxides of nitrogen (NOx) concentration at a location in an engine's exhaust system where the NOx concentration of the exhaust gas is equivalent to the NOx concentration of the exhaust gas just before it leaves the exhaust system and enters the atmosphere.

"*Tier 5 Final emission standards*" means the Tier 5 final exhaust emission standards in title 13, CCR section 2423.1.

"*Transient test*" means an exhaust emission test conducted according to the test procedures incorporated by reference in title 13, CCR section 2423.1(b)(1)(A) that is used to determine compliance with the transient test standard to which an engine is certified.

"Off-Road Low Load Cycle (OR LLC)" means the engine dynamometer schedule in Part VI, Subpart B of the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A).

"*Nonroad Transient Test Cycle (NRTC)*" means the engine dynamometer schedule in 40 CFR appendix VI of part 1039, entitled, "Nonroad Compression-ignition Composite Transient Cycle," of the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A).

"*Transient test standard*" means the certification exhaust emission standards and test procedures applicable to the NRTC incorporated by reference in title 13, CCR section 2423.1(d)(1) to which the engine is certified.

(d) *Implementation Requirements*.

Engines shall meet the Stage 1 and Stage 2 requirements in sections (d)(1) and (d)(2), respectively, in accordance with the implementation schedule in section (d)(3).

(1) *Stage 1 Requirements*.

(A) Stage1 standardization requirements in sections (e)(1) and (e)(2),

(B) Demonstration testing requirements in section (g) (only for engines equipped with a tailpipe NOx sensor),

(C) Certification documentation requirements in sections (h)(1), (h)(2)(A), (h)(2)(C) (if applicable), and (h)(3),

(D) Deficiencies requirements in section (j), and

(E) Enforcement requirements in section (k).

(2) *Stage 2 Requirements*.

(A) *On-Board Monitoring and Diagnostics (OBMD) Engines*. For engines equipped with a selective catalytic reduction (SCR) system(s) or a tailpipe NOx sensor, Stage 2 requirements consist of the following:

1. Stage 1 standardization requirements in sections (e)(1) and (e)(2),
2. Stage 2 standardization requirements in sections (e)(1) and (e)(3),
3. OBMD diagnostic requirements in sections (f)(1) and (f)(3) through (f)(6),
4. Demonstration testing requirements in section (g),
5. Certification documentation requirements in sections (h)(1), (h)(2)(B), (h)(2)(C), and (h)(3),
6. Post-certification verification requirements in section (i),
7. Deficiencies requirements in section (j), and
8. Enforcement requirements in section (k).

(B) *On-Board Diagnostic (OBD) Engines*. For engines that are not equipped with an SCR system(s) or a tailpipe NOx sensor, Stage 2 requirements consist of the following:

1. Stage 1 standardization requirements in sections (e)(1) and (e)(2),
2. Stage 2 standardization requirements in sections (e)(1) and (e)(3),

3. OBD diagnostic requirements in section (f)(2) through (f)(6),

4. Demonstration testing requirements in section (g),

5. Certification documentation requirements in sections (h)(1), (h)(2)(B), and (h)(3),

6. Post-certification verification requirements in section (i),

7. Deficiencies requirements in section (j), and

8. Enforcement requirements in section (k).

(3) *Implementation Schedule*.

(A) The implementation schedule by engine MY and power category is shown in Table 1 below.

Table 1. Implementation Schedule

Power Category	Stage 1	Stage 2
All	2036-2038 MY	2039+ MY

(e) *Standardization Requirements*.

(1) *Documents Incorporated by Reference*.

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

(A) SAE J1930 “Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO 15031-2,” August 2024 (SAE J1930).

(B) SAE J1930-DA “Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet,” January 2023.

(C) SAE J1939, which consists of:

1. SAE J1939 “Serial Control and Communications Heavy-Duty Vehicle Network - Top Level Document,” June 2023.

2. SAE J1939-DA “Digital Annex of Serial Control and Communication Heavy Duty Vehicle Network Data,” September 2024.

3. SAE J1939-1 “On-Highway Equipment Control and Communication Network,” September 2021.

4. SAE J1939-11 “Physical Layer, 250 Kbps, Twisted Shielded Pair,” December 2016.

5. SAE J1939-13, “Off-Board Diagnostic Connector,” August 2024 (SAE J1939-13).

6. SAE J1939-15 “Physical Layer, 250 Kbps, Un-Shielded Twisted Pair (UTP),” December 2018.

7. SAE J1939-21 “Data Link Layer,” May 2022.

8. SAE J1939-31 “Network Layer,” June 2023.

9. SAE J1939-71 “Vehicle Application Layer,” August 2022.

10. SAE J1939-73 “Application Layer-Diagnostics,” August 2022.

11. SAE J1939-81 “Network Management,” March 2017.

12. SAE J1939-84 “OBD Communications Compliance Test Cases for Heavy-Duty Components and Vehicles,” June 2023.

(D) SAE J1962 “Diagnostic Connector,” July 2016 (SAE J1962).

(E) SAE J1978-2 “OBD-II Scan Tool - Second Generation Protocols,” December 2024,” (SAE J1978-2).

(F) SAE J1979-DA “Digital Annex of E/E Diagnostic Test Modes,” April 2025

(G) SAE J1979-2, “E/E Diagnostic Test Modes: OBDonUDS,” April 2021 (SAE J1979-2).

(H) SAE J2012 “Diagnostic Trouble Code Definitions,” December 2016 (SAE J2012).

(I) SAE J2012-DA “Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions,” March 2024.

(J) SAE J2403 “Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature,” August 2020 (SAE J2403).

(K) ISO 2575:2021 “Road vehicles – Symbols for controls, indicators and tell-tales,” September 2021 (ISO 2575).

(L) ISO 15765-4:2021 “Road vehicles – Diagnostic communication over Controller Area Network (DoCAN) – Part 4: Requirements for emission-related systems,” July 2021 (ISO 15765-4).

(2) *Stage 1 Standardization Requirements*. The requirements of this section apply to engines required to meet the Stage 1 and Stage 2 requirements in accordance with section (d).

(A) *Communication Protocol*. The manufacturer shall use one of the following standardized protocols for communication of all required OR OBD-related messages from on-board to off-board network communications to a scan tool designed to communicate with an SAE J1939 network or meeting SAE J1978-2 specifications:

1. SAE J1939. All required OR OBD-related messages using this protocol shall use the 500 kilobits per second baud rate.

2. ISO 15765-4. All required OR OBD-related messages using this protocol shall use the 500 kilobits per second baud rate. The manufacturer shall use SAE J1979-2 for the standardized functions required in section (e).

(B) *Diagnostic Link Connector*.

1. The off-road equipment shall incorporate a standard data link connector (i.e., diagnostic link connector) meeting the following specifications:

a. For applications using the SAE J1939 protocol (section (e)(2)(A)1.), the connector shall conform to the “Type 2” specifications of SAE J1939-13.

b. For applications using the ISO 15765-4 protocol (section (e)(2)(A)2.), the connector shall conform to the “Type A” connector specifications of SAE J1962.

2. Except as provided in section (e)(2)(B)5., the connector shall be located near the operator controls or the engine’s power switch. The location of the connector shall be in plain, unobstructed view of a person facing the operator controls or engine power switch.

3. Except as provided in section (e)(2)(B)5., the connector shall not be covered with or located behind any form of panel, access door, or storage device (e.g., fuse panel cover, hinged door, ashtray, coinbox) that requires opening or removal to access the connector.

4. The connector shall be mounted in a manner that allows operation of the equipment and does not interfere with use of the operator controls while a scan tool is connected to the connector. The connector may be equipped with a dust cap in the shape and size of the connector for environmental protection purposes so long as the dust cap is removable by hand without the use of any tools and is labeled “OBD” to aid technicians in identifying the connector.

5. If it is not technically feasible for the connector to meet the requirements of section (e)(2)(B)2. or 3., the connector may be located in an alternate location or may be covered so long as the manufacturer applies a durable label to the exterior of the equipment that indicates the location of the connector and the connector location is accessible by hand without requiring the use of tools or removal of parts.

(C) *Data Stream Signals*. The OR OBD system shall make available the following signals on demand through the diagnostic link connector in accordance with SAE J1939 or SAE J1979-2 specifications (whichever is applicable). The signals shall be accessible to a scan tool designed to communicate with an SAE J1939 network or a scan tool meeting SAE J1978-2 specifications. For each signal, the OR OBD system shall always use the actual signal value instead of a default or limp home value.

1. For all engines:
    a. Certification-Critical Signals.
        i. Engine speed,
        ii. Actual indicated engine torque (as a percentage of reference engine maximum torque),
        iii. Nominal engine friction torque (as a percentage of reference engine maximum torque),
        iv. Reference engine maximum torque,
        v. Engine fuel rate,
        vi. Engine coolant temperature (for engines so equipped),
        vii. PM filter regeneration status (for engines so equipped),
        viii. Throttle position (for engines so equipped),
        ix. Engine intake manifold temperature (for engines so equipped),
        x. Engine intake manifold pressure (for engines so equipped),
        xi. Engine out exhaust temperature (upstream of all aftertreatment components; e.g., diesel oxidation catalyst inlet temperature is acceptable if the diesel oxidation catalyst is the first component in the aftertreatment system),
        xii. Engine family name,
        xiii. Engine serial number,

xiv. Engine rated power,

xv. Engine rated speed, and

xvi. OR OBD requirements to which the engine is certified (i.e., Tier 5 Stage 1, Tier 5 Stage 2).

b. Additional Standard Signals.

i. Engine oil temperature,

ii. Engine control module system voltage, and

iii. Modeled exhaust flow rate (mass/time).

2. For all engines so equipped:

a. Primary Signals.

i. Normalized trigger for PM filter regeneration,

ii. Fuel pressure,

iii. Fuel injection timing,

iv. Engine intercooler temperature,

v. Air flow rate from mass air flow sensor,

vi. Commanded EGR valve duty cycle/position,

vii. Actual EGR valve duty cycle/position,

viii. EGR error between actual and commanded,

ix. Absolute pedal position and redundant absolute pedal position,

x. Boost pressure,

xi. Commanded/target boost pressure,

xii. Turbocharger inlet air temperature,

xiii. Fuel rail pressure,

xiv. Commanded fuel rail pressure,

xv. PM filter inlet temperature,

xvi. PM filter outlet temperature,

xvii. PM filter delta pressure,

xviii. Exhaust gas temperature sensor output,

xix. Variable geometry turbocharger position,

xx. Commanded variable geometry turbocharger position,

xxi. Turbocharger compressor inlet temperature,

xxii. Turbocharger compressor inlet pressure,

xxii. Turbocharger turbine inlet temperature,

xxiv. Turbocharger turbine outlet temperature,

xxv. Wastegate valve position,

xxvi. Glow plug lamp status,

xxvii. EGR temperature,

xxviii. Variable geometry turbocharger control status (e.g., open loop, closed loop),

xxix. Reductant level (e.g., DEF tank fill level),

xxx. Oxygen sensor output,

xxxi. Air/fuel ratio sensor output,

xxxii. NOx sensor output (e.g., NOx concentration, oxygen concentration),

xxxiii. Corrected NOx sensor output (the corrected NOx concentration used by the applicable ECU),

xxxiv. PM sensor output,

xxxv. Engine hours of operation while low/empty SCR reductant operator warning/inducement active,

xxxvi. Reductant quality sensor output,

xxxvii. NOx mass emission rate – engine out,

xxxviii. NOx mass emission rate – tailpipe,

xxxix. Commanded DEF dosing,

xl. DEF dosing mode (A, B, C, etc.),

xli. DEF dosing rate,

xlii. Target ammonia storage level on SCR,

xliii. Modeled actual ammonia storage level on SCR,

xliv. SCR intake temperature,

xlv. SCR outlet temperature,

xlvi. Stability of NOx sensor reading,

xlvii. EGR mass flow rate,

xlviii. Engine fuel rate,

xlix. Equipment fuel rate,

l. Hydrocarbon doser flow rate,

li. Charge air cooler outlet temperature,

lii. Crankcase pressure sensor output,

liii. Crankcase oil separator rotational speed,

liv. Fuel pressure from the high-pressure and low-pressure fuel system,

lv. Vehicle speed,

lvi. Engine percent load at current speed,

lvii. Ambient air temperature,

lviii. Barometric pressure,

lix. SCR outlet temperature,

lx. NOx adsorber regeneration status, and

lxi. NOx adsorber desulfurization status.

b. For engines that have inducement or engine derate strategies, all signals in 40 CFR section 1036.110(b)(9), as it existed on October 25, 2024, and incorporated by reference herein, for which the associated components must satisfy the diagnostic requirements in sections (f)(1) or (f)(2).

3. Any physical inputs and outputs used by OR OBD system diagnostics which are not listed above.

4. Any physical inputs and outputs used by AECDs which are not listed above.

5. Any physical inputs and outputs used by off-road real emissions assessment logging (OR-REAL) calculations under section (e)(2)(D)1. which are not listed above.

6. Any physical inputs and outputs used by inducements which are not listed above.

7. Any physical inputs and outputs used by the engine cooling system which are not listed above.

8. Any physical inputs and outputs used by the lubrication system which are not listed above.

(D) *Tracking Data*.

1. *Off-Road Real Emissions Assessment Logging (OR-REAL) Data*. For engines equipped with an SCR system or a tailpipe NOx sensor, the OR OBD system shall comply with the OR-REAL tracking requirements described below:

a. The manufacturer shall implement software algorithms to track and report in a standardized format the following parameters in the units specified in the parentheses:

i. NOx mass – engine out (grams (g)),

ii. NOx mass – tailpipe (g),

iii. Engine output energy (kilowatt-hours (kWh)),

iv. Engine run time (hours), and

v. Equipment fuel consumption (liters).

b. The OR OBD system shall store the parameters in section (e)(2)(D)1.a. into the four data arrays described below. The OR OBD system shall update the data in each array every second using signals that are sampled at a frequency of at least 1 Hertz.

i. Active 50 Hour Array.

I. When the NOx sensors used to determine the NOx mass parameters listed in section (e)(2)(D)1.a. are all reporting valid NOx concentration data, the OR OBD system shall store data for all parameters in section (e)(2)(D)1.a. into the Active 50 Hour Array.

II. When the total engine run time value that is stored in Bin 1 (defined in section (e)(2)(D)1.c.i. below) of the Active 50 Hour Array reaches 50 hours, the OR OBD system shall transfer all

stored data to the Stored 50 Hour Array described in section (e)(2)(D)1.b.ii. The OR OBD system shall reset all data in the Active 50 Hour Array to zero and begin incrementing anew.

ii. Stored 50 Hour Array.

I. The Stored 50 Hour Array is a static repository for data stored by the Active 50 Hour Array. The OR OBD system shall overwrite the stored 50 Hour Array data with the data stored in the Active 50 Hour Array only when the total engine run time stored in Bin 1 (defined in section (e)(2)(D)1.c.i. below) of the Active 50 Hour Array reaches 50 hours.

iii. Lifetime Array.

I. When the NOx sensors used to determine the NOx mass parameters listed in section (e)(2)(D)1.a. are all reporting valid NOx concentration data, the OR OBD system shall store data for all parameters in section (e)(2)(D)1.a. into the Lifetime Array.

II. The Lifetime Array shall maintain a running total of parameter data for the actual life of the engine.

iv. Lifetime Engine Activity Array.

I. The OR OBD system shall store the parameters in section (e)(2)(D)1.a.iii. through v. into the Lifetime Engine Activity Array whenever the engine is running regardless of NOx sensor status.

II. The Lifetime Engine Activity Array shall maintain a running total of parameter data for the actual life of the engine.

c. The OR OBD system shall store each parameter in each array in section (e)(2)(D)1.b. into a series of bins that are defined as indicated below. Table 2 indicates the bins that are assigned to each array and to each parameter. References to “rated power” mean the engine’s rated net brake power.

i. “Bin 1” shall store the total value of the parameter in a given array. The values in Bins 2 through 13 shall sum to equal the value in Bin 1.

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

I. “Bin 2” is for SCR outlet temperatures less than or equal to 200 degrees Celsius;

II. “Bin 3” is for SCR outlet temperatures greater than 200 degrees Celsius and less than or equal to 250 degrees Celsius;

III. “Bin 4” is for SCR outlet temperatures greater than 250 degrees Celsius and less than or equal to 400 degrees Celsius;

IV. “Bin 5” is for SCR outlet temperatures greater than 400 degrees Celsius.

iii. 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 6” is for SCR outlet temperatures less than or equal to 200 degrees Celsius;

II. “Bin 7” is for SCR outlet temperatures greater than 200 degrees Celsius and less than or equal to 250 degrees Celsius;

III. “Bin 8” is for SCR outlet temperatures greater than 250 degrees Celsius and less than or equal to 400 degrees Celsius;

IV. “Bin 9” is for SCR outlet temperatures greater than 400 degrees Celsius.

iv. Bins that store data when the engine power output is greater than 50 percent of rated power:

I. “Bin 10” is for SCR outlet temperatures less than or equal to 200 degrees Celsius;

II. “Bin 11” is for SCR outlet temperatures greater than 200 degrees Celsius and less than or equal to 250 degrees Celsius;

III. “Bin 12” is for SCR outlet temperatures greater than 250 degrees Celsius and less than or equal to 400 degrees Celsius;

IV. “Bin 13” is for SCR outlet temperatures greater than 400 degrees Celsius.

v. “Bin 14” shall store data only when a regeneration event is being commanded. Storage of data into Bins 1 through 13 shall occur independently of data storage into Bin 14, and shall not be interrupted or otherwise affected by activity related to Bin 14.

vi. “Bin 15” shall store the total value of the parameter in a given array only when the Stage 2 pause conditions of section (e)(2)(D)1.g.i. are met. The OR OBD system shall not store data into Bin 15 under any conditions for Stage 1 engines.

vii. “Bin A” and “Bin B” shall store data according to the requirements of section (e)(2)(D)1.d., below.

Table 2. OR-REAL Bin Assignments.

Parameter	Active 50-Hour Array (Bins)	Stored 50-Hour Array (Bins)	Lifetime Array (Bins)	Lifetime Engine Activity Array (Bins)
NOx mass – engine out (g)	1-15	1-15	1-15	None
NOx mass – tailpipe (g)	1-15, A, and B	1-15, A, and B	1-15, A, and B	None
Engine output energy (kWh)	1-15 and B	1-15 and B	1-15 and B	1-15
Engine run time (hours)	1-15, A, and B	1-15, A, and B	1-15, A, and B	1-15
Total fuel consumption (liters)	1-15, A, and B	1-15, A, and B	1-15, A, and B	1-15

d. The 2-bin moving average window (2B-MAW) bins described below shall store data comprised of overlapping 300-second windows of engine operation. Storage of data shall begin after engine start when 300 seconds of engine operation have elapsed for which no exclusions apply (see section (e)(2)(D)1.d.vi.). Each second thereafter, the OR OBD system shall save the last 300 seconds of exclusion-free data into the appropriate bin. The OR OBD system shall discard any partial window of valid data (i.e., a window that contains less than 300 seconds of valid data) at the end of the operating cycle.

i. “Bin A” shall store data when the normalized CO_2 emission mass over the window is 8 percent or less as determined according to section (e)(2)(D)1.d.iii.

ii. "Bin B" shall store data when the normalized CO_2 emission mass over the window is greater than 8 percent as determined according to section (e)(2)(D)1.d.iii.

iii. Determination of normalized CO_2 emission mass. The OR OBD system shall estimate the normalized CO_2 emission mass over a window using the method described below:

I. $Normalized\ CO_2\ emission\ mass = \frac{Window\ CO_2\ mass}{e_{CO2} \times P_{max} \times t_{window}}$, where:

II. "Window CO_2 mass" is the total mass of CO_2 in grams emitted by the engine over the 300-second window. The OR OBD system shall estimate the CO_2 emission mass over each second of the 300-second window according to section (e)(2)(D)1.d.iv.

III. "e_{CO2}" is the CO_2 emission rate in g/kW-hr from the certification test data of the emission-data engine over the NRTC duty cycle, as determined in accordance with 40 CFR section 1039.235, except for constant speed engines. For constant speed engines, e_{CO2} is the CO_2 emission rate from the certification test data of the emission-data engine over the applicable steady-state duty cycle, as determined in accordance with 40 CFR section 1039.235.

IV. "P_{max}" is the highest value of rated power in units of kilowatts for all the configurations included in the engine family.

V. "t_{window}" is the duration of the window, i.e., 0.083 hours (300 seconds).

iv. Determination of CO_2 emission mass. The OR OBD system shall estimate the mass of CO_2 emitted by the engine over each second in a window using the oxygen (O_2) signal in percent from a NOx sensor according to the method described below:

I. $CO_2\ mass = \frac{CO_2\ percent}{100} \times \frac{CO_2\ molar\ mass}{Air\ molar\ mass} \times Exhaust\ mass$, where

II. "CO_2 percent" = (20.95 – O_2 signal) / (1 + 1.8 / 4), where the value 1.8 is the representative ratio of hydrogen to carbon atoms for diesel fuel,

III. "CO_2 molar mass" = 44.01 g/mol,

IV. “Air molar mass” = 28.97 g/mol,

V. “Exhaust mass” is the modeled exhaust flow rate determined by the OR OBD system in grams per second multiplied by a time of one second.

v. Alternative method for determining CO_2 mass. The manufacturer may request Executive Officer approval to determine CO_2 mass using an alternative method to the method required in section (e)(2)(D)1.d.iv. The Executive Officer shall approve the request upon determining, based on complete and accurate manufacturer-submitted emissions data over the NRTC test cycle (or steady-state test cycle for constant speed engines), that the total CO_2 mass over the test cycle determined using the alternative method is either:

I. At least as accurate as the required method relative to the test facility result, or

II. Within +/- 15 percent of the test facility result.

vi. For fuels that do not contain carbon, the OR OBD system shall determine the normalized CO_2 emission mass as described below:

I. $Normalized\ CO_2\ emission\ mass = \frac{EOE_{window}}{P_{max} \times t_{window}}$, where:

II. “EOE_{window}” is the total engine output energy over the window in units of kW-hr. The OR OBD system shall calculate the total EOE over each second of the 300-second window as defined in section (c).

III. “P_{max}“ and “t_{window}” are the same as described in section (e)(2)(D)d.iii.

vii. Excluded Data. The OR OBD system shall exclude data from a window for any period meeting one or more of the following conditions:

I. The engine is off.

II. OR-REAL tracking is paused.

III. For engines required to meet Stage 2 requirements, the MIL is commanded on, or a pending fault code is stored. The OBD system shall furthermore reset or clear the memory that stores the

last 300 seconds of valid data upon illumination of the MIL or storage of a pending fault code.

IV. One of the NOx sensors used to determine the NOx mass parameters listed in section (e)(2)(D)1.a. is not reporting valid NOx concentration data.

V. The engine is commanding an infrequent regeneration event (e.g., an active PM filter regeneration, catalyst desulfurization, de-crystallization event).

VI. The barometric pressure is less than 82.5 kilopascals (kPa).

VII. The ambient air temperature is less than 0 degrees Celsius.

VIII. The ambient air temperature is greater than -0.0014 x h + 37.78 degrees Celsius, where the height “h” shall be approximated by (101.3 – barometric pressure) kPa x 328 feet / 1.2 kPa.

viii. The OR OBD system shall handle time intervals which include alternating periods of both valid data that are less than 300 seconds and periods of excluded data according to the following requirements:

I. The OR OBD system shall combine non-continuous periods of valid data into a 300-second window and store them in the appropriate bin provided that no period of excluded data exceeds 599 seconds.

II. The OR OBD system shall discard a partial window of valid data (i.e., a window that contains less than 300 seconds of valid data) if it includes a period of excluded data that is 600 or more seconds long. If data are discarded, a new window shall begin with the first two consecutive seconds for which none of the conditions for excluded data are satisfied.

e. Numerical Value Specifications. For each parameter specified in section (e)(2)(D)1.a.:

i. For parameters in arrays described in sections (e)(2)(D)1.b., the OR OBD system shall reset each number to zero only when an NVRAM reset occurs (e.g., reprogramming event). The OR OBD system shall not reset the numbers to zero under any other

circumstances including when a scan tool (generic or enhanced) command to clear fault codes is received.

ii. The OR OBD system shall store each number within 120 seconds after the end of an operating cycle.

f. Pause Conditions for Engines Required to Meet Stage 1 Requirements.

i. Except for the conditions described in section (e)(2)(D)1.f.ii. below, the OR OBD system shall continue tracking all parameters listed in section (e)(2)(D)1.a. in Bins 1-14 and Bins A-C according to Table 2.

ii. The OR OBD system shall pause tracking of all parameters listed in section (e)(2)(D)1.a. within 10 seconds if any of the conditions in sections (e)(2)(D)1.f.ii.I. through IV. below occur. When the condition no longer occurs (e.g., the engine stop lamp is not commanded on), tracking of all parameters in section (e)(2)(D)1.a. shall resume within 10 seconds:

I. The engine has a diagnostic system (not required by this regulation) which detects a malfunction of any component used to determine SCR outlet temperature and the manufacturer's designated warning or notification lamp is commanded on for that malfunction;

II. The engine has a diagnostic system (not required by this regulation) which detects a malfunction of a NOx sensor that is used to calculate engine-out or tailpipe NOx mass and the manufacturer's designated warning or notification lamp is commanded on for that malfunction;

III. The SCR inducement system has activated a torque reduction or final inducement; or

IV. The engine stop lamp (if equipped) is commanded on.

iii. The manufacturer may request Executive Officer approval to pause tracking of all parameters listed in section (e)(2)(D)1.a. if a malfunction occurs that is not covered under sections (e)(2)(D)1.f.ii.I. through IV. above (e.g., a malfunction that results in a light being commanded on for equipment with no engine stop lamp such that the operator is likely to turn off the engine, a malfunction of any component used as a primary input to the exhaust gas flow model). The Executive Officer shall approve the request upon determining based on complete and

accurate manufacturer-submitted data or engineering evaluation that the malfunction will significantly affect the accuracy of the parameter values specified under section (e)(2)(D)1.a.

g. Pause Conditions for Engines Required to Meet Stage 2 Requirements.

i. Except for malfunctions described in section (e)(2)(D)1.g.ii. below, the OR OBD system shall continue tracking all parameters listed in section (e)(2)(D)1.a. if a malfunction has been detected and the MIL is commanded on. Within 10 seconds of the MIL being commanded on, the OR OBD system shall store tracked data only in Bin 15 as described in section (e)(2)(D)1.c.vi. and shall pause storage of data in all other bins (Bins 1-14 and Bins A and B). When the malfunction is no longer detected and the MIL is no longer commanded on, storage of all tracked parameters in section (e)(2)(D)1.a. shall resume in Bins 1-14 and Bins A and B and shall pause in Bin 15 within 10 seconds.

ii. The OR OBD system shall pause tracking of all parameters listed in section (e)(2)(D)1.a. within 10 seconds if any of the conditions in sections (e)(2)(D)1.g.ii.I. through IV. below occur. When the condition no longer occurs (e.g., the engine stop lamp is not commanded on), tracking of all parameters in section (e)(2)(D)1.a. shall resume within 10 seconds:

I. A malfunction of any component used to determine SCR outlet temperature has been detected and the MIL is commanded on for that malfunction;

II. A malfunction of a NOx sensor that is used to calculate engine-out or tailpipe NOx mass has been detected and the MIL is commanded on or a pending fault code is stored for that malfunction (the pause condition in section (e)(2)(D)1.f.ii.II. shall also apply for a Stage 2 engine if the engine has an engine-out NOx sensor diagnostic (not required by this regulation) for which the MIL is not commanded on when the diagnostic detects a malfunction);

III. The SCR inducement system has activated a torque reduction or final inducement; or

IV. The engine stop lamp (if equipped) is commanded on.

iii. The manufacturer may request Executive Officer approval to pause tracking of all parameters listed in section (e)(2)(D)1a. if a malfunction occurs that is not covered under sections (e)(2)(D)1.g.ii.I. through IV. above (e.g., a malfunction that results in a light being commanded on for equipment with no engine stop lamp such that the operator is likely to turn off the engine, a malfunction of any component used as a primary input to the exhaust gas flow model). The Executive Officer shall approve the request upon determining based on complete and accurate manufacturer-submitted data or engineering evaluation that the malfunction will significantly affect the accuracy of the parameter values specified under section (e)(2)(D)1.a.

h. NOx Mass Accuracy Requirements.

i. The engine-out and tailpipe NOx mass parameters that are calculated by the OR OBD system to fulfill the requirements in section (e)(2)(D)1. and data stream requirements in section (e)(2)(C)2.a. shall not have an error of more than +/- 15 percent, or alternatively at the manufacturer's discretion, +/- 0.08 g/kW-hr when divided by the net brake work of the engine. This requirement applies only to the NOx mass parameters in sections (e)(2)(D)1. and (e)(2)(C)2.a.

ii. The OR OBD system 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 be calculated using the most accurate NOx concentration and exhaust flow rate values that are calculated within the applicable electronic control unit.

iii. Any negative concentrations reported by a NOx sensor that are less (i.e., more negative) than – 5 ppm shall be set to – 5 ppm when used in a NOx mass calculation. If a NOx sensor reports negative concentrations of any magnitude for more than three consecutive seconds, negative concentrations reported after 3 seconds shall be set to zero when used in a NOx mass calculation.

iv. The manufacturer shall not include a humidity correction factor when calculating NOx mass.

v. The Executive Officer shall determine compliance with the accuracy requirement in section (e)(2)(D)1.h.i. by comparing

data from the OR OBD system and the test facility that are submitted by the manufacturer as described in section (h)(2)(C)4. The Executive Officer shall compare the total tailpipe NOx mass calculated by the OR OBD system over the appropriate test cycle (specified in section (g)(3)(C)2.) 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.

vi. Notwithstanding the compliance determination based on the data submitted as described in section (h)(2)(C)4., manufacturers shall not include any calibration or software feature which adversely impacts the accuracy of the calculated NOx mass values relative to the accuracy demonstrated at the time of certification. This requirement applies under all conditions, in particular when the engine operates in conditions outside of the certification testing environment.

2. Total Engine Run Time.

a. Manufacturers shall implement software algorithms to track and report the total engine run time in the standardized format specified in SAE J1939 or SAE J1979-2 (whichever is applicable).

b. Numerical Value Specifications. The total engine run time value shall never be reset to zero under any circumstances, including when an NVRAM reset occurs (e.g., reprogramming event) or a scan tool (generic or enhanced) command to clear fault codes is received.

3. Ignition Cycle Counter.

a. Definition. The ignition cycle counter is defined as a counter that indicates the number of ignition cycles an engine has experienced as defined in section (e)(2)(D)3.b. The OR OBD system shall report the ignition cycle counter in accordance with the specifications in section (e)(2)(D)3.d.

b. Specifications for Incrementing.

i. When the OR OBD system increments the ignition cycle counter in accordance with section (e)(2)(D)3.b.ii. below, the OR OBD system shall increment the ignition cycle counter by an integer of one. The OR OBD system shall not increment the ignition cycle counter more than once per ignition cycle.

ii. The OR OBD system shall increment the ignition cycle counter within 10 seconds if and only if the engine exceeds an engine

speed of 150 rpm below the normal, warmed-up idle speed for at least two seconds plus or minus one second.

c. Specifications for Disabling Incrementation.

i. For an engine required to meet Stage 1 requirements, the OR OBD system shall disable further incrementing of the ignition cycle counter if (1) the engine has a diagnostic system (not required by this regulation) which detects a malfunction of any component used to determine if the criteria in section (e)(2)(D)3.b.ii. are satisfied (e.g., engine speed or time of operation) and (2) the manufacturer's designated warning or notification lamp is commanded on for that malfunction.

ii. For an engine required to meet Stage 2 requirements, the OR OBD system shall disable further incrementing of the ignition cycle counter if (1) a malfunction is detected for any component used to determine if the criteria in section (e)(2)(D)3.b.ii. are satisfied (e.g., engine speed or time of operation) and (2) the corresponding pending fault code or MIL-on/confirmed fault code is stored.

iii. The OR OBD system shall not disable incrementing of the ignition cycle counter for any condition other than those specified in sections (e)(2)(D)3.c.i. and ii. above. Incrementing of the ignition cycle counter shall resume within 10 seconds when the malfunction is no longer present (e.g., pending fault code erased through self-clearing or by a scan tool command).

d. Numerical Value Specifications.

i. The ignition cycle counter shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.

ii. The ignition cycle counter shall be reset to zero only when a NVRAM reset occurs (e.g., reprogramming event) and shall not be reset to zero under any other circumstances including when a scan tool command to clear fault codes is received.

iii. If the ignition cycle counter reaches the maximum value of 65,535, the ignition cycle counter shall reset to zero on the next ignition cycle to avoid overflow problems.

4. General Denominator.

a. Definition. The general denominator is defined as a measure of the number of times an engine has been operated as defined in section (e)(2)(D)4.b. The OR OBD system shall report the general denominator in accordance with the specifications in section (e)(2)(D)4.d.

b. Specifications for Incrementing.

i. When the OR OBD system increments the general denominator in accordance with section (e)(2)(D)4.b.ii. below, the OR OBD system shall increment the general denominator by an integer of one. The OR OBD system shall not increment the general denominator more than once per operating cycle.

ii. The OR OBD system shall increment the general denominator within 10 seconds if and only if the criteria identified below are satisfied on a single operating cycle:

I. Cumulative time since engine start of the operating cycle is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet (2,438 meters) above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (or -6.7 degrees Celsius); and

II. Cumulative engine operation at or above 8 percent of rated power occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet (2,438 meters) above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (or -6.7 degrees Celsius).

c. Specifications for Disabling Incrementation.

i. For an engine required to meet Stage 1 requirements, the OR OBD system shall disable further incrementing of the general denominator if (1) the engine has a diagnostic system (not required by this regulation) which detects a malfunction of any component used to determine if the criteria in section (e)(2)(D)4.b.ii. are satisfied (e.g., power output, ambient temperature, or time of operation) and (2) the manufacturer's designated warning lamp is commanded on for that malfunction.

ii. For an engine required to meet Stage 2 requirements, the OR OBD system shall disable further incrementing of the general denominator if (1) a malfunction has been detected for any component used to determine if the criteria in section

(e)(2)(D)4.b.ii. are satisfied (e.g., power output, ambient temperature, or time of operation) and (2) the corresponding pending or MIL-on/confirmed fault code is stored.

iii. The OR OBD system shall not disable incrementing of the general denominator for any condition other than those specified in section (e)(2)(D)4.c.i. and ii. above. Incrementing of the general denominator shall resume within 10 seconds when the malfunction is no longer present (e.g., pending fault code erased through self-clearing or by a scan tool command).

d. Numerical Value Specifications.

i. The general denominator shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.

ii. The general denominator shall be reset to zero only when a NVRAM reset occurs (e.g., reprogramming event) and shall not be reset to zero under any other circumstances including when a scan tool command to clear fault codes is received.

iii. If the general denominator reaches the maximum value of 65,535, the general denominator shall reset to zero on the next operating cycle that meets the general denominator definition to avoid overflow problems.

(E) *Software Calibration Identification Number*.

1. The OR OBD system shall report a single software calibration identification number (CAL ID) for each DEC ECU through the standardized diagnostic link connector in accordance with SAE J1939 or the SAE J1979-2 specifications (whichever is applicable).

2. The OR OBD system shall use a unique CAL ID for every emission-related calibration or software set having at least one bit of different data from any other emission-related calibration or software set.

a. Control units coded with multiple emission or diagnostic calibrations 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 equipment.

b. Control units that utilize a strategy that will result in MIL illumination if the incorrect variant is used are not required to use unique CAL IDs.

(F) *Software Calibration Verification Number*.

1. The OR OBD system shall report a single calibration verification number (CVN) for each CAL ID. The CVN shall be capable of being used to determine if the emission-related software or calibration data are valid and applicable for that application and CAL ID.

2. The OR OBD system shall make available the CVN through the standardized diagnostic link connector in accordance with the SAE J1939 or SAE J1979-2 specifications (whichever is applicable). The OR OBD system shall report each CVN to a generic scan tool in the same order as the CAL IDs are reported to the scan tool to allow the scan tool to match each CVN to the corresponding CAL ID.

3. The OR OBD system shall use the CRC-16 or CRC-32 algorithm to calculate a single CVN for each CAL ID.

4. The OR OBD system shall calculate the CVN at least once per ignition cycle and store the CVN value until the CVN is subsequently updated.

5. The OR OBD system shall not erase the stored CVN value under the following conditions:

a. For engines required to meet the Stage 2 requirements, when the emission-related diagnostic information described in section (e)(3)(G)1. is erased by a generic scan tool in accordance with SAE J1939 or SAE J1979-2 specifications (whichever is applicable), or

b. For all engines, during normal equipment shut down (i.e., key off and engine off).

6. When a CVN request message is received by the on-board computer, the OR OBD system shall make available the stored CVN value through the diagnostic link connector to a generic scan tool.

a. Except as provided for below in sections (e)(2)(F)6.b. through d., when a CVN request is received, the OR OBD system shall not use delayed timing in sending the CVN and shall not respond with a message indicating that the CVN value is not currently available (e.g., shall not respond with a negative response code, acknowledgement (00E80016) parameter group number: Control Byte = 3, or a negative acknowledgement), and shall not respond with a default value (i.e., a value or space holder that is not a valid CVN value).

b. If the CVN request message is received within the first 120 seconds of engine operation after a reprogramming event or an NVRAM reset or within

the first 120 seconds of engine operation after a volatile memory reset or battery disconnect, the on-board computer may respond with one or more messages directing the scan tool to wait or resend the request message after the delay (e.g., a negative response code, acknowledgement (00E80016) parameter group number: Control Byte = 3, or a negative acknowledgement). Such messages and delays shall conform to the specifications for transmitting CVN data contained in SAE J1939 or SAE J1979-2 (whichever is applicable).

c. When a CVN request is received, engines using the SAE J1939 protocol may respond with one or more messages directing the scan tool to wait or resend the request message after the delay (e.g., a negative response code, acknowledgement (00E80016) parameter group number: Control Byte = 3, or a negative acknowledgement) when the on-board computer is already sending a different multi-packet message using a transport protocol broadcast announce message (TP.BAM). Such messages shall conform to the specifications for transmitting CVN data contained in SAE J1939.

d. If a communication malfunction is preventing access to a CVN value for reporting in response to a scan tool request, the OR OBD system may report a default CVN value in lieu of a valid CVN value if:

i. For Stage 1 engines, the manufacturer-specific diagnostic system (not required by this regulation) detects the communication malfunction and the manufacturer's designated warning or notification lamp is commanded on for that malfunction,

ii. For Stage 2 engines, a MIL-on/confirmed fault code is stored with the MIL commanded on or a pending fault code is stored, with the fault code pinpointing the communication malfunction for the module that is unable to report a valid CVN.

iii. For Stage 1 engines and Stage 2 engines, the default CVN value used cannot be mistaken for a valid CVN (e.g., all zeros or all question marks for the default value cannot be mistaken for a valid CVN).

7. Manufacturers shall make the CVN and CAL ID combination information available for all engines in an electronic format that allows for off-board verification that the CVN is valid and appropriate for a specific engine and CAL ID.

a. Manufacturers shall submit the CVN and CAL ID information to the Executive Officer twice per year not more than 30 calendar days after June 30 and December 31.

b. Manufacturers shall submit information about all CVN and CAL ID combinations applicable for every engine, including CVN and CAL ID combinations from running changes and field fixes after the production period has ended.

c. The manufacturer shall submit the information through XXXX@arb.ca.gov.

(3) *Stage 2 Standardization Requirements*. The requirements of this section apply to engines required to meet the Stage 2 requirements in accordance with section (d). Engines required to meet the Stage 2 requirements shall meet both the Stage 1 standardization requirements in section (e)(2) and the Stage 2 standardization requirements in section (e)(3), in accordance with section (d)(2).

(A) Malfunction Indicator Light (MIL).

1. MIL Specification and Location for Equipment with an Instrument Panel.

a. The equipment shall be equipped with a MIL that, when illuminated, displays the ISO engine symbol (i.e., symbol number F.01 as described in ISO 2575, incorporated by reference (section (e)(1)).

b. The MIL shall be located on the instrument panel. For equipment that have more than one instrument panel, the MIL shall be located on the instrument panel in closest proximity to the operator while the operator is using the steering controls or other frequently used equipment controls.

2. MIL Specification and Location for Equipment Without an Instrument Panel.

a. The equipment shall be equipped with a MIL that consists of an amber light emitting diode (LED) light with a minimum diameter or width of 5 millimeters.

b. The MIL shall be permanently embedded or affixed to the equipment in the following location:

i. For equipment with one or more control panels, the MIL shall be located on the control panel in closest proximity to the operator and in plain, unobstructed view of the operator while the operator is using the steering controls or other frequently used equipment controls.

ii. For equipment with no control panel, the MIL shall be located in plain, unobstructed view of the operator while the operator is

using the steering controls or other frequently used equipment controls.

c. The word “OBD” shall be permanently engraved or printed immediately below the MIL in all capital letters using at least 14-point font size.

3. The MIL shall be of sufficient illumination to be readily visible under all lighting conditions and shall be amber in color when illuminated.

4. The MIL shall illuminate in the key on, engine off position before engine cranking to indicate that the MIL is functional.

a. The MIL shall continuously illuminate during this functional check for a minimum of 15 seconds.

b. During this functional check of the MIL, the data stream value for MIL status (see section (e)(3)(E)1.) shall indicate commanded off unless the MIL is commanded on for a detected malfunction.

c. This functional check of the MIL is not required during equipment operation in the key on, engine off position subsequent to the initial engine cranking of an ignition cycle.

5. There shall be only one MIL used to indicate all malfunctions detected by the OR OBD system on a single piece of equipment (i.e., the manufacturer shall not implement more than one MIL on a single piece of equipment that meets the MIL requirements of the regulation). The MIL shall not be used for any purpose other than specified in this regulation.

(B) Fault Codes.

1. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

a. For all monitors/diagnostics required in section (f), the OR OBD system shall make stored pending and MIL-on fault codes available through the diagnostic link connector in a standardized format in accordance with SAE J1939 specifications (i.e., Diagnostic Message (DM) 6 and DM12). For manufacturer-specific diagnostics that are designed to identify malfunctions in emissions-related components, the fault codes stored by the diagnostics shall be made available to a generic scan tool through the diagnostic link connector in accordance with SAE J1939 specifications.

b. The OR OBD system shall employ standardized fault codes conforming to SAE J1939.

c. Except as otherwise specified in section (f), the stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different.

d. Except as provided in section (e)(3)(B)1.d.ii. below, manufacturers shall use appropriate SAE-defined fault codes of SAE J1939.

i. This requirement applies both to monitors/diagnostics required in section (f) and manufacturer-specific diagnostics that are designed to identify malfunctions in emissions-related components.

ii. With Executive Officer approval, manufacturers may use a manufacturer-defined fault code in accordance with SAE J1939 specifications. The Executive Officer shall approve the use if there is no available SAE-defined fault code for the malfunction and if the additional diagnostic and repair information provided by the fault code is useful to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code shall not be used to represent two different failure modes) across a manufacturer's entire product line.

e. The OR OBD system shall store a pending or MIL-on fault code (as required in section (f)) and make the fault code available to an SAE J1939 scan tool within 10 seconds after a monitor or diagnostic has determined that a malfunction has occurred.

2. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

a. For all monitors/diagnostics required in section (f), the OR OBD system shall make stored pending and confirmed fault codes available through the diagnostic link connector in a standardized format in accordance with SAE J1979-2 specifications. For manufacturer-specific diagnostics that are designed to identify malfunctions in emissions-related components, the fault codes stored by the diagnostics shall be made available to a generic scan tool through the diagnostic link connector in accordance with SAE 1979-2 specifications.

b. The OR OBD system shall employ standardized 3-byte fault codes conforming to SAE J2012.

c. Except as otherwise specified in section (f), the stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction.

i. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different.

ii. For monitors/diagnostics required to support test results in accordance with section (e)(3)(D), except as provided below, a unique fault code shall be used for each monitor or diagnostic.

iii. A manufacturer may request Executive Officer approval to use a specific fault code for more than one diagnostic. The Executive Officer shall approve the request upon determining that there is no available unique SAE-defined fault code for each of the monitors/diagnostics or, based on manufacturer-submitted information, it is technically not feasible to support a unique fault code for each of the monitors/diagnostics (e.g., it is not technically feasible to split multiple test results from a single supported fault code into single test results for multiple supported fault codes).

d. Except as provided in section (e)(3)(B)2.d.ii. below, manufacturers shall use appropriate SAE-defined fault codes of SAE J2012 (e.g., P0xxx, P2xxx).

i. This requirement applies both to monitors/diagnostics required in section (f) and manufacturer-specific diagnostics that are designed to identify malfunctions in emissions-related components.

ii. With Executive Officer approval, manufacturers may use a manufacturer-defined fault code in accordance with SAE J2012 specifications (e.g., P1xxx). The Executive Officer shall approve the use if there is no available SAE-defined fault code for the malfunction and if the additional diagnostic and repair information provided by the fault code is useful to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code shall not be used to represent two different failure modes) across a manufacturer's entire product line.

e. The OR OBD system shall store a pending or confirmed fault code (as required in section (f)) and make the fault code available to an SAE

J1978-2 scan tool within 10 seconds after a monitor or diagnostic has determined that a malfunction has occurred.

(C) Freeze Frames.

1. For engines using the SAE J1939 protocol:

a. The OR OBD system shall make “freeze frame” information required to be stored pursuant to sections (f)(1)(A)4. and (f)(4) available on demand through the standardized diagnostic link connector in accordance with SAE J1939-73 specifications.

b. Freeze frame information shall include:

i. The fault code which caused the freeze frame data to be stored.

ii. All the signals required in sections (e)(2)(C)1.a.i. through xiv., (e)(2)(C)1.b., and (e)(2)(D)2. (total engine run time).

iii. All the signals required in sections (e)(2)(C)2. through 8. that are used for diagnostic or control purposes in the specific DEC ECU that stored the fault code.

c. The OR OBD system shall store freeze frame conditions on at least one data frame for at least one fault code.

2. For engines using the ISO 15765-4 protocol:

a. The OR OBD system shall make “freeze frame” information required to be stored pursuant to sections (f)(1)(A)4. and (f)(4) available on demand through the standardized diagnostic link connector in accordance with SAE J1979-2 specifications.

b. Freeze frame information shall include:

i. The fault code which caused the freeze frame data to be stored.

ii. All the signals required in sections (e)(2)(C)1.a.i. through xiv., (e)(2)(C)1.b., and (e)(2)(D)2. (total engine run time).

iii. All the signals required in sections (e)(2)(C)2. through 8. that are used for diagnostic or control purposes in the specific DEC ECU that stored the fault code.

c. Except as provided below in sections (e)(3)(C)2.c.i. and ii., the OR OBD system shall store freeze frame conditions for a minimum of five fault codes.

i. Each DEC ECU capable of storing and directly communicating five or more pending fault codes to a generic scan tool shall have the ability to store freeze frame conditions for a minimum of five fault codes from the population of fault codes that is communicated by that control unit to a generic scan tool.

ii. Each DEC ECU capable of storing and directly communicating one to four pending fault codes to a generic scan tool shall have the ability to store freeze frame conditions for all fault codes that are communicated by that control unit to a generic scan tool.

(D) Test Results.

1. Except as provided in section (e)(3)(D)7. below, for all monitors/diagnostics identified in sections (f)(1)(A) through (E), (f)(2)(A) through (E), and (f)(2)(H), the OR OBD system shall:

a. Store the test results of the most recent monitoring decisions of the respective monitor or diagnostic.

b. Store the test limits established for monitoring the respective monitor or diagnostic.

c. Make the test results and test limits available through the diagnostic link connector in accordance with the standardized format specified in SAE J1939-73 for the SAE J1939 protocol or in SAE J1979-2 for the ISO 15765-4 protocol.

2. The OR OBD system shall report test results such that properly functioning components and systems (i.e., “passing” systems) do not store test values outside of the established test limits. Test limits shall include both minimum and maximum acceptable values and shall be defined so that a test result equal to any of the test limit is a “passing” value, not a “failing” value.

3. The test results shall be standardized such that the name of the monitored component (e.g., aftertreatment diesel particulate filter system) can be identified by a generic scan tool and the test results and test limits can be scaled and reported with the appropriate engineering units by a generic scan tool.

4. The OR OBD system shall store a test result until the test result is updated by a more recent valid test result or the emission-related diagnostic information (as defined in section (e)(3)(G)1.) of the OR OBD system computer is cleared.

5. If the emission-related diagnostic information (as defined in section (e)(3)(G)1.) is cleared:

a. For engines using the SAE J1939 protocol, the OR OBD system shall report values corresponding to ‘test not complete’ for all test results in accordance with SAE J1939-73 specifications. The OR OBD system shall update the test results once the applicable monitor or diagnostic has run and has valid test results and test limits to report.

b. For engines using the ISO 15765-4 protocol, the OR OBD system shall report values of zero for all test results and test limits. The OR OBD system shall update the test results once the applicable monitor or diagnostic has run and has valid test results and test limits to report.

6. The OR OBD system shall always report all test results and test limits. The OR OBD system shall store and report unique test results for each separate monitor or diagnostic.

7. The requirements of section (e)(3)(D) do not apply to the following diagnostics:

a. PM sensor and heater circuit/out-of-range diagnostics specified under sections (f)(1)(C)2.a., (f)(1)(C)2.c.ii., (f)(2)(B)2.a., and (f)(2)(B)2.c.ii.,

b. Tailpipe NOx sensor and heater circuit/out-of-range diagnostics specified under sections (f)(1)(D)2.a. and (f)(1)(D)2.d.ii.,

c. Fuel system feedback control diagnostics specified under section (f)(2)(E)2.d., and

d. Other emission control component or system circuit/out-of-range diagnostics specified under sections (f)(2)(H)2.

(E) Additional Data Stream Signals. The OR OBD system shall make available the following signals on demand through the diagnostic link connector in accordance with SAE J1939 or SAE J1979-2 specifications (whichever is applicable). The signals shall be accessible to a scan tool designed to communicate with an SAE J1939 network or a scan tool meeting SAE J1978-2 specifications. The OR OBD system shall always use the actual signal value instead of a default or limp home value.

1. MIL status.

2. Engine run time since code clear.

3. Engine run time while MIL activated.

4. For engines required to meet OBMD requirements in accordance with section (d)(2)(A), the following signals which correspond to the operation of the OBM NOx emission threshold monitor in section (f)(1)(A):

a. OBM NOx monitor window count. The signal shall be the current number of 300-second windows that the OBM NOx emission threshold monitor has counted towards making the next monitoring decision. After the monitor has counted 2,400 windows and has made a monitoring decision, the associated window count signal shall be reset to zero.

b. OBM NOx monitor NOx mass. The signal shall be the current sum of the NOx mass in all of the 300-second windows that the OBM NOx emission threshold monitor has counted towards making the next monitoring decision. After the monitor has counted 2,400 windows and has made a monitoring decision, the associated NOx mass signal shall be reset to zero.

c. OBM NOx monitor engine output energy. The signal shall be the current sum of the engine output energy in all of the 300-second windows that the OBM NOx emission threshold monitor has counted towards making the next monitoring decision. After the monitor has counted 2,400 windows and has made a monitoring decision, the associated engine output energy signal shall be reset to zero.

(F) Additional Tracking Data. The manufacturer shall implement software algorithms to track and report in a standardized format the following parameters:

1. PM Filter Fault Code History. For all engines equipped with a PM filter, the OR OBD system shall track the following information each time the OR OBD system detects a PM filter filtering performance malfunction or a PM sensor malfunction:

a. Fault Codes. The OR OBD system shall track the 5 most recent pending and MIL-on/confirmed fault codes. If a pending fault code matures to a MIL-on/confirmed fault code (as described under section (f)(4)(A)4.a.ii.III.), the OR OBD system shall replace the pending fault code's information with the MIL-on/confirmed fault code's information.

b. Total Engine Run Time. For each of the tracked fault codes, the OR OBD system shall track the total engine run time at the time the fault code was stored.

c. Numerical Value Specifications. The OR OBD system shall not reset the PM filter fault code history data to zero under any circumstances including when an NVRAM reset occurs (e.g., reprogramming event) or a scan tool (generic or enhanced) command to clear fault codes is received.

2. Monitor Activity Data. The OR OBD system shall track and report the following data in accordance with SAE J1939 or SAE J1979-2 specifications (whichever is applicable).

a. Mini-Numerator

i. Definition. The mini-numerator is defined as a counter that indicates the number of operating cycles over which a monitor or diagnostic ran and completed since the last time the mini-denominator (defined below in section (e)(3)(F)2.b.) was reset to zero. The OR OBD system shall track and report a mini-numerator for each supported fault code that can illuminate the MIL.

ii. Specifications for Incrementing.

I. When the OR OBD system increments the mini-numerator, it shall be incremented by an integer of one. The mini-numerator shall not be incremented more than once per operating cycle.

II. The OR OBD system shall increment the mini-numerator at the end of an operating cycle if and only if the associated monitor or diagnostic ran and completed on the operating cycle.

III. If a malfunction has been detected which can illuminate the MIL as described in section (f)(4)(A) and a pending fault code or MIL-on/confirmed fault code is stored, the OR OBD system shall pause and resume incrementing of the mini-numerator on an operating cycle according to the following provisions: (1) All mini-numerators that are tracked on the DEC ECU that stored the pending fault code or MIL-on/confirmed fault code shall be paused; (2) If the malfunction disables incrementing of the general denominator in accordance with section (e)(2)(D)4.c., all mini-numerators on all DEC ECUs shall be paused; and (3) incrementing of all paused mini-numerators that are tracked on a DEC ECU shall resume for the next driving cycle in which no pending fault codes and MIL-on/confirmed fault codes are stored on the DEC ECU and no pending fault codes and MIL-on/confirmed fault codes that can disable incrementing of the general denominator are stored on any DEC ECU.

IV. The OR OBD system shall cease further incrementing of the mini-numerator if the mini-numerator has reached a value of 255.

iii. Specifications for Resetting. The OR OBD system shall reset the mini-numerator to zero at the same time the OR OBD system resets the mini-denominator to zero as described below in section (e)(3)(F)2.b.

b. Mini-Denominator

i. Definition. The mini-denominator is defined as a counter that indicates the number of general denominator incrementations that have accumulated since the last time the mini-denominator was reset to zero. The OR OBD system shall track and report a mini-denominator for each DEC ECU that is capable of storing a fault code and that tracks and reports mini-numerator data.

ii. Specifications for Incrementing.

I. When the OR OBD system increments the mini-denominator, it shall be incremented by an integer of one. The mini-denominator shall not be incremented more than once per operating cycle.

II. The OR OBD system shall increment the mini-denominator at the end of an operating cycle if and only if the general denominator increments during the operating cycle as described in section (e)(2)(D)4.

III. The OR OBD system shall pause further incrementing of the mini-denominator on an operating cycle if a malfunction has been detected which can illuminate the MIL as described in section (f) and the DEC ECU that tracks and reports the mini-denominator stores a pending fault code or MIL-on/confirmed fault code for the malfunction. The OR OBD system shall resume incrementing the mini-denominator on the next operating cycle in which no such fault code is present.

IV. The OR OBD system shall cease further incrementing of the mini-denominator if the mini-denominator has reached a value of 255.

iii. Specifications for Resetting. The OR OBD system shall reset the mini-denominator to zero after the mini-denominator has reached a value of 255 and the OR OBD system has updated the monitor activity ratio described below in section (e)(3)(F)2.c. The reset shall occur before the beginning of the next operating cycle.

c. Monitor Activity Ratio

i. Definition. The monitor activity ratio, or MAR, is defined as the ratio of the mini-numerator to the mini-denominator when the mini-denominator reaches its maximum value of 255. The MAR shall have a minimum value of zero and a maximum value of

one. The OR OBD system shall track and report a MAR for each supported fault code that can illuminate the MIL.

ii. Specifications for Updating. The MAR shall be updated only at the end of the same operating cycle in which the mini-denominator reaches a value of 255. The current value for the MAR shall be replaced with the new value.

iii. Specifications for Resetting. The OR OBD system shall not reset the MAR to zero except under the conditions described below in section (e)(3)(F)2.d.

d. In addition to the specifications for resetting described above in sections (e)(3)(F)2.a.iii., (e)(3)(F)2.b.iii., and (e)(3)(F)2.c.iii., the mini-numerator, mini-denominator, and MAR may be reset to zero when a NVRAM reset occurs (e.g., reprogramming event). The numbers shall not be reset to zero under any other circumstances including when a scan tool command to clear fault codes is received.

(G) Erasure of Emission-Related Diagnostic Information.

1. For purposes of section (e)(3)(G), “emission-related diagnostic information” includes the following:

a. Fault codes (i.e., pending, confirmed, and MIL-on fault codes) (section (e)(3)(B))

b. Freeze frames (section (e)(3)(C))

c. Test results (section (e)(3)(D))

d. The following data stream signals: engine run time while MIL activated, engine run time since code clear, and MIL status (section (e)(3)(E))

2. The OR OBD system shall erase the emission-related diagnostic information if any of the following occurs:

a. The OR OBD system receives a command from a scan tool (generic or enhanced) to erase the information,

b. An on-board computer reprogramming event, or

c. Power to the on-board computer is disconnected and the OR OBD system does not store the emission-related diagnostic information in NVRAM.

3. For engines using the SAE J1939 protocol, if any of the emission-related diagnostic information is erased as a result of a command by a scan tool or during an on-board reprogramming event:

a. The OR OBD system shall erase all the emission-related diagnostic information from all control units, and

b. The OR OBD system shall not erase a subset of the emission-related diagnostic information (e.g., the OR OBD system shall not erase only one of three stored fault codes or only information from one control unit without erasing information from the other control unit(s)).

4. For engines using the ISO 15765-4 protocol:

a. If any of the emission-related diagnostic information is erased as a result of a functional Service $14 request by a scan tool, the OR OBD system shall erase all emission-related diagnostic information from all control units. The OR OBD system shall not erase a subset of the emission-related diagnostic information in response to a scan tool command (e.g., the OR OBD system shall not erase only one of three stored fault codes or only information from one control unit without erasing information from the other control unit(s)).

b. If any of the emission-related diagnostic information is erased as a result of a physical Service $14 request by a scan tool, the OR OBD system shall erase all emission-related diagnostic information in only that control unit that received the physical Service $14 request (i.e., no other control unit is required to erase emission-related diagnostic information if it did not receive a physical Service $14 request). For the control units that received the physical Service $14 request, the OR OBD system shall not erase a subset of the emission-related diagnostic information in response to a scan tool command (e.g., the OR OBD system shall not erase only one of three stored fault codes).

c. If any of the emission-related diagnostic information is erased during an on-board reprogramming event, the OR OBD system shall erase all the emission-related diagnostic information in the control unit that is being reprogrammed (i.e., control units that are not being reprogrammed are not required to erase emission-related diagnostic information). For the control units that are being reprogrammed, the OR OBD system shall not erase a subset of the emission-related diagnostic information during this reprogramming event (e.g., the OR OBD system shall not erase only one of three stored fault codes).

(f) *Diagnostic Requirements*.

Section (f) applies to engines required to meet the Stage 2 requirements in accordance with section (d)(2). Sections (f)(1) and (f)(2) set forth the monitoring and diagnostic requirements. Section (f)(3) sets forth the monitoring conditions

requirements for the applicable diagnostics described in sections (f)(1) and (f)(2). Section (f)(4) sets forth the MIL, fault code, and freeze frame requirements for the applicable diagnostics described in sections (f)(1) and (f)(2). Section (f)(5) sets forth the malfunction criteria determination requirements. Section (f)(6) sets forth the exceptions to the diagnostic requirements.

(1) *OBMD Diagnostic Requirements*. The monitor or diagnostic requirements of this section apply to engines that are required to meet the OBMD requirements in accordance with section (d)(2)(A).

(A) OBM NOx Emission Threshold Monitor.

1. Requirement. The OR OBD system shall monitor the engine for proper control of tailpipe NOx emissions.

2. Malfunction Criteria.

a. The OR OBD system shall detect a malfunction when the engine's NOx control capability decreases to the point that the engine's tailpipe NOx emissions (as measured by the tailpipe NOx sensor) exceed:

i. For engines in power categories less than 56 kW or greater than 560 kW: 1.2 g/kW-hr or 1.5 times the applicable standard, whichever is higher, as calculated from 2,400 windows of data in Bin B in accordance with section (f)(1)(A)2.b. below. If the applicable standard is an NMHC+NOx standard, for the purposes of this section, the applicable standard shall be considered a NOx standard (e.g., a 4.0 g/kW-hr NMHC+NOx standard will be considered a 4.0 g/kW-hr NOx standard).

ii. For engines in power categories greater than or equal to 56 kW and less than or equal to 560 kW: 0.60 g/kW-hr as calculated from 2,400 windows of data that satisfy Bin Bcriteria in accordance with sections (f)(1)(A)2.b. below.

b. The OR OBD system shall make a monitoring decision each time 2,400 windows have accumulated that meet the criteria for Bin B according to section (e)(2)(D)1.d.

i. The formation of the windows shall be in accordance with section (e)(2)(D)1.d. except:

I. The excluded data requirements in section (e)(2)(D)1.d.vi. do not apply.

II. The manufacturer may alternatively construct each 300-second window of data using 30 intervals, 10 seconds each, instead of 300 intervals, 1 second each.

ii. The monitoring decision shall be made by dividing the sum of the tailpipe NOx mass over the 2,400 windows by the sum of the engine output energy over the 2,400 windows and comparing the result with the appropriate threshold in section (f)(1)(A)2.a.

iii. The monitoring decision shall be based on 2,400 windows that are not included in any other monitoring decision (i.e., none of the 2,400 windows used in a monitoring decision shall be used in any other monitoring decision, but data from portions of a window included in one monitoring decision may be included in a window in another monitoring decision).

iv. The OR OBD system shall make a monitoring decision from a 2,400-window block of data that is comprised of windows from one operating cycle or more than one operating cycle.

I. The OR OBD system shall not discard partial blocks of data (i.e., blocks that contain less than 2,400 windows of data) at the end of an operating cycle.

II. The OR OBD system shall discard partial windows of data (i.e., windows that contain less than 300 seconds of data) at the end of an operating cycle.

v. If more than one 2,400-window block of data occurs in the operating cycle, the OR OBD system shall make a monitoring decision for each 2,400-window block of data in the operating cycle.

3. Monitoring Conditions.

a. Except as provided for in section (f)(1)(A)3.b. below, the OR OBD system shall monitor for malfunctions identified in section (f)(1)(A)2. under all operating conditions.

b. The OR OBD system shall pause monitoring (i.e., shall pause forming 300-second windows) under any of the following conditions:

i. A malfunction of the tailpipe NOx sensor has been detected and the MIL is commanded on or a pending fault code is stored for that malfunction;

ii. The SCR inducement system has activated a torque reduction or final inducement;

iii. The engine stop lamp (if equipped) is commanded on;

iv. The tailpipe NOx sensor is not reporting valid NOx concentration data;

v. The engine is commanding an infrequent regeneration event (e.g., an active PM filter regeneration, catalyst desulfurization, de-crystallization event);

vi. The barometric pressure is less than 82.5 kPa;

vii. The ambient air temperature is less than 0 degrees Celsius;

viii. The ambient air temperature is greater than -0.0014 x h + 37.78 degrees Celsius, where the height "h" shall be approximated by (101.3 – barometric pressure) kPa x 328 feet / 1.2 kPa;

ix. The DEF stored in the DEF tank is frozen.

c. The manufacturer may request Executive Officer approval to pause monitoring if a malfunction occurs that is not covered under section (f)(1)(A)3.b. above (e.g., a malfunction that results in a light being commanded on for equipment with no engine stop lamp such that the operator is likely to turn off the engine, a malfunction of any component used as a primary input to the exhaust gas flow model). The Executive Officer shall approve the request upon determining based on complete and accurate manufacturer-submitted data or engineering evaluations that the malfunction will significantly affect the accuracy of the tailpipe NOx mass or engine output energy calculations.

d. The OR OBD system shall reset all of the windows associated with the OBM NOx emission threshold monitor that have accumulated since the last monitoring decision if monitoring has paused due to either of the conditions described in sections (f)(1)(A)3.b.i. or iii.

4. MIL, Fault Code, and Freeze Frame Requirements.

a. MIL Illumination and Fault Code Storage Protocol.

i. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

I. Pending Fault Code Storage. Upon detection of a malfunction, the OR OBD system shall store a pending fault code within 10 seconds.

II. Pending Fault Code Erasure. After storage of a pending fault code under section (f)(1)(A)4.a.i.I., if the monitor runs and does not detect a malfunction in the next 2,400-window block of data , the corresponding pending fault code shall be erased.

III. MIL-on Fault Code Storage, Pending Fault Code Erasure, and MIL Illumination. After storage of a pending fault code under section (f)(1)(A)4.a.i.I., except as provided below in section (f)(1)(A)4.a.iv., if the identified malfunction is again detected in the next 2,400 window block of data, the OR OBD system shall illuminate the MIL continuously, erase the pending fault code, and store a MIL-on fault code within 10 seconds.

ii. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

I. Pending Fault Code Storage. Upon detection of a malfunction, the OR OBD system shall store a pending fault code within 10 seconds.

II. Pending Fault Code Erasure. After storage of a pending fault code under section (f)(1)(A)4.a.ii.I., if the monitor runs and does not detect a malfunction in the next 2,400-window block of data, the corresponding pending fault code shall be erased.

III. Confirmed Fault Code Storage and MIL Illumination. After storage of a pending fault code under section (f)(1)(A)4.a.ii.I., except as provided below in section (f)(1)(A)4.a.iv., if the identified malfunction is again detected in the next 2,400-window block of data, the OR OBD system shall illuminate the MIL continuously, keep the pending fault code stored, and store a confirmed fault code within 10 seconds.

iii. The OR OBD system shall not illuminate the MIL if the OR OBD system detects a malfunction when the engine has exceeded its emission warranty period specified in title 13, CCR section 2425. The fault code and freeze frame requirements set forth in section (f)(1)(A)4. still apply.

b. MIL Extinguishing and Fault Code Erasure Protocol.

i. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

I. MIL Extinguishing. Once the MIL has been illuminated in accordance with section (f)(1)(A)4.a.i.III., the OR OBD system shall extinguish the MIL after three subsequent sequential 2,400-window blocks of data during which the OBM NOx emission threshold monitor executes and the previously detected malfunction is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

II. MIL-on Fault Code Erasure. The OR OBD system shall erase the corresponding MIL-on fault code in conjunction with extinguishing the MIL as described under section (f)(1)(A)4.b.i.I. above.

ii. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

I. MIL Extinguishing. Once the MIL has been illuminated in accordance with section (f)(1)(A)4.a.ii.III., the OR OBD system shall extinguish the MIL after three subsequent sequential 2,400-window blocks of data in the same 3B-MAW bin during which the diagnostic responsible for illuminating the MIL executes and the previously detected malfunction is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

II. Confirmed Fault Code and Pending Fault Code Erasure. The OR OBD system shall erase the corresponding confirmed fault code and pending fault code in conjunction with extinguishing the MIL as described under section (f)(1)(A)4.b.ii.I. above.

c. Freeze Frame Conditions Storage and Erasure Protocol. The OR OBD system shall store and erase “freeze frame” conditions (as described in section (e)(3)(C)) present at the time a malfunction is detected as follows:

i. For engines using the SAE J1939 protocol for the standardized functions required in section (e), the OR OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

I. If the pending fault code is erased in the next 2,400-window block of data during which a malfunction is not detected (as described in section (f)(1)(A)4.a.i.II.), the OR OBD system shall erase the corresponding freeze frame conditions.

II. If the pending fault code matures to a MIL-on fault code (as described under section (f)(1)(A)4.a.i.III.), the OR OBD system shall

replace the stored freeze frame conditions with freeze frame conditions associated with the MIL-on fault code.

III. The OR OBD system shall erase the freeze frame information in conjunction with the erasure of the MIL-on fault code as described in section (f)(1)(A)4.b.i.II.

IV. If a fault code is stored when the maximum number of frames of freeze frame conditions is already stored, the OR OBD system shall not replace any currently stored freeze frame conditions with freeze frame conditions for the newly stored fault code except as allowed for MIL-on fault codes in section (f)(1)(A)4.c.i.II.

ii. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e), the OR OBD system shall store freeze frame conditions on two frames of data (referred to as the "first frame" and "second frame") for a given fault code in conjunction with the storage of a pending fault code.

I. If the pending fault code is erased in the next 2,400-window blocks of data during which a malfunction is not detected (as described in section (f)(1)(A)4.a.ii.II.), the OR OBD system shall erase the corresponding freeze frame conditions on the first and second frames for the fault code.

II. If the pending fault code matures to a confirmed fault code (as described in section (f)(4)(A)4.a.ii.III.), the OR OBD system shall retain the freeze frame conditions stored with the pending fault code on the first frame and replace the stored freeze frame conditions on the second frame with freeze frame conditions for the confirmed fault code.

III. After storage of the confirmed fault code (as described in section (f)(4)(A)4.a.ii.III), if the malfunction is detected during a 2,400-window block of data after the 2,400-window block of data in which the confirmed fault code was first stored, the OR OBD system shall replace the stored freeze frame conditions on the second frame with freeze frame conditions of the redetected malfunction.

IV. The OR OBD system shall erase the freeze frame conditions on the first and second frames in conjunction with the erasure of the confirmed fault code and pending fault code as described under section (f)(4)(A)4.b.ii.II.

V. If a fault code is stored when the maximum number of frames of freeze frame conditions is already stored in the DEC ECU, the OR OBD system shall not replace any currently stored freeze frame conditions in the DEC ECU with freeze frame conditions for the newly stored fault code except as allowed in section (f)(1)(A)4.c.ii.II.

(B) Particulate Matter (PM) Filter Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the PM filter on engines so equipped for filtering performance and regeneration malfunctions.

b. For engines equipped with active regeneration systems that utilize an active/intrusive injection (e.g., in-exhaust fuel injection, in-exhaust fuel/air burner):

i. The OR OBD system shall monitor the active/intrusive injection system for performance malfunctions.

ii. The OR OBD system shall monitor the individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system in accordance with the comprehensive component diagnostic requirements in section (f)(1)(G).

2. Malfunction Criteria.

a. Filtering Performance.

i. The OR OBD system shall detect a malfunction if a decrease in the filtering capability of the PM filter causes an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.040 g/kW-hr as measured from the applicable emission test cycle (i.e., NRTC or steady state cycle), or the applicable standard plus 0.020 g/kW-hr (e.g., 0.060 g/kW-hr if the exhaust emission standard is 0.040 g/kW-hr).

ii. If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding the malfunction criteria specified in section (f)(1)(B)2.a.i. above, the OR OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

b. Frequent Regeneration. The OR OBD system shall detect a malfunction when the PM filter regeneration frequency exceeds the manufacturer's specified design limits for allowable regeneration frequency.

c. Active/Intrusive Injection. For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve regeneration of the PM filter, the OR OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve regeneration of the PM filter.

3. Monitoring Conditions.

a. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(1)(B)2.a. and b. (i.e., PM filter filtering performance and frequent regeneration malfunctions) in accordance with section (f)(3).

b. The OR OBD system shall monitor for malfunctions identified in section (f)(1)(B)2.c. (i.e., PM filter active/intrusive injection malfunctions) whenever an ECU commands a PM filter regeneration event to occur. The manufacturer may disable monitoring during conditions when the OR OBD system cannot robustly distinguish between a malfunctioning injection system and a properly operating injection system. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(C) PM Sensor and Heater Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the PM sensor on engines so equipped for circuit and performance malfunctions.

b. For engines equipped with heated PM sensors, the OR OBD system shall monitor the PM sensor heater for circuit and performance malfunctions.

2. Malfunction Criteria.

a. Circuit. The OR OBD system shall detect circuit malfunctions (e.g., open circuit, short to ground, high voltage) and malfunctions of the PM sensor caused by out-of-range values.

b. Monitoring Capability. To the extent feasible, the OR OBD system shall detect a malfunction of the PM sensor when the PM sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics is no longer sufficient for use as an OR OBD system

monitoring device (i.e., for use by other diagnostics to detect malfunctions). For this requirement, “sufficient” is defined as the capability of the worst performing acceptable PM sensor to detect the best performing unacceptable other monitored system or component (e.g., PM filter).

c. PM Sensor Heater.

i. Heater Performance. The OR OBD system shall detect a malfunction of the PM sensor 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).

ii. Circuit. The OR OBD system shall detect malfunctions of the PM sensor heater circuit (e.g., open circuit, short circuits) that conflict with the commanded state of the PM sensor heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

3. Monitoring Conditions.

a. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(1)(C)2.b. and (f)(1)(C)2.c.i. (PM sensor monitoring capability and heater performance malfunctions) in accordance with section (f)(3).

b. Except as provided in section (f)(1)(C)3.c. below, the OR OBD system shall monitor continuously for malfunctions identified in sections (f)(1)(C)2.a. and (f)(1)(C)2.c.ii. (i.e., PM sensor circuit malfunctions and PM sensor heater circuit malfunctions). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

c. For malfunctions identified in sections (f)(1)(C)2.a. and (f)(1)(C)2.c.ii. (i.e., PM sensor circuit malfunctions and PM sensor heater circuit malfunctions), the manufacturer may temporarily disable continuous monitoring during conditions where a properly functioning PM sensor or PM sensor heater cannot be distinguished from a malfunctioning PM sensor or PM sensor heater. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(D) Tailpipe NOx Sensor and Heater Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the tailpipe NOx sensor used by the OBM NOx emission threshold monitor (described in section (f)(1)(C)) or data stream signals or tracking data required in section (e) for circuit, performance, and activity malfunctions.

b. For engines equipped with heated tailpipe NOx sensors, the OR OBD system shall monitor the heater for circuit and performance malfunctions.

2. Malfunction Criteria.

a. Circuit. The OR OBD system shall detect circuit malfunctions (e.g., open circuit, short to ground, high voltage) and malfunctions of the tailpipe NOx sensor caused by out-of-range values.

b. Performance. The OR OBD system shall detect a malfunction if a failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) causes the error in the OR OBD system's NOx mass calculation to exceed +/- **TBD** g/kW-hr as measured from the applicable emission test cycle (i.e., NRTC or steady state cycle).

c. Activity. The OR OBD system shall detect a malfunction of the tailpipe NOx sensor (e.g., internal sensor temperature not properly achieved/maintained, stabilization criteria not properly achieved/maintained) when the tailpipe 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 tailpipe NOx sensor to be actively reporting NOx concentration data.

i. The malfunctions include malfunctions that delay the time it takes for the tailpipe NOx sensor to become active after start (e.g., time after start to satisfy tailpipe NOx sensor stabilization criteria takes longer than normal) and malfunctions that cause the tailpipe NOx sensor to not be active for longer periods of time than normal (e.g., ratio of sensor inactive time to active time is higher than normal).

ii. If the tailpipe NOx sensor activity malfunction is caused by a malfunction of a component other than the tailpipe NOx sensor (e.g., a component that is used as an input necessary to make the tailpipe NOx sensor become active), the OR OBD system

shall monitor the component and detect a malfunction that prevents the tailpipe NOx sensor from being active.

d. Tailpipe NOx Sensor Heater.

i. Heater Performance. The OR OBD system shall detect a malfunction of the tailpipe NOx sensor 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).

ii. Circuit. The OR OBD system shall detect malfunctions of the tailpipe NOx heater circuit (e.g., open circuit, short circuits) that conflict with the commanded state of the tailpipe NOx sensor heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

3. Monitoring Conditions.

a. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(1)(D)2.b., (f)(1)(D)2.c., and (f)(1)(D)2.d.i. (i.e., tailpipe NOx sensor performance, activity, and sensor heater performance malfunctions) in accordance with section (f)(3).

b. Except as provided in section (f)(1)(D)3.c. below, the OR OBD system shall monitor continuously for malfunctions identified in sections (f)(1)(D)2.a. and (f)(1)(D)2.d.ii. (i.e., tailpipe NOx sensor circuit malfunctions and sensor heater circuit malfunctions). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

c. For malfunctions identified in sections (f)(1)(D)2.a. and (f)(1)(D)2.d.ii. (i.e., tailpipe NOx sensor circuit malfunctions and sensor heater circuit malfunctions), the manufacturer may temporarily disable continuous monitoring during conditions where a properly functioning NOx sensor or NOx sensor heater cannot be distinguished from a malfunctioning NOx sensor or NOx sensor heater. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(E) Diesel Oxidation Catalyst (DOC) Diagnostic.

1. Requirement. For DOCs used to generate an exotherm to assist PM filter regeneration, the OR OBD system shall monitor the DOC on engines so equipped for insufficient exotherm malfunctions.

2. Malfunction Criteria. The OR OBD system shall detect a malfunction when the DOC is unable to generate a sufficient exotherm to achieve regeneration of the PM filter.

3. Monitoring Conditions. The OR OBD system shall monitor for malfunctions identified in section (f)(1)(E)2. (i.e., DOC exotherm malfunctions) whenever an ECU commands a PM filter regeneration event to occur. The manufacturer may disable monitoring during conditions when the OR OBD system cannot robustly distinguish between a malfunctioning DOC and a properly operating DOC. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(F) Closed Crankcase Ventilation (CV) System Diagnostic.

1. Requirement. The OR OBD system shall monitor the closed CV system on engines so equipped for system integrity malfunctions.

2. Malfunction Criteria.

a. For the purposes of section (f)(1)(F):

i. Any additional external CV system tubing or hoses that are used to equalize crankcase pressure or to provide a ventilation path between various areas of the engine (e.g., crankcase and valve cover) are considered part of the closed CV system.

ii. Any fittings that are used for connection (e.g., nipples or barbs that the hoses must be placed over for proper attachment) are considered part of the “hose, tube, line, or valve.”

b. The OR OBD system shall detect a malfunction of the closed CV system as follows:

i. Except as provided in section (f)(1)(F)2.b.iii. below, the OR OBD system shall detect a malfunction of the closed CV system when a disconnection of the system occurs between the crankcase

and the intake ducting, including the CV valve or any check valves if equipped.

ii. Except as provided in section (f)(1)(F)2.b.iii. below, for any hose, tube, line, or valve that transports crankcase vapors, the OBD system shall detect a closed CV system malfunction when the system contains a disconnection or break equal to or greater than the smallest internal cross-sectional area of that hose, tube, or line.

iii. Manufacturers are not required to detect disconnections or breaks of a closed CV system hose, tube, line, or valve if the disconnection or break:

I. Causes the engine to stall immediately during idle operation,

II. Is unlikely to occur due to a closed CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses),

III. Results in a rapid loss of oil or other overt indication of a closed CV system malfunction such that the equipment operator is certain to respond and have the equipment repaired, or

IV. Occurs downstream of where the crankcase vapors are delivered to the air intake system.

3. Monitoring Conditions. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(1)(F)2.b.i. and ii. in accordance with section (f)(3).

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(G) Comprehensive Component Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (f)(1)(A) through (F) above that provides input to (directly or indirectly) or receives commands from an on-board computer and meets any of the following:

i. Is used as part of the diagnostic strategy for a monitored system or component described in sections (f)(1)(A) through (F),

ii. Is an input to (directly or indirectly) or output from an AECD strategy, or

iii. Is used as an input for OR-REAL tracking described in section (e)(2)(D)1.

b. The OR OBD system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (f)(1)(A) through (F) and (f)(1)(G)1.a. that provides input to (directly or indirectly) or receives commands from an on-board computer, and is used as part of the diagnostic strategy for another monitored system or component described in section (f)(1)(G).

c. The OR OBD system shall monitor for malfunction the ability of an on-board computer to send and receive information to and from other on-board computers if it affects the performance of the OR OBD system.

d. The OR OBD system shall monitor for malfunction the individual electronic components described in section (f)(1)(B)1.b.ii. that are required to be monitored in accordance with the comprehensive component diagnostic requirements in section (f)(1)(G).

2. Malfunction Criteria.

a. Input Components.

i. For input components described in sections (f)(1)(G)1.a. and (f)(1)(G)1.d. above, the OR OBD system shall detect the following malfunctions:

I. Circuit malfunctions for non-digital inputs and lack of communication to the on-board computer for digital inputs;

II. Out-of-range values; and

III. For rationality fault diagnostics, malfunctions where the sensor output is inappropriately high and malfunctions where the sensor output is inappropriately low, to the extent feasible.

ii. For input components described in section (f)(1)(G)1.b., the OR OBD system shall detect the following malfunctions:

I. Circuit malfunctions for non-digital inputs and lack of communication to the on-board computer for digital inputs;

II. Out-of-range values; and

III. For rationality fault diagnostics, malfunctions where one of the following occurs, whichever the manufacturer chooses: the sensor output is inappropriately high, the sensor output is inappropriately low, or the sensor output is stuck at the same value.

b. Output Components/Systems.

i. Functional Check. The OR OBD system shall detect a malfunction of an output component/system when proper functional response of the component and system to computer commands does not occur.

ii. If a functional check is not feasible, the OR OBD system shall detect a malfunction of an output component/system caused by a circuit malfunction (e.g., open circuit, short to ground, high voltage) if the signal to the output component/system is non-digital, and communication errors or the lack of communication if the signal to the output component/system is digital.

c. For malfunctions described in section (f)(1)(G)1.c., the OR OBD system shall detect a malfunction of an on-board computer if any of the following occurs:

i. The computer cannot send information to another on-board computer, or

ii. The computer cannot receive information from another on-board computer.

3. Monitoring Conditions.

a. Input Components.

i. Except as provided in section (f)(1)(G)3.d. below, the OR OBD system shall monitor continuously for malfunctions identified in sections (f)(1)(G)2.a.i.I., (f)(1)(G)2.a.i.II., (f)(1)(G)2.a.ii.I., and (f)(1)(G)2.a.ii.II. (i.e., circuit malfunctions, communication malfunctions, and out of range values). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

ii. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(1)(G)2.a.i.III. and (f)(1)(G)2.a.ii.III. (i.e., rationality malfunctions) in accordance with section (f)(3), with the following exceptions:

I. In lieu of the requirement in section (f)(3)(B), the rationality fault diagnostics shall run every time the monitoring conditions are met during the operation cycle; and

II. For rationality fault diagnostics that require a regeneration event, the diagnostic is not subject to the monitor activity ratio requirement in section (f)(3)(C) if the regeneration event is infrequent, is an approved AECD, and is needed for robust monitoring.

b. Output Components/Systems.

i. The manufacturer shall define the monitoring conditions for malfunctions identified in section (f)(1)(G)2.b.i. (i.e., functional malfunctions) in accordance with section (f)(3) except as provided below.

I. For functional checks that require a regeneration event, the diagnostic is not subject to the monitor activity ratio requirement in section (f)(3)(C) if the regeneration event is infrequent, is an approved AECD, and is needed for robust monitoring.

II. For all functional checks, the OR OBD system is not required to activate an output component/system when it would not normally be active for the purposes of performing a functional check of the output component/system.

ii. Except as provided in section (f)(1)(G)3.d. below, the OR OBD system shall monitor continuously for malfunctions identified in section (f)(1)(G)2.b.ii. (i.e., circuit malfunctions and communication malfunctions). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

c. Except as provided in section (f)(1)(G)3.d. below, the manufacturer shall monitor for malfunctions identified in section (f)(1)(G)2.c. (i.e., on-board computer communication malfunctions) under all operating conditions. The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

d. For malfunctions identified in sections (f)(1)(G)2.a.i.I., (f)(1)(G)2.a.i.II., (f)(1)(G)2.a.ii.I., (f)(1)(G)2.a.ii.II., (f)(1)(G)2.b.ii., and (f)(1)(G)2.c. (i.e., circuit malfunctions, communication malfunctions, and out of range values), the manufacturer may temporarily disable monitoring during

conditions when a properly functioning component cannot be distinguished from a malfunctioning component. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. Except as provided below, the requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

a. For output component/system malfunctions identified in section (f)(1)(G)2.b.ii. (i.e., circuit malfunctions), manufacturers are not required to store different fault codes for each distinct malfunction (e.g., open circuit, shorted low).

(2) *OBD Diagnostic Requirements.* The diagnostic requirements of this section apply to engines that are required to meet the OBD requirements in accordance with section (d)(2)(B).

(A) PM Filter Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the PM filter on engines so equipped for filtering performance and regeneration malfunctions.

b. For engines equipped with active regeneration systems that utilize an active/intrusive injection (e.g., in-exhaust fuel injection, in-exhaust fuel/air burner):

i. The OR OBD system shall monitor the active/intrusive injection system for performance malfunctions.

ii. The OR OBD system shall monitor the individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system in accordance with the comprehensive component diagnostic requirements in section (f)(2)(G).

2. Malfunction Criteria.

a. Filtering Performance.

i. The OR OBD system shall detect a malfunction if a decrease in the filtering capability of the PM filter causes an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.040 g/kW-hr as measured from the applicable emission test cycle (i.e., NRTC or steady state cycle),

or the applicable standard plus 0.020 g/kW-hr (e.g., 0.060 g/kW-hr if the exhaust emission standard is 0.040 g/kW-hr).

ii. If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding the malfunction criteria specified in section (f)(2)(A)2.a.i. above, the OR OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

b. Frequent Regeneration. The OR OBD system shall detect a malfunction when the PM filter regeneration frequency exceeds the manufacturer's specified design limits for allowable regeneration frequency.

c. Active/Intrusive Injection. For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve regeneration of the PM filter, the OR OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve regeneration of the PM filter.

3. Monitoring Conditions.

a. Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(2)(A)2.a. and b. (i.e., PM filter filtering performance and frequent regeneration malfunctions) in accordance with section (f)(3).

b. The OR OBD system shall monitor for malfunctions identified in section (f)(2)(A)2.c. (i.e., PM filter active/intrusive injection malfunctions) whenever an ECU commands a PM filter regeneration event to occur. The manufacturer may disable monitoring during conditions when the OR OBD system cannot robustly distinguish between a malfunctioning injection system and a properly operating injection system. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(B) PM Sensor and Heater Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the PM sensor on engines so equipped for circuit and performance malfunctions.

b. For engines equipped with heated PM sensors, the OR OBD system shall monitor the PM sensor heater for circuit and performance malfunctions.

2. Malfunction Criteria.

a. Circuit. The OR OBD system shall detect circuit malfunctions (e.g., open circuit, short to ground, high voltage) and malfunctions of the PM sensor caused by out-of-range values.

b. Monitoring Capability. To the extent feasible, the OR OBD system shall detect a malfunction of the PM sensor when the PM sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics is no longer sufficient for use as an OR OBD system monitoring device (i.e., for use by other diagnostics to detect malfunctions). For this requirement, “sufficient” is defined as the capability of the worst performing acceptable PM sensor to detect the best performing unacceptable other monitored system or component (e.g., PM filter).

c. PM Sensor Heater.

i. Heater Performance. The OR OBD system shall detect a malfunction of the PM sensor 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).

ii. Circuit. The OR OBD system shall detect malfunctions of the PM sensor heater circuit (e.g., open circuit, short circuits) that conflict with the commanded state of the PM sensor heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

3. Monitoring Conditions.

a. Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(2)(B)2.b. and (f)(2)(B)2.c.i. (PM sensor monitoring capability and heater performance malfunctions) in accordance with section (f)(3).

b. Except as provided in section (f)(2)(B)3.c. below, the OR OBD system shall monitor continuously for malfunctions identified in sections (f)(2)(B)2.a. and (f)(2)(B)2.c.ii. (i.e., PM sensor circuit malfunctions and PM sensor heater circuit malfunctions). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

c. For malfunctions identified in sections (f)(2)(B)2.a. and (f)(2)(B)2.c.ii. (i.e., PM sensor circuit malfunctions and PM sensor heater circuit malfunctions), the manufacturer may temporarily disable continuous monitoring during conditions where a properly functioning PM sensor or PM sensor heater cannot be distinguished from a malfunctioning PM sensor or PM sensor heater. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(C) Exhaust Gas Recirculation (EGR) System Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the EGR system on engines so equipped for low flow rate, high flow rate, and slow response malfunctions.

b. For engines equipped with EGR coolers (e.g., heat exchangers), the OR OBD system shall monitor the cooler system for insufficient cooling malfunctions.

c. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component diagnostic requirements in section (f)(2)(G).

2. Malfunction Criteria.

a. Low Flow.

i. The OR OBD system shall detect a malfunction of the EGR system if a decrease from the manufacturer's specified EGR flow rate causes an engine's NMHC, CO, NOx, or PM emissions to exceed any of the emission thresholds set forth in Table 3 of section (f)(2)(I).

ii. For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding the malfunction criteria specified in section (f)(2)(C)2.a.i. above, the OR OBD system shall detect a malfunction when, for feed-back controlled EGR systems, the EGR system has reached its control limits such that it cannot increase EGR flow to achieve the commanded flow rate or, for

non-feedback controlled EGR systems, the EGR system has no detectable amount of EGR flow when EGR flow is expected.

b. High Flow. The OR OBD system shall detect a malfunction when, for feedback-controlled EGR systems, the EGR system has reached its control limits such that it cannot reduce EGR flow to achieve the commanded flow rate or, for non-feedback controlled EGR systems, the EGR system has maximum detectable EGR flow when little or no EGR flow is expected.

c. Slow Response. The OBD system shall detect a malfunction of the EGR system when no detectable response to a change in commanded or expected flow rate occurs.

d. EGR Cooler Performance. The OR OBD system shall detect a malfunction when the system has no detectable amount of EGR cooling.

3. Monitoring Conditions. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(2)(C)2.a. through d. (i.e., EGR system low flow, high flow, slow response, and EGR cooler performance malfunctions) in accordance with section (f)(3).

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(D) DOC Diagnostic.

1. Requirement. For DOCs used to generate an exotherm to assist PM filter regeneration, the OR OBD system shall monitor the DOC on engines so equipped for insufficient exotherm malfunctions.

2. Malfunction Criteria. The OR OBD system shall detect a malfunction when the DOC is unable to generate a sufficient exotherm to achieve regeneration of the PM filter.

3. Monitoring Conditions. The OR OBD system shall monitor for malfunctions identified in section (f)(2)(D)2. (i.e., DOC exotherm malfunctions) whenever an ECU commands a PM filter regeneration event to occur. The manufacturer may disable monitoring during conditions when the OR OBD system cannot robustly distinguish between a malfunctioning DOC and a properly operating DOC. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(E) Fuel System Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor the fuel delivery system for pressure control, injection quantity, injection timing, and feedback control malfunctions.

b. The individual electronic components (e.g., actuators, valves, sensors, pumps) that are used in the fuel system and not specifically addressed in this section shall be monitored in accordance with the comprehensive component diagnostic requirements in section (f)(2)(G).

2. Malfunction Criteria.

a. Fuel System Pressure Control.

i. The OR OBD system shall detect a malfunction of the fuel system pressure control system (e.g., fuel, hydraulic fluid) if a failure or deterioration causes an engine's NMHC, CO, NOx, or PM emissions to exceed any of the emission thresholds set forth in Table 3 of section (f)(2)(I).

ii. For engines in which no failure or deterioration of the fuel system pressure control could result in an engine's emissions exceeding the applicable malfunction criteria specified in section (f)(2)(E)2.a.i., the OR OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel system pressure cannot be delivered.

b. Injection Quantity.

i. The OR OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver the commanded quantity of fuel (i.e., the fuel quantity delivered is too high or too low) such that an engine's NMHC, CO, NOx, or PM emissions exceed any of the emission thresholds set forth in Table 3 of section (f)(2)(I).

ii. For engines in which no failure or deterioration of the fuel injection quantity could result in an engine's emissions exceeding the applicable malfunction criteria specified in section (f)(2)(E)2.b.i. above, the OR OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel quantity cannot be delivered.

c. Injection Timing.

i. The OR OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver fuel at the proper crank angle/timing (i.e., injection timing is too advanced or too retarded) such that an engine's NMHC, CO, NOx, or PM emissions exceed any of the emission thresholds set forth in Table 3 of section (f)(2)(I).

ii. For engines in which no failure or deterioration of the fuel injection timing could result in an engine's emissions exceeding the applicable malfunction criteria specified in section (f)(2)(E)2.c.i. above, the OR OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel injection timing cannot be achieved.

d. Feedback Control. If the engine is equipped with feedback control of the fuel system (e.g., feedback control of pressure or pilot injection quantity), the OR OBD system shall detect a malfunction:

i. If the system fails to begin control within a manufacturer specified time interval;

ii. If a failure or deterioration causes open loop or default operation; or

iii. If control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

e. Malfunction Criteria Determination. For purposes of determining the fuel system malfunction criteria in sections (f)(2)(E)2.a. through c.:

i. For the fuel system pressure control diagnostic in section (f)(2)(E)2.a., the malfunction criteria shall be established by using a malfunction that affects all injectors equally. Additionally, for systems that have single component failures which could affect a single injector (e.g., systems that build injection pressure within the injector that could have a single component pressure fault caused by the injector itself), the malfunction criteria shall also be established by using a malfunction that affects a single injector.

ii. For the injection quantity and injection timing diagnostics in sections (f)(2)(E)2.b. and c., the malfunction criteria shall be established by both (1) a malfunction that affects all the injectors equally and (2) a malfunction that affects only one injector.

3. Monitoring Conditions.

a. Except as provided in sections (f)(2)(E)3.b. and d. below, the OR OBD system shall monitor for malfunctions identified in sections (f)(2)(E)2.a. and d. (i.e., fuel system fuel pressure control and feedback control malfunctions) under all operating conditions. The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

b. For fuel systems that achieve injection fuel pressure within the injector or increase pressure within the injector (e.g. in the injector of an amplified common rail system), manufacturers may request Executive Officer approval to define the monitoring conditions for malfunctions identified in section (f)(2)(E)2.a in accordance with section (f)(3). The Executive Officer shall approve the monitoring conditions upon the manufacturer submitting data or analysis identifying all possible failure modes and the effect each has (e.g., failure modes and effects analysis) on fuel pressure across the entire range of engine operating conditions, and upon the Executive Officer determining based on the data and/or analysis that the monitoring conditions allow for robust detection of all causes of fuel pressure malfunctions.

c. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(2)(E)2.b. and c. (i.e., fuel system injection quantity and timing malfunctions) in accordance with section (f)(3).

d. For the malfunction criteria specified in section (f)(2)(E)2.d.iii. (i.e., fuel system feedback control used up all adjustment malfunction), the manufacturer may temporarily disable monitoring during conditions when the OR OBD system cannot robustly distinguish between a malfunctioning system and a properly operating system if the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(F) Closed Crankcase Ventilation (CV) System Diagnostic.

1. Requirement. The OR OBD system shall monitor the closed CV system on engines so equipped for system integrity malfunctions.

2. Malfunction Criteria.

a. For the purposes of section (f)(2)(F):

i. Any additional external CV system tubing or hoses that are used to equalize crankcase pressure or to provide a ventilation path between various areas of the engine (e.g., crankcase and valve cover) are considered part of the closed CV system.

ii. Any fittings that are used for connection (e.g., nipples or barbs that the hoses must be placed over for proper attachment) are considered part of the “hose, tube, line, or valve.”

b. The OR OBD system shall detect a malfunction of the closed CV system as follows:

i. Except as provided in section (f)(2)(F)2.b.iii. below, the OR OBD system shall detect a malfunction of the closed CV system when a disconnection of the system occurs between the crankcase and the intake ducting, including the CV valve or any check valves if equipped.

ii. Except as provided in section (f)(2)(F)2.b.iii. below, for any hose, tube, line, or valve that transports crankcase vapors, the OBD system shall detect a closed CV system malfunction when the system contains a disconnection or break equal to or greater than the smallest internal cross-sectional area of that hose, tube, or line.

iii. Manufacturers are not required to detect disconnections or breaks of a closed CV system hose, tube, line, or valve if the disconnection or break:

I. Causes the engine to stall immediately during idle operation,

II. Is unlikely to occur due to a closed CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses),

III. Results in a rapid loss of oil or other overt indication of a closed CV system malfunction such that the equipment operator is certain to respond and have the equipment repaired, or

IV. Occurs downstream of where the crankcase vapors are delivered to the air intake system.

3. Monitoring Conditions. Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(2)(F)2.b.i. and ii. in accordance with section (f)(3).

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(G) Comprehensive Component Diagnostic.

1. Requirements.

a. The OR OBD system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (f)(2)(A) through (F) and (f)(2)(H) that provides input to (directly or indirectly) or receives commands from an on-board computer and meets any of the following:

i. Is used as part of the diagnostic strategy for a monitored system or component described in sections (f)(2)(A) through (F) and (f)(2)(H), or

ii. Is an input to (directly or indirectly) or output from an AECD strategy.

b. The OR OBD system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (f)(2)(A) through (F), (f)(2)(H), and (f)(2)(G)1.a. that provides input to (directly or indirectly) or receives commands from an on-board computer, and is used as part of the diagnostic strategy for another monitored system or component described in section (f)(2)(G).

c. The OR OBD system shall monitor for malfunction the ability of an on-board computer to send and receive information to and from other on-board computers if it affects the performance of the OR OBD system.

d. The OR OBD system shall monitor for malfunction the individual electronic components described in sections (f)(2)(A)1.b.ii., (f)(2)(C)1.c., and (f)(2)(E)1.b. that are required to be monitored in accordance with the comprehensive component diagnostic requirements in section (f)(2)(G).

2. Malfunction Criteria.

a. Input Components.

i. For input components described in sections (f)(2)(G)1.a. and (f)(2)(G)1.d. above, the OR OBD system shall detect the following malfunctions:

I. Circuit malfunctions for non-digital inputs and lack of communication to the on-board computer for digital inputs;

II. Out-of-range values; and

III. For rationality fault diagnostics, malfunctions where the sensor output is inappropriately high and malfunctions where the sensor is inappropriately low, to the extent feasible.

ii. For input components described in section (f)(2)(G)1.b., the OR OBD system shall detect the following malfunctions:

I. Circuit malfunctions for non-digital inputs and lack of communication to the on-board computer for digital inputs;

II. Out-of-range values; and

III. For rationality fault diagnostics, malfunctions where one of the following occurs, whichever the manufacturer chooses: the sensor output is inappropriately high, the sensor output is inappropriately low, or the sensor output is stuck at the same value.

b. Output Components/Systems.

i. Functional Check. The OR OBD system shall detect a malfunction of an output component/system when proper functional response of the component and system to computer commands does not occur.

ii. If a functional check is not feasible, the OR OBD system shall detect a malfunction of an output component/system caused by a circuit malfunction (e.g., open circuit, short to ground, high voltage) if the signal to the output component/system is non-digital, and communication errors or the lack of communication if the signal to the output component/system is digital.

c. For malfunctions described in section (f)(2)(G)1.c., the OR OBD system shall detect a malfunction of an on-board computer if any of the following occurs:

i. The computer cannot send information to another on-board computer, or

ii. The computer cannot receive information from another on-board computer.

3. Monitoring Conditions.

a. Input Components.

i. Except as provided in section (f)(2)(G)3.d. below, the OR OBD system shall monitor continuously for malfunctions identified in sections (f)(2)(G)2.a.i.I., (f)(2)(G)2.a.i.II., (f)(2)(G)2.a.ii.I., and (f)(2)(G)2.a.ii.II. (i.e., circuit malfunctions, communication malfunctions, and out of range values). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

ii. The manufacturer shall define the monitoring conditions for malfunctions identified in sections (f)(2)(G)2.a.i.III. and (f)(2)(G)2.a.ii.III. (i.e., rationality malfunctions) in accordance with section (f)(3), with the following exceptions:

I. In lieu of the requirement in section (f)(3)(B), the rationality fault diagnostics shall run every time the monitoring conditions are met during the operation cycle; and

II. For rationality fault diagnostics that require a regeneration event, the diagnostic is not subject to the monitor activity ratio requirement in section (f)(3)(C) if the regeneration event is infrequent, is an approved AECD, and is needed for robust monitoring.

b. Output Components/Systems.

i. The manufacturer shall define the monitoring conditions for malfunctions identified in section (f)(2)(G)2.b.i. (i.e., functional malfunctions) in accordance with section (f)(3) except as provided below.

I. For functional checks that require a regeneration event, the diagnostic is not subject to the monitor activity ratio requirement in section (f)(3)(C) if the regeneration event is infrequent, is an approved AECD, and is needed for robust monitoring.

II. For all functional checks, the OR OBD system is not required to activate an output component/system when it would not normally be active for the purposes of performing a functional check of the output component/system.

ii. Except as provided in section (f)(2)(G)3.d. below, the OR OBD system shall monitor continuously for malfunctions identified in section (f)(2)(G)2.b.ii. (i.e., circuit malfunctions and communication malfunctions). The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as

defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

c. Except as provided in section (f)(2)(G)3.d. below, the manufacturer shall monitor for malfunctions identified in section (f)(2)(G)2.c. (i.e., on-board computer communication malfunctions) under all operating conditions. The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

d. For malfunctions identified in sections (f)(2)(G)2.a.i.I., (f)(2)(G)2.a.i.II., (f)(2)(G)2.a.ii.I., (f)(2)(G)2.a.ii.II., (f)(2)(G)2.b.ii., and (f)(2)(G)2.c. (i.e., circuit malfunctions, communication malfunctions, and out of range values), the manufacturer may temporarily disable monitoring during conditions when a properly functioning component cannot be distinguished from a malfunctioning component. The manufacturer shall limit the disablement interval only to that necessary for avoiding false detection.

4. MIL, Fault Code, and Freeze Frame Requirements. Except as provided below, the requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

a. For output component/system malfunctions identified in section (f)(2)(G)2.b.ii. (i.e., circuit malfunctions), manufacturers are not required to store different fault codes for each distinct malfunction (e.g., open circuit, shorted low).

(H) Other Emission Control Component or System Diagnostic.

1. Requirement. For engines equipped with the emission control components or systems listed below, the OR OBD system shall monitor the components/systems for proper performance.

a. Catalyst that is not a DOC covered by section (f)(2)(D).

b. Air-fuel ratio sensor.

c. Oxygen sensor.

2. Malfunction Criteria. The manufacturer shall submit a plan for Executive Officer approval of the monitoring strategy and malfunction criteria for each component/system under section (f)(2)(H)1. prior to introduction on a production engine. The Executive Officer shall approve the monitoring strategy and malfunction criteria if the plan shows the following:

a. The diagnostic(s) is able to robustly detect all malfunctions that meet the malfunction criteria specified for these

components/systems in the gasoline/spark-ignited monitoring requirements in title 13, CCR section 1971.1,

b. The monitoring conditions for each diagnostic meet the requirements of section (f)(2)(H)3. below, and

c. For malfunction criteria that are based on an emission threshold, the diagnostic detects the malfunction when NMHC, CO, NOx, or PM emissions exceed the emission thresholds set forth in section (f)(2)(I) in lieu of the emission thresholds specified in title 13, CCR section 1971.1.

3. Monitoring Conditions. Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(2)(H)2. in accordance with section (f)(3).

4. MIL, Fault Code, and Freeze Frame Requirements. The requirements for MIL illumination/extinguishment, fault code storage/erasure, and freeze frame storage/erasure are set forth in section (f)(4).

(I) OBD Emission Thresholds.

1. The manufacturer shall use the emission thresholds in Table 3 in section (f)(2)(I)2. below for the following diagnostics:

a. EGR system low flow diagnostic (section (f)(2)(C)2.a.i.)

b. Fuel system pressure control diagnostic (section (f)(2)(E)2.a.i.)

c. Fuel system injection quantity diagnostic (section (f)(2)(E)2.b.i.)

d. Fuel system injection timing diagnostic (section (f)(2)(E)2.c.i.)

e. Other emission control component or system diagnostic (section (f)(2)(H)2.c.)

2. The applicable emission thresholds by power category are shown in Table 3 below, with the thresholds specified either as a multiplier for the applicable standard (e.g., a NOx threshold of “1.5x” means a threshold of 1.5 times the applicable NOx standard) or as an absolute emission level as measured from the applicable emission test cycle.

Table 3. Emission Thresholds

Power Category	NOx Threshold	PM Threshold	NMHC Threshold	CO Threshold
< 19 kW	1.5x	2.0x	n/a	2.0x

19 ≤ kW < 56	1.5x	0.040 g/kW-hr	2.0x	2.0x
56 ≤ kW ≤ 560	0.60 g/kW-hr	0.040 g/kW-hr	0.38 g/kW-hr	2.0x
> 560 kW Gen sets	1.2 g/kW-hr	0.040 g/kW-hr	0.38 g/kW-hr	2.0x
> 560 kW Mobile	1.5x	2.0x	2.0x	2.0x

(3) *Monitoring Conditions Requirements.* For monitoring conditions of diagnostics in sections (f)(1) and (f)(2) that are required to meet the requirements of section (f)(3):

(A) Except as provided below in sections (f)(3)(D) and (E) and elsewhere in sections (f)(1) and (f)(2), the manufacturer shall define monitoring conditions that meet all the following criteria:

1. Are technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false indications of malfunctions),

2. Are designed to ensure monitoring will occur under conditions which may reasonably be expected to be encountered in normal equipment operation and use, and

3. Are designed to ensure monitoring will occur during the following test cycles:

a. For engines certified to transient test standards, during the NRTC.

b. For engines certified to steady-state test standards, during the applicable steady-state cycle.

(B) Monitoring shall occur at least once per operating cycle in which the monitoring conditions are met.

(C) The monitoring conditions shall ensure that the diagnostic yields a monitor activity ratio (as defined in section (e)(3)(F)2.c.) that meets or exceeds 0.05 on in-use engines.

(D) In lieu of the criterion in section (f)(3)(A)3., manufacturers may request Executive Officer approval to define monitoring conditions that are not encountered during the NRTC (for engines certified to the transient test standards) or the applicable steady-state cycle (for engines certified to the steady-state test standards). The Executive Officer shall approve the request upon finding the following:

1. The conditions encountered during the NRTC or the applicable steady-state cycle (whichever is applicable) restrict robust detection of malfunctions;

2. The monitoring conditions are technically necessary to ensure robust detection of malfunction; and

3. Data or an engineering evaluation submitted by the manufacturer are complete and accurate and demonstrate that the component/system does not normally function during the NRTC or the applicable steady-state cycle.

(E) For intrusive diagnostics, in addition to meeting the criteria in sections (f)(3)(A) through (D), the manufacturer shall submit a monitoring strategy plan to the Executive Officer for review and approval of the diagnostic. The Executive Officer shall approve the plan if the intrusive diagnostic meets any of the following based on complete and accurate manufacturer-submitted data or engineering evaluation:

1. Running the intrusive diagnostic enhances the effectiveness of the emission control system (e.g., increases catalyst conversion efficiency for a few minutes at the beginning of an operating cycle) or does not affect the effectiveness of the emission control system. The manufacturer shall submit emissions data from operating the engine with the intrusive diagnostic running on certification test cycles (e.g., NRTC, steady-state cycle).

2. If running the intrusive diagnostic reduces the effectiveness of the emission control system (i.e., causes increases in emissions), the intrusive diagnostic meets any of the following:

a. The intrusive diagnostic runs only once after the MIL is illuminated for the malfunction by a non-intrusive diagnostic, or

b. The intrusive diagnostic meets all the following conditions:

i. It uses the best available monitoring technology known or that should be known to the manufacturer and given the limitations of the existing hardware on the engine and equipment,

ii. The monitoring conditions created by the intrusive diagnostic are needed for robust detection of malfunctions, and

iii. The manufacturer had considered alternative diagnostic concepts that did not reduce the effectiveness of the emission control system but determined that the concepts would not meet any of the requirements of sections (f)(3)XXX or would require additional hardware to implement **<reasons for why the alternate monitor would be rejected TBD>**. The manufacturer's consideration of alternative diagnostic concepts

shall include evaluation of other modifications to the proposed diagnostic, the monitored components themselves, and other diagnostic(s) that use the monitored components (e.g., altering other diagnostics to lessen the sensitivity and reliance on the component or characteristic of the component subject to the proposed diagnostic).

(4) *MIL, Fault Code, and Freeze Frame Requirements.* For the MIL, fault code, and freeze frame protocols of diagnostics in sections (f)(1) and (f)(2) that are required to meet the requirements of section (f)(4):

(A) MIL Illumination and Fault Code Storage Protocol.

1. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

a. Pending Fault Code Storage. Upon detection of a malfunction, the OR OBD system shall store a pending fault code within 10 seconds.

b. Pending Fault Code Erasure. After storage of a pending fault code under section (f)(4)(A)1.a., if a malfunction is not detected before the end of the next operating cycle in which monitoring occurs (i.e., the diagnostic runs and there is no indication of the malfunction at any time during the next operating cycle), the OR OBD system shall erase the corresponding pending fault code at the end of the operating cycle.

c. MIL-on Fault Code Storage and MIL Illumination. After storage of a pending fault code under section (f)(4)(A)1.a., if the malfunction is again detected before the end of the next operating cycle in which monitoring occurs, the OR OBD system shall illuminate the MIL continuously, erase the corresponding pending fault code, and store a MIL-on fault code within 10 seconds.

d. Requesting Alternative Protocols. A manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols to those specified in sections (f)(4)(A)1.a. through c. above. The Executive Officer shall grant approval upon determining that the manufacturer has provided data or an engineering evaluation that are complete and accurate and that demonstrate that the alternative protocol can evaluate the monitored component's performance and detect malfunctions in a manner that is equally effective and timely. The Executive Officer shall not accept strategies requiring on average more than 6 operating cycles for MIL illumination.

e. MIL Illumination and Fault Code Storage for Default Mode of Operation. Except as provided for in section (f)(4)(D), the OR OBD system shall store fault codes and illuminate the MIL when the engine enters a default mode of operation that can affect emissions or the performance of the OR OBD system or in the event of a malfunction of an on-board computer that can affect the performance of the OR OBD system.

i. Except as provided for in section (f)(4)(A)1.e.ii., the OR OBD system shall illuminate the MIL and store a MIL-on fault code within 10 seconds of detection of the condition that causes the engine to enter the default mode of operation or detection of the on-board computer malfunction.

ii. If the default mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default mode of operation can run on the next operating cycle and confirm the presence of the condition that caused the default mode of operation), in lieu of illuminating the MIL and storing a MIL-on fault code within 10 seconds on the first operating cycle where the default mode of operation is entered, the OR OBD system may meet the following requirements:

I. Pending fault code storage. If the engine enters the default mode of operation in the first operating cycle, the OR OBD system shall store a pending fault code within 10 seconds of detection;

II. Pending fault code erasure. After storage of a pending fault code under section (f)(4)(A)1.e.ii.I., if the condition causing the default mode of operation is not detected before the end of the next operating cycle, the OR OBD system shall erase the pending fault code; and

III. MIL-on fault code storage and MIL illumination. After storage of a pending fault code under section (f)(4)(A)1.e.ii.I., if the condition causing the default mode of operation is again detected before the end of the next operating cycle, the OR OBD system shall erase the pending fault code, store a MIL-on fault code, and illuminate the MIL within 10 seconds of detection.

2. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

a. Pending Fault Code Storage. Upon detection of a malfunction, the OR OBD system shall store a pending fault code within 10 seconds.

b. Pending Fault Code Erasure. After storage of a pending fault code under section (f)(4)(A)2.a., if a malfunction is not detected before the end of the next operating cycle in which monitoring occurs (i.e., the diagnostic runs and there is no indication of the malfunction at any time during the next operating cycle), the OR OBD system shall erase the corresponding pending fault code at the end of the operating cycle.

c. Confirmed Fault Code Storage and MIL Illumination. After storage of a pending fault code under section (f)(4)(A)2.a., if the malfunction is again detected before the end of the next operating cycle in which monitoring occurs, the OR OBD system shall illuminate the MIL continuously, keep the pending fault code stored, and store a confirmed fault code within 10 seconds.

d. Requesting Alternate Protocols. In lieu of the requirements in sections (f)(4)(A)2.a. through c. above, a manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols. The Executive Officer shall grant approval upon determining that the manufacturer has provided data or an engineering evaluation that are complete and accurate and that demonstrate that the alternate protocol can evaluate the monitored component's performance and detect malfunctions in a manner that is equally effective and timely, and that the strategy does not require on average more than 6 operating cycles for MIL illumination.

e. MIL Illumination and Fault Code Storage for Default Mode of Operation. Except as provided for in section (f)(4)(D), the OR OBD system shall store fault codes and illuminate the MIL when the engine enters a default mode of operation that can affect emissions or the performance of the OR OBD system or in the event of a malfunction of an on-board computer that can affect the performance of the OR OBD system.

i. Except as provided for in section (f)(4)(A)2.e.ii., the OR OBD system shall illuminate the MIL and store a pending fault code and confirmed fault code within 10 seconds of detection of the condition that causes the engine to enter the default mode of operation or detection of the on-board computer malfunction.

ii. If the default mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default mode of operation can run on the next operating cycle and confirm the presence of the condition that caused the default mode of operation), in lieu of illuminating the MIL and storing a confirmed fault code within 10 seconds on the first operating cycle where

the default mode of operation is entered, the OR OBD system may meet the following requirements:

I. Pending fault code storage. If the engine enters the default mode of operation in the first operating cycle, the OR OBD system shall store a pending fault code within 10 seconds of detection;

II. Pending fault code erasure. After storage of a pending fault code under section (f)(4)(A)2.e.ii.I., if the condition causing the default mode of operation is not detected before the end of the next operating cycle, the OR OBD system shall erase the pending fault code; and

III. Confirmed fault code storage and MIL illumination. After storage of a pending fault code under section (f)(4)(A)2.e.ii.I.,if the condition causing the default mode of operation is again detected before the end of the next operating cycle, the OR OBD system shall keep the pending fault code, store a confirmed fault code, and illuminate the MIL within 10 seconds of detection.

(B) MIL Extinguishing and Fault Code Erasure Protocol.

1. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

a. MIL Extinguishing. Once the MIL has been illuminated, the OR OBD system shall extinguish the MIL after three subsequent sequential operating cycles during which the diagnostic responsible for illuminating the MIL executes and the previously detected malfunction is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

b. MIL-on Fault Code Erasure. The OR OBD system shall erase the corresponding MIL-on fault code in conjunction with extinguishing the MIL as described under section (f)(4)(B)1.a.

c. MIL Extinguishing and Fault Code Erasure for Default Mode of Operation. For on-board computer malfunctions that can affect the performance of the OR OBD system, the MIL extinguishing and fault code erasure requirements of section (f)(4)(B)1.a. and b. shall apply. For default modes of operation that can affect emissions or the performance of the OR OBD system and are recoverable during each subsequent operating cycle after the MIL is illuminated (i.e., where the diagnostic or control strategy that caused the default mode of operation can run on every subsequent operating cycle and confirm the presence of the condition that caused the default mode

of operation on each cycle), the manufacturer shall meet the following requirements:

i. Once the MIL has been illuminated in accordance with section (f)(4)(A)1.e., the OR OBD system shall extinguish the MIL after three subsequent sequential operating cycles during which the diagnostic responsible for illuminating the MIL executes and the previously detected condition causing the default mode of operation is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

ii. The OR OBD system shall erase the corresponding MIL-on fault code in conjunction with extinguishing the MIL as described under section (f)(4)(B)1.c.i. above.

2. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

a. MIL Extinguishing. Once the MIL has been illuminated, the OR OBD system shall extinguish the MIL after three subsequent sequential operating cycles during which the diagnostic responsible for illuminating the MIL executes and the previously detected malfunction is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

b. Confirmed Fault Code and Pending Fault Code Erasure. The OR OBD system shall erase the corresponding confirmed fault code and pending fault code in conjunction with extinguishing the MIL as described under section (f)(4)(B)2.a. above.

c. MIL Extinguishing and Fault Code Erasure for Default Mode of Operation. For on-board computer malfunctions that can affect the performance of the OR OBD system, the MIL extinguishing and fault code erasure requirements of section (f)(4)(B)2.a. and b. shall apply. For default modes of operation that can affect emissions or the performance of the OR OBD system and are recoverable during each subsequent operating cycle after the MIL is illuminated (i.e., where the diagnostic or control strategy that caused the default mode of operation can run on every subsequent operating cycle and confirm the presence of the condition that caused the default mode of operation on each cycle), the manufacturer shall meet the following requirements:

i. Once the MIL has been illuminated in accordance with section (f)(4)(A)2.e., the OR OBD system shall extinguish the MIL after three subsequent sequential operating cycles during which the

diagnostic responsible for illuminating the MIL executes and the previously detected condition causing the default mode of operation is no longer present, provided no other malfunction has been detected that would independently illuminate the MIL.

ii. The OR OBD system shall erase the corresponding confirmed fault code and pending fault code in conjunction with extinguishing the MIL as described under section (f)(4)(B)2.c.i. above.

(C) Freeze Frame Conditions Storage and Erasure Protocol. The OR OBD system shall store and erase "freeze frame" conditions (as described in section (e)(3)(C)) present at the time a malfunction is detected as follows.

1. For engines using the SAE J1939 protocol for the standardized functions required in section (e):

a. Except as provided in sections (f)(4)(C)1.b. and c. below, the OR OBD system shall store and erase freeze frame conditions as follows:

i. The OR OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

ii. If the pending fault code is erased in the next operating cycle in which monitoring occurs and a malfunction is not detected (as described under section (f)(4)(A)1.b.), the OR OBD system shall erase the corresponding freeze frame conditions.

iii. If the pending fault code matures to a MIL-on fault code (as described under section (f)(4)(A)1.c.), the OR OBD system shall replace the stored freeze frame conditions with freeze frame conditions regarding the MIL-on fault code.

iv. The OR OBD system shall erase the freeze frame information in conjunction with the erasure of the MIL-on fault code (as described under section (f)(4)(B)1.b.).

b. For alternate strategies that do not store pending fault codes (i.e., diagnostics using alternate statistical strategies described in section (f)(4)(A)1.d. such as diagnostics that store a MIL-on fault code and illuminate the MIL upon the first detection of a malfunction), the OR OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of the MIL-on fault code.

c. If a fault code is stored when the maximum number of frames of freeze frame conditions is already stored, the OR OBD system shall not

replace any currently stored freeze frame conditions with freeze frame conditions for the newly stored fault code except as allowed for MIL-on fault codes in section (f)(4)(C)1.a.iii.

2. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e):

a. Except as provided in sections (f)(4)(C)2.b. and c. below, the OR OBD system shall store and erase freeze frame conditions as follows:

i. The OR OBD system shall store freeze frame conditions on two frames of data (referred to as the “first frame” and “second frame”) for a given fault code.

ii. The OR OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

iii. After storage of the pending fault code and freeze frame conditions during an operating cycle, if the malfunction is again detected within the same operating cycle, the OR OBD system shall replace the stored freeze frame conditions on the second frame with freeze frame conditions for the redetected malfunction anytime the malfunction is redetected.

iv. If the pending fault code is erased in the next operating cycle in which monitoring occurs and a malfunction is not detected (as described in section (f)(4)(A)2.b.), the OR OBD system shall erase the corresponding freeze frame conditions on the first and second frames for the fault code.

v. If the pending fault code matures to a confirmed fault code (as described in section (f)(4)(A)2.c.), the OR OBD system shall retain the freeze frame conditions stored with the pending fault code on the first frame and replace the stored freeze frame conditions on the second frame with freeze frame conditions of the confirmed fault code.

vi. After storage of the confirmed fault code and freeze frame conditions during an operating cycle, if the malfunction is again detected within the same operating cycle or in a subsequent operating cycle, the OR OBD system shall replace the stored freeze frame conditions on the second frame with freeze frame conditions for the redetected malfunction anytime the malfunction is redetected.

vii. The OR OBD system shall erase the freeze frame conditions on the first and second frames in conjunction with the erasure of the confirmed fault code (as described under section (f)(4)(B)2.b.).

b. For alternate strategies that store both a pending fault code and confirmed fault code and illuminate the MIL upon the first detection of a malfunction (i.e., diagnostics using alternate statistical strategies described in section (f)(4)(A)2.d.), the OR OBD system shall store and erase freeze frame conditions in the first and second frames in conjunction with the storage and erasure of the confirmed fault code. After storage of the confirmed fault code and freeze frame conditions during an operating cycle, if the malfunction is again detected within the same operating cycle or in a subsequent operating cycle, the OR OBD system shall replace the stored freeze frame conditions on the second frame with freeze frame conditions for the redetected malfunction anytime the malfunction is redetected.

c. If a fault code is stored when the maximum number of frames of freeze frame conditions is already stored in the DEC ECU, the OR OBD system shall not replace any currently stored freeze frame conditions in the DEC ECU with freeze frame conditions for the newly stored fault code.

(D) Exceptions to MIL and Fault Code Requirements.

1. If the engine enters a default mode of operation that can affect emissions or the performance of the OR OBD system, a manufacturer shall be exempt from the requirements of section (f)(4)(A)1.e. and (f)(4)(A)2.e. (i.e., exempt from illuminating the MIL and storing fault codes) if any of the following are met:

a. The default mode of operation (1) causes an overt indication (e.g., illumination of a red engine shut-down warning light) such that the equipment operator is certain to respond and have the problem corrected, (2) is not otherwise caused by a component required to be monitored by the OR OBD system under sections (f)(1) and (f)(2), and (3) is not invoked to protect a component required to be monitored by the OR OBD system under sections (f)(1) and (f)(2); or

b. The default mode of operation is an AECD that is properly activated due to the occurrence of conditions that have been approved by the Executive Officer.

(5) *Malfunction Criteria Determination.*

(A) General Malfunction Criteria Determination Requirements. For purposes of determining the malfunction criteria for diagnostics in sections (f)(1) and (f)(2):

1. For diagnostics described in sections (f)(1)(B) through (F), (f)(2)(A) through (F), and (f)(2)(H), the manufacturer shall use a component/system deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world deterioration and failure modes under normal and malfunctioning engine and emission control system operating conditions.

2. For comprehensive component diagnostics described in sections (f)(1)(G) and (f)(2)(G), the manufacturer is not required to deteriorate the component/system using methods established by the manufacturer to represent real world deterioration and failure modes for purposes of determining the malfunction criteria, but is required to design the diagnostic to detect real world deterioration and failure modes under normal and malfunctioning engine and emission control system operating conditions.

3. For engines that are certified to transient test standards, in determining the malfunction criteria for diagnostics in sections (f)(1) and (f)(2) (except (f)(1)(A)) that are required to indicate a malfunction when emissions exceed an emission threshold (e.g., 0.040 g/kW-hr as measured from an applicable emission test cycle, 2.0 times any of the applicable standards), the manufacturer shall use the emission test cycle and standard (i.e., NRTC and transient test standard or applicable steady-state cycle and steady-state test standard) determined by the manufacturer to be more stringent (i.e., to result in higher emissions with the same level of component malfunction) as the “applicable emission test cycle” and “applicable standard.”

a. The manufacturer shall use data or engineering analysis to determine the test cycle and standard that are more stringent.

b. The manufacturer shall identify in the certification documentation (required under section (h)) the test cycle and standard determined by the manufacturer to be more stringent for each applicable diagnostic.

c. If the Executive Officer reasonably believes that a manufacturer has incorrectly determined the test cycle and standard that is more stringent for a diagnostic, the Executive Officer shall require the manufacturer to provide complete and accurate emission data or engineering analysis that show that the other test cycle and standard are less stringent.

4. For engines that are certified to steady-state test standards and not to transient test standards, in determining the malfunction criteria for diagnostics in sections (f)(1) and (f)(2) (except (f)(1)(A)) that are required to indicate a malfunction when emissions exceed an emission threshold (e.g., 0.040 g/kW-hr as measured from an applicable emission test cycle, 2.0 times any of the applicable standards), the manufacturer shall use the applicable steady-state cycle and steady-state test standard as the "applicable emission test cycle" and "applicable standard."

(B) Adjusted Emissions for Infrequent Regeneration Events.

1. For diagnostics in sections (f)(1)(B), (f)(2)(A), (f)(2)(C), (f)(2)(E), and (f)(2)(H) that are required to indicate a malfunction when emissions exceed a certain emission threshold (e.g., 2.0 times the applicable standards) on engines equipped with emission controls that experience infrequent regeneration events, a manufacturer shall adjust the emission test results that are used to determine the malfunction criterion. The manufacturer shall adjust the emission result for each diagnostic using the procedure described in 40 CFR section 1039.525 (last amended October 25, 2016, and hereby incorporated by reference) with the component for which the malfunction criteria are being established deteriorated to the malfunction threshold. The adjusted emission value shall be used for purposes of determining whether or not the specified emission threshold is exceeded (e.g., a malfunction shall be detected when the adjusted emission value exceeds 2.0 times any applicable standard).

2. For calculating the adjustment factors, the manufacturer shall submit a frequency factor derivation plan to the Executive Officer for approval. The Executive Officer shall approve the plan upon determining the frequency factor derivation appropriately incorporates the impact of the malfunction on the regeneration event frequency.

(6) *Exceptions to Diagnostic Requirements.*

(A) Low Temperature Exemption. The manufacturer may request Executive Officer approval to exempt a specific component from the comprehensive component diagnostic requirements of section (f)(1)(G) and (f)(2)(G) if all malfunctions of the component affect the diagnostic strategy for any other monitored component or system only when the ambient temperature is below 20 degrees Fahrenheit (i.e., -6.7 degrees Celsius). The Executive Officer shall approve the request upon the manufacturer submittal of data or engineering evaluation that are complete and accurate and support that the following criteria are met when the ambient temperature is above 20 degrees Fahrenheit (i.e., -6.7 degrees Celsius): (1) all malfunctions of the component do not affect the diagnostic strategy for any other

monitored component or system, and (2) the ambient temperature is determined based on a temperature sensor monitored by the OR OBD system (e.g., IAT sensor).

(g) *Demonstration Testing Requirements*.

(1) *Requirement*. The manufacturer shall test and submit test data from one or more test engines. The demonstration testing requirements of section (g) do not apply to Stage 1 engines (i.e., engines required to meet the Stage 1 requirements in accordance with section (d)(1)) that are not equipped with a tailpipe NOx sensor.

(A) The manufacturer shall perform the testing each model year and submit the test data as part of the certification documentation described under section (h).

(B) The manufacturer is not required to test and submit the test data for a test engine in accordance with section (g) if:

1. The manufacturer has previously submitted the data for all engine ratings in all engine families,

2. For engines that are equipped with a tailpipe NOx sensor, the NOx mass calculation algorithm and input sensor specifications (i.e., specifications of the sensors used for the NOx mass calculations) in all the previously tested engines have not changed to the extent that the NOx mass calculation is affected since the engine was tested, and

3. For Stage 2 engines, the engine, emission control system, and calibrations of all the monitors/diagnostics required to be tested (in accordance with section (g)(3)(D)) in all the previously tested engines have not changed to the extent that the emissions test data are affected since the engine was tested.

(2) *Test Engine Selection*.

(A) Test Engine Selection for Baseline Emissions Testing and Diagnostic Testing.

1. The test engine selection requirements of section (g)(2)(A) apply to the baseline emissions test in section (g)(3)(B) and diagnostic tests in section (g)(4)(D).

2. Prior to submitting any applications for certification for a model year, the manufacturer shall notify the Executive Officer of the engine families and engine ratings within each family planned for that model year. The Executive Officer will then select the engine family(ies) and the specific engine rating within the engine family(ies) that the manufacturer shall use as demonstration test engines to provide test data.

3. The manufacturer shall test and submit emissions and diagnostic test data from the following number of test engines:

a. If the manufacturer certifies for sale in California one to five engine families in the model year, one test engine.

b. If the manufacturer certifies for sale in California six to ten engine families in the model year, test engines from two engine ratings for a total of two test engines.

c. If the manufacturer certifies for sale in California eleven or more engine families in the model year, test engines from three engine ratings for a total of three test engines.

4. When determining the number of engine families a manufacturer certifies in a model year in section (g)(2)(A)3. above, the manufacturer shall not include engine families that consist only of Stage 1 engines.

(B) Test Engine Selection for Tailpipe NOx Mass Accuracy Testing. For the tailpipe NOx mass accuracy test in section (g)(3)(C), the manufacturer shall test and submit test data for each engine equipped with a tailpipe NOx sensor that the manufacturer submits an application for in accordance with the certification documentation requirements of section (h). If the manufacturer submits an application for an OR OBD certification documentation group with engines equipped with a tailpipe NOx sensor, the manufacturer is not required to test and submit test data for engines in the group that are not the representative engine.

(3) *Testing Requirements*.

(A) Test Engine System Aging Requirements. Prior to conducting testing under sections (g)(3)(B) through (D), the manufacturer shall age the test engine system (engine, engine emission controls, and aftertreatment) using the following aging requirements:

1. Except as provided for in section (g)(3)(A)2. below, the manufacturer shall use a certification emission durability test engine system aged in accordance with Part IV: 40 CFR Part 1065, Subpart L, sections 1065.1131 through 1065.1145, as set forth in and modified by the “California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts,” incorporated by reference in title 13, CCR, section 2423.1.

2. For testing of Stage 1 engines that are equipped with a tailpipe NOx sensor and Stage 2 OBMD engines, in lieu of the engine system described in section (g)(3)(A)1. above, the manufacturer may use a low-hour engine with emissions stabilized using the same procedures the manufacturer uses for its

low-hour emission-data certification engine. If the manufacturer selects this option, the manufacturer shall use the low-hour engine in combination with a tailpipe NOx sensor that is aged to full useful life. For the purposes of this section, a full useful life aged NOx sensor means a NOx sensor that has been aged together with an engine in accordance with Part IV: 40 CFR Part 1065, Subpart L, sections 1065.1131 through 1065.1145, as set forth in and modified by the "California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts," incorporated by reference in title 13, CCR, section 2423.1.

(B) Baseline Emissions Test. For engines required to meet the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall perform a baseline emissions test with no malfunctions implanted on the engine system (engine, engine emission controls, and aftertreatment) before performing the required testing in sections (g)(3)(C) and (g)(4)(D). For engines that certify to the transient test standard, the manufacturer shall operate the test engine over the NRTC and the applicable steady-state cycle. For engines that are certified to steady-state test standards and not to transient test standards, the manufacturer shall operate the test engine over the applicable steady-state cycle. The manufacturer shall collect NMHC, CO, NOx, and PM emissions data during this test.

(C) Tailpipe NOx Mass Accuracy Test. For engines equipped with a tailpipe NOx sensor that are required to meet the Stage 1 requirements in accordance with section (d)(1) or the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall perform the following test to determine compliance with the NOx mass accuracy requirements in section (e)(2)(D)1.h.

1. Test Engine. The manufacturer shall use an engine in the baseline configuration (i.e., with no malfunctions on the engine, engine emission controls, and aftertreatment system).

2. Test Procedure.

a. For engines that certify to the transient test standards, the manufacturer shall conduct a transient test with the test engine using the NRTC. The transient test shall be immediately preceded by a hot or cold-start preconditioning NRTC without cycling the ignition in between the two NRTCs to ensure that all NOx sensors are reporting NOx data throughout the entire transient test (i.e., the second NRTC).

b. For engines that certify to steady-state test standards and that do not certify to the transient test standard, the manufacturer shall conduct a steady-state test with the test engine using either the discrete-mode cycle or RMC. The steady-state test shall be immediately preceded by a

preconditioning cycle without cycling the ignition in between the preconditioning cycle and the steady-state test to ensure that all NOx sensors are reporting NOx data throughout the entire steady-state test. The preconditioning cycle shall be the same cycle used in the steady-state test.

3. Data Collection. The manufacturer shall collect the following data during the testing described above and in the format described in section (h)(2)(C)4.:

a. Data from the OR OBD System. The manufacturer shall collect the following data at a frequency of at least 1 Hertz from the OR OBD system throughout both the preconditioning cycle and the transient or steady-state test:

i. Engine-out NOx mass emission rate, if equipped;

ii. System-out (i.e., tailpipe) NOx mass emission rate;

iii. Engine output energy;

iv. Engine speed; and

v. Actual indicated engine torque.

b. Data from the Test Facility for NRTC or RMC-based Testing. The manufacturer shall collect the following data at a frequency of at least 1 Hertz from the test facility system throughout the transient or steady-state test (not the preconditioning cycle).

i. System-out NOx Mass Emission Rate. To allow for a direct comparison with NOx data from the OR OBD system, the manufacturer shall not correct the test facility NOx mass data for humidity;

ii. Engine speed;

iii. Torque; and

iv. Net brake work.

c. Data from the test facility for discrete-mode cycle-based testing. The manufacturer shall collect the following data from the test facility system during the sampling period of each mode during the steady-state test (not the preconditioning cycle).

i. Sampling time;

ii. System-out NOx mass. To allow for a direct comparison with NOx data from the OR OBD system, the manufacturer shall not correct the test facility NOx mass data for humidity;

iii. Engine speed;

iv. Torque; and

v. Net brake work.

(D) Diagnostic Tests. For engines required to meet the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall test the following diagnostics using the testing protocol indicated below .

1. Specific Diagnostics To Be Demonstration Tested.

a. For OBMD engines (i.e., engines required to meet section (d)(2)(A)):

i. OBM NOx emission threshold monitor (section (f)(1)(A)2.).

ii. PM filter filtering performance diagnostic (section (f)(1)(B)2.a.i.)

iii. Tailpipe NOx sensor performance diagnostic (section (f)(1)(D)2.b.).

b. For OBD engines (i.e., engines required to meet section (d)(2)(B)):

i. PM filter filtering performance diagnostic (section (f)(2)(A)2.a.i.).

ii. EGR system low flow diagnostic (section (f)(2)(C)2.a.i.).

iii. Fuel system diagnostics.

I. Pressure control diagnostic (section (f)(2)(E)2.a.i).

II. Injection quantity diagnostic (section (f)(2)(E)2.b.i.).

III. Injection timing diagnostic (section (f)(2)(E)2.c.i.).

iv. Other emission control component or system diagnostics (section (f)(2)(H)2.c.)

c. For testing of the fuel system diagnostics on OBD engines under section (g)(3)(D)1.b.iii., the following testing requirements apply:

i. For testing of the fuel system pressure control diagnostics under section (g)(3)(D)1.b.iii.I., the manufacturer shall perform a test for each of the following that is applicable: (1) with a high side malfunction (i.e., malfunction that causes too much pressure)

that affects all injectors equally; (2) with a low side malfunction (i.e., malfunction that causes too little pressure) that affects all injectors equally; and (3) for systems that have single component failures which could affect a single injector (e.g., systems that build injection pressure within the injector that could have a single component pressure fault caused by the injector itself), with a malfunction that affects the worst case injector (i.e., a malfunction on the injector that will result in the worst case emissions).

ii. For testing of the fuel system injection quantity diagnostics under section (g)(3)(D)1.b.iii.II., the manufacturer shall perform a test for each of the following that is applicable: (1) with a high side malfunction (i.e., malfunction that causes too much fuel quantity) that affects all injectors equally; (2) with a low side malfunction (i.e., malfunction that causes too little fuel quantity) that affects all injectors equally; and (3) with a malfunction that affects the worst case injector (i.e., a malfunction on the injector that will result in the worst case emissions).

iii. For testing of the fuel system injection timing diagnostics under section (g)(3)(D)1.b.iii.III., the manufacturer shall perform a test for each of the following that is applicable: (1) with a high side malfunction (i.e., malfunction that causes too advanced timing) that affects all injectors equally; (2) with a low side malfunction (i.e., malfunction that causes too retarded timing) that affects all injectors equally; and (3) with a malfunction that affects the worst case injector (i.e., a malfunction on the injector that will result in the worst case emissions).

2. Implanting of Malfunction and Malfunction Preconditioning Cycles.

a. Implanting of Malfunction.

i. The manufacturer shall implant a single malfunction with the component/system set at its malfunction criteria limit as determined by the manufacturer for meeting the requirements of section (f). Except as specified below, the component/system being evaluated shall be deteriorated to the applicable malfunction limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria using methods established by the manufacturer in accordance with section (f)(5)(A)1.

I. For the OBM NOx emission threshold monitor test on OBMD engines (section (g)(3)(D)1.a.i.), the manufacturer shall implant the malfunction on one component/system of the manufacturer's choosing. The malfunction is not required to be representative of real-world aging and deterioration (e.g., a partially coated SCR catalyst is acceptable), but must result in an actual increase in NOx emissions (e.g., tailpipe NOx sensor signal manipulation is not acceptable).

II. For the fuel system diagnostic tests (section (g)(3)(D)1.b.iii.) on OBD engines, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction or that there is no reasonably feasible method to induce a hardware malfunction.

III. For the tailpipe NOx sensor diagnostic test (section (g)(3)(D)1.a.iii.) on OBMD engines, the manufacturer may electronically simulate a malfunctioning sensor in lieu of using an induced hardware malfunction.

ii. The manufacturer shall implant the malfunction as follows:

I. If the Executive Officer approves the use of a malfunction preconditioning cycle under section (g)(3)(D)2.b. below, the manufacturer shall implant the malfunction on the test engine immediately prior to conducting the malfunction preconditioning cycle in section (g)(3)(D)2.b. The manufacturer shall not replace, modify, or adjust the system or component after the last malfunction preconditioning cycle has taken place.

II. If the Executive Officer does not approve the use of any malfunction preconditioning cycle under sections (g)(3)(D)2.b. and c., the manufacturer shall implant the malfunction immediately prior to conducting the applicable malfunction detection cycle(s) and exhaust emission tests under section (g)(3)(D)3.

b. Optional Malfunction Preconditioning Cycle. The manufacturer may request Executive Officer approval to operate the test engine over a "malfunction preconditioning cycle" (i.e., NRTC or applicable steady-state cycle) prior to conducting the tests under section (g)(3)(D)3. below. The Executive Officer shall approve the request upon determining that a manufacturer has provided data or engineering evaluation that are complete and accurate and demonstrate that:

i. The malfunction preconditioning cycle is necessary for the emission control system to stabilize emissions (e.g., through control system adaptation or learning) due to the introduction of the malfunction,

ii. The malfunction preconditioning cycle is not solely intended for the purpose of adding monitoring time to detect a malfunction, and

iii. The test engine does not need to be cold soaked prior to conducting the malfunction preconditioning cycle in order for the monitor or diagnostic testing to be successful.

c. Optional Second Malfunction Preconditioning Cycle. The manufacturer may request Executive Officer approval to use an additional identical malfunction preconditioning cycle following a 20-minute hot soak after the first malfunction preconditioning cycle. The Executive Officer shall approve the request upon determining that a manufacturer has provided data or engineering evaluation that are complete and accurate and demonstrate that the additional malfunction preconditioning cycle:

i. Is necessary for the emission control system to stabilize emissions (e.g., through control system adaptation or learning) due to the introduction of the malfunction, and

ii. Is not solely intended for the purpose of adding monitoring time to detect a malfunction.

d. For test engines equipped with PM filters that experience infrequent regeneration events, the manufacturer shall not run a manual PM filter regeneration event immediately before or any time after the malfunction is implanted, except for the following:

i. When conducting the regeneration emission test under section (g)(3)(D)3.c.;

ii. If the diagnostic requires a regeneration event to enable monitoring; or

iii. With Executive Officer approval, if a regeneration event is expected to occur during demonstration testing of a specific diagnostic during the malfunction preconditioning cycles (section (g)(3)(D)2.b. or c.), the malfunction detection cycles (section (g)(3)(D)3.a.), or the exhaust emission test (section (g)(3)(D)3.b.). The Executive Officer shall approve the manual PM filter regeneration event if the manufacturer submitted data

or engineering evaluation (soot model information) that are complete and accurate and that show that a regeneration event will most likely occur during demonstration testing of the diagnostic. If approved, the manufacturer shall run a manual PM filter regeneration event while operating the engine on an NRTC or the applicable steady-state cycle and before the malfunction is implanted for that specific diagnostic.

3. Demonstration Test Sequence.

a. Malfunction Detection Cycle. After the manufacturer has met the malfunction implanting and malfunction preconditioning cycle requirements under section (g)(3)(D)2., the manufacturer shall operate the test engine over test cycles (i.e., malfunction detection cycles) to run the diagnostic as follows:

i. For the OBM NOx emission threshold monitor, the manufacturer shall operate the test engine over the applicable test cycle (i.e., NRTC or applicable steady-state cycle) until the OR OBD system stores the MIL-on/confirmed fault code and illuminates the MIL.

I. The manufacturer shall demonstrate the OBM NOx monitor's ability to make a diagnostic decision from a 2,400-window block of data comprised of windows from different operating cycles. To do so, when operating the test engine over the applicable test cycles, the manufacturer shall separate test cycles by a soak period of at least five minutes such that storing the pending fault code requires at least two ignition cycles and storing the MIL-on/confirmed fault code requires at least two ignition cycles.

II. To expedite malfunction detection, when operating the test engine over the applicable test cycles, the manufacturer may run two repetitions of the appropriate test cycle within one ignition cycle. For example, a test sequence may consist of two NRTCs, a five-minute engine soak, two NRTCs to store the pending fault code, a five-minute engine soak, two NRTCs, a five-minute engine soak, and two more NRTCs to store the MIL-on/confirmed fault code.

III. For engines certified to transient test standards, the malfunction detection cycle shall be the NRTC for the OBM NOx emission threshold monitor.

ii. For diagnostics (except the OBM NOx emission threshold monitor) that are designed to run on the NRTC in accordance with section (f)(3)(A)3.:

I. If the emission threshold malfunction criteria are based on the NRTC/transient test standard as determined in section (f)(5)(A)3., except as provided in section (g)(3)(D)3.a.v. below, the manufacturer shall operate the test engine over the NRTC to allow for initial detection of the malfunction (i.e., storage of a pending fault code). If a cold soak is required to run the diagnostic, the manufacturer may perform a cold soak prior to conducting this cycle.

II. If the emission threshold malfunction criteria are based on the applicable steady-state cycle/steady-state test standard as determined in section (f)(5)(A)3., except as provided in section (g)(3)(D)3.a.v. below, the manufacturer shall operate the test engine over the NRTC to allow for initial detection of the malfunction (i.e., storage of a pending fault code), then over a second NRTC to allow the OR OBD system to store a MIL-on/confirmed fault code and illuminate the MIL. If a cold soak is required to run the diagnostic, the manufacturer may perform a cold soak prior to conducting these cycles.

iii. For diagnostics (except the OBM NOx emission threshold monitor) that are designed to run on the applicable steady-state cycle in accordance with section (f)(3)(A)3., except as provided in section (g)(3)(D)3.a.v. below, the manufacturer shall operate the test engine over the applicable steady-state cycle to allow for initial detection of the malfunction (i.e., storage of a pending fault code). If a cold soak is required to run the diagnostic, the manufacturer may perform a cold soak prior to conducting this cycle.

iv. For diagnostics designed to run over alternate monitoring conditions other than the NRTC and the applicable steady-state cycle that were approved under section (f)(3)(D), the manufacturer shall operate the test engine over the alternate conditions to allow for initial detection of the tested system or component malfunction (i.e., storage of a pending fault code), then over the alternate conditions again to allow for the OR OBD system to store the MIL-on/confirmed fault code and illuminate the MIL.

v. The manufacturer shall omit the malfunction detection cycle(s) under sections (g)(3)(D)3.a. above if:

I. Initial detection of the tested system or component malfunction (i.e., storage of the pending fault code) was achieved

during the malfunction preconditioning cycle under section (g)(3)(D)2.b or c., or

II. The diagnostic stores a MIL-on/confirmed fault code and illuminates the MIL after the first detection of the malfunction.

b. Exhaust Emission Test. After the manufacturer has met the malfunction detection cycle requirements under section (g)(3)(D)3.a. above, the manufacturer shall operate the test engine over the exhaust emission test (transient test or steady-state test) determined by section (f)(5)(A)3. or (f)(5)(A)4.

i. For the OBM NOx emission threshold monitor, the manufacturer shall operate the test engine over the NRTC exhaust emission test.

ii. Except as provided below, the exhaust emission test shall not include any other test cycle (e.g., any test cycle used to precondition the engine specifically for demonstrating compliance with the tailpipe emission standards) prior to running the exhaust emission test cycle. The manufacturer may request Executive Officer approval to operate the engine on an additional test cycle or other operating conditions prior to running the exhaust emission test. Executive Officer approval shall be granted upon determining that a manufacturer has provided data or an engineering evaluation that are complete and accurate and that demonstrate that the additional test cycle or conditions is necessary to stabilize the emission control system.

c. Regeneration Emission Test. On engines equipped with PM filters that experience infrequent regeneration events, the manufacturer shall operate the test engine over the applicable test cycle (NRTC or applicable steady-state cycle) and trigger a PM filter regeneration event during this test (i.e., the regeneration emission test). The manufacturer shall run the regeneration emission test:

i. Immediately following the exhaust emission test under section (g)(3)(D)3.b. for each diagnostic, or

ii. After all exhaust emission tests under section (g)(3)(D)3.b. for all diagnostics have been completed.

4. Test Data Collection.

a. The manufacturer shall collect the following data during the test cycle in which the MIL is illuminated: Approximate time on the test cycle (in seconds after engine start) when the MIL illuminates (e.g., MIL illuminated at 200 seconds into the NRTC).

b. The manufacturer shall collect the following emission test data during the exhaust emission test and regeneration emission test under sections (g)(3)(D)3.b. and c.: NMHC, CO, NOx, and PM emissions data as applicable (based on the applicable emission threshold malfunction criteria for the monitor or diagnostic).

c. The manufacturer shall collect an OR OBD data snapshot immediately prior to engine shut-down at the end of each test cycle under section (g)(4)(D) (e.g., at the end of each malfunction preconditioning cycle, at the end of the exhaust emission test). If the manufacturer cannot collect the OR OBD data snapshot immediately prior to an engine shut-down, the manufacturer shall collect the data immediately after the engine shut-down.

5. Exceptions to Testing Protocol. For a manufacturer required to test more than one test engine under section (g)(2)(A)3., the manufacturer may utilize internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain the emission test data required in section (g)(3)(D)4.b. for all but one of the required test engines. The manufacturer may use this option if the data from the alternative test procedure are representative of official emission test results. Manufacturers using this option are still responsible for meeting the emission threshold malfunction criteria specified in section (f) when emission tests are performed in accordance with official test procedures.

(4) *Evaluation Criteria*.

(A) For the tailpipe NOx mass accuracy test conducted in accordance with section (g)(3)(C), the test shall be considered a pass if the absolute error of the tailpipe NOx mass emission rate of the OR OBD system relative to the test facility (determined according to section (h)(2)(C)4.e.) complies with the accuracy requirements of section (e)(2)(D)1.h.i.

(B) For each diagnostic test conducted in accordance with section (g)(4)(D):

1. The test shall be considered a pass if all the following occurs:

a. The tested diagnostic detects the malfunction, stores a MIL-on/confirmed fault code, and illuminates the MIL before the end of the exhaust emission test specified in section (g)(3)(D)3.b.,

b. The emissions data collected during the exhaust emission test in accordance with section (g)(3)(D)4. are below the applicable emission threshold malfunction criteria specified in section (f), and

c. No default mode of operation or emission control strategy is activated when the tested diagnostic detects the malfunction.

2. The test shall be considered a fail if any of the following occurs:

a. The tested diagnostic does not store a MIL-on/confirmed fault code before the end of the exhaust emission test specified in section (g)(3)(D)3.b.,

b. The tested diagnostic does not illuminate the MIL before the end of the exhaust emission test specified in section (g)(3)(D)3.b., or

c. The tested diagnostic detects the malfunction, no default mode of operation or emission control strategy is activated when the malfunction is detected, and the emissions data collected during the exhaust emission test in accordance with section (g)(3)(D)4. exceed the applicable emission threshold malfunction criteria specified in section (f) for any emission constituent.

3. If the tested diagnostic illuminates the MIL with emissions below the applicable emission threshold malfunction criteria specified in section (f) and a default fuel or emission control strategy is activated when the malfunction is detected, the manufacturer shall retest the test engine with the tested system or component adjusted to the worst acceptable limit (i.e., adjusted to the level of performance where the tested diagnostic indicates the system or component's performance is passing but at the closest possible value relative to the monitor or diagnostic threshold value at which a malfunction would be detected that would invoke the default mode of operation and illuminate the MIL).

a. The retest shall be considered a pass if emissions are below the applicable emission threshold malfunction criteria specified in section (f) for the tested diagnostic. The manufacturer may request the Executive Officer to accept test data when the system or component's performance is at the worst acceptable limit within a margin of error necessary to accommodate testing variability or other practical limitations in setting the performance at the absolute worst acceptable limit. The Executive Officer shall accept the test data upon determining that the test data adequately demonstrate that emissions do not exceed the applicable malfunction criteria at the tested

worst acceptable limit and that emissions will not exceed the applicable emission threshold malfunction criteria before the performance exceeds the monitor or diagnostic threshold for malfunction detection.

b. The retest shall be considered a fail if emissions for any emission constituent are above the applicable emission threshold malfunction criteria specified in section (f) for the tested diagnostic.

c. In lieu of retesting using a system/component adjusted to the worst acceptable limit as described above, the manufacturer may request Executive Officer approval to use computer modifications to disable the default fuel or emission control strategy when retesting the engine. Prior to retesting the engine, the manufacturer shall submit a proposed test plan for Executive Officer approval that identifies the computer modifications that will be used to disable the default fuel or emission control strategy. The Executive Officer shall approve the plan upon determining that the test data or engineering evaluation submitted by the manufacturer are complete and accurate and demonstrate that testing the engine with the computer modifications used to disable the default fuel or emission control strategy produce emissions results equivalent to testing the engine with the production-level calibration (i.e., emissions data from back-to-back tests of an engine with no malfunctions installed are equivalent, with one test not using the computer modifications and the other test(s) using the computer modifications).

i. The retest shall be considered a pass if the criteria under section (g)(4)(B)1. are met.

ii. The retest shall be considered a fail if the criteria under section (g)(4)(B)2. are met.

4. If the tested diagnostic illuminates the MIL with emissions above the applicable emission threshold malfunction criteria specified in section (f) and a default fuel or emission control strategy is activated when the malfunction is detected, the manufacturer shall retest the test engine with the tested system or component adjusted to the worst acceptable limit (i.e., adjusted to the level of performance where the tested diagnostic indicates the system or component's performance is passing but at the closest possible value relative to the monitor or diagnostic threshold value at which a malfunction would be detected that would invoke the default mode of operation and illuminate the MIL).

a. The retest shall be considered a pass if emissions are below the applicable emission threshold malfunction criteria specified in section (f) for the tested diagnostic. The manufacturer may request the Executive Officer to accept test data when the system or component's performance is at the worst

acceptable limit within a margin of error necessary to accommodate testing variability or other practical limitations in setting the performance at the absolute worst acceptable limit. The Executive Officer shall accept the test data upon determining that the test data adequately demonstrate that emissions do not exceed the applicable malfunction criteria at the tested worst acceptable limit and that emissions will not exceed the applicable emission threshold malfunction criteria before performance exceeds the monitor or diagnostic threshold for malfunction detection.

b. The retest shall be considered a fail if emissions for any emission constituent are above the applicable emission threshold malfunction criteria specified in section (f) for the tested diagnostic.

c. In lieu of retesting using a system/component adjusted to the worst acceptable limit as described above, the manufacturer may request Executive Officer approval to use computer modifications to disable the default fuel or emission control strategy when retesting the engine. Prior to retesting the engine, the manufacturer shall submit a proposed test plan for Executive Officer approval that identifies the computer modifications that will be used to disable the default fuel or emission control strategy. The Executive Officer shall approve the plan upon determining that the test data or engineering evaluation submitted by the manufacturer are complete and accurate and demonstrate that testing the engine with the computer modifications used to disable the default fuel or emission control strategy produce emissions results equivalent to testing the engine with the production-level calibration (i.e., emissions data from back-to-back tests of an engine with no malfunctions installed are equivalent, with one test not using the computer modifications and the other test(s) using the computer modifications).

i. The retest shall be considered a pass if the criteria under section (g)(4)(B)1. are met.

ii. The retest shall be considered a fail if the criteria under section (g)(4)(B)2. are met.

5. If a test for a diagnostic is considered a fail, the manufacturer may recalibrate the diagnostic (e.g., change the malfunction criteria limit, change the monitoring conditions) and retest the system on the same test engine.

a. The manufacturer shall retest all diagnostics that were tested prior to the recalibration and are affected by the recalibration.

b. All diagnostics that are retested shall considered a pass or fail based on the conditions in section (g)(4)(B)1. through 4. above.

(h) *Certification Documentation Requirements*.

(1) *Requirement*. The manufacturer is required to submit an application (i.e., certification documentation) to the Executive Officer for certification of the OR OBD system on an engine each model year. The application shall include all the information required under section (h)(2).

(A) If any of the items listed in section (h)(2) below are standardized for all of a manufacturer's engines, the manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its engines.

(B) In lieu of submitting an application for the OR OBD system on each engine, the manufacturer may submit an application for the OR OBD system on one engine that is also representative of other engines (e.g., one engine that is representative of multiple engine ratings within an engine family, one engine representing more than one engine family) if the criteria below are met. The grouping of engines shall be referred to as an "OR OBD certification documentation group."

1. The representative engine shall be from the engine family that has the highest projected California sales number among the engine families in the OR OBD certification documentation group and be from the engine rating with the highest projected California sales number among the engine ratings in the engine family. The manufacturer shall determine the engine family and engine rating with the highest projected California sales based on sales data from the previous 3 model years and projected market demand. For engines without 3 years of sales data history, the manufacturer shall estimate the highest projected sales based on available market data.

2. The grouping shall consist of engines that are certified to the same NOx and PM emission standards, with the exception that engines certified to FELs that are used in lieu of specific NOx and PM emission standards can be grouped with engines that are certified to those specific NOx and PM emission standards.

3. The grouping shall not consist of a subset of engines required to meet the Stage 1 requirements under section (d)(1) and another subset of engines required to meet the Stage 2 requirements under section (d)(2).

4. For a grouping of engines required to meet the Stage 2 requirements, the grouping shall not consist of a subset of engines required to meet the OBMD diagnostic requirements in section (f)(1) (i.e., engines that are equipped with an SCR system or tailpipe NOx sensor) and another subset of engines required to meet the OBD diagnostic requirements in section (f)(2) (i.e., engines that are not equipped with an SCR system or tailpipe NOx sensor).

(C) To the extent possible, the certification documentation shall use SAE J1930 or SAE J2403 terms, abbreviations, and acronyms.

(2) *Required Certification Documentation*. For each application, the manufacturer shall submit the applicable documentation specified below.

(A) For engines required to meet the Stage 1 requirements of section (d)(1):

1. A cover letter including the following information (for OR OBD certification documentation groups, the information shall be provided for all engines in the group, with the information for the representative engine distinguished from the information for the other engines):

a. The manufacturer name;

b. The model year of the engine;

c. The engine family, engine rating, and power category of the engine;

d. The types of equipment the engines will be used in;

e. A statement that the engines are meeting the Stage 1 requirements;

f. The emission standards the engines are being certified to;

g. All deficiencies applicable to the equivalent previous model year engines, the changes or resolution of each deficiency for the current model year engines, and all other known issues that apply to the current model year engines (e.g., issues found on another engine that also apply to these engines, unresolved issues identified during post-certification verification under section (i) from a previous model year); and

h. A statement of compliance indicating that the OR OBD system(s) on the engines in the application complies with the requirements of section 2422, with the exception of issues indicated under section (h)(2)(A)1.h. above (if applicable), and indicating that the manufacturer will comply with the required deadlines for submission of results/data for post-certification verification according to section (i).

2. A written identification of the communication protocol (SAE J1939 or ISO 15765-4) utilized by the engines for communication with a scan tool.

3. A diagram of the emission control system on the engine.

4. Information about the CVN algorithm used (CRC-16 or CRC-32).

5. For engines equipped with an SCR system, a description of each of the DEF dosing modes employed by the engine, the conditions under which each mode is activated, and an explanation of how each mode is represented in the associated standardized data stream signal required in section (e)(2)(C)2.a.xl.

6. The following data to support compliance with the Stage 1 standardization requirements under section (e)(2) (for OR OBD certification documentation groups, the data is required only for the representative engine):

a. OR OBD data snapshot. The manufacturer shall obtain OR OBD data snapshots from an engine both before and after operating the engine over certification test cycles repeated as necessary to achieve at least one hour of operation.

b. A log of data stream signals recorded over the period of engine operation indicated in section (h)(2)(A)6.a. above. The data shall be time aligned at a frequency of 1 Hertz and submitted in a CSV file format. The log shall include the following signals if the engine is so equipped: engine speed, actual indicated engine torque, nominal engine friction torque, engine coolant temperature, engine oil temperature, engine fuel rate, modeled exhaust flow rate, engine intake manifold temperature, air flow rate from mass air flow sensor, fuel injection timing, EGR mass flow rate, commanded EGR valve duty cycle/position, actual EGR valve duty cycle/position, EGR error between actual and commanded, boost pressure, commanded/target boost pressure, PM filter inlet temperature, PM filter outlet temperature, exhaust gas temperature sensor output, variable geometry turbocharger position, corrected NOx sensor output, DEF dosing mode, stability of NOx sensor reading, commanded DEF dosing, DEF dosing rate, charge air cooler outlet temperature, SCR intake temperature, SCR outlet temperature, modeled actual ammonia storage level on SCR, and target ammonia storage level on SCR.

(B) For engines required to meet the Stage 2 requirements of section (d)(2):

1. A cover letter including the following information (for OR OBD certification documentation groups, the information shall be provided for all engines in the group, with the information for the representative engine distinguished from the information for the other engines):

a. The manufacturer name;

b. The model year of the engine;

c. The engine family, engine rating, and power category of the engine;

d. For an OR OBD certification documentation group, the engine families, engine ratings, and power categories of all the engines in the group;

e. The types of equipment the engines will be used in;

f. A statement that the engines are meeting the Stage 2 requirements;

g. The emission standards the engine(s) is being certified to;

h. A statement indicating the diagnostic requirements the engines are required to meet (the OBMD diagnostic requirements under section (f)(1) or the OBD diagnostic requirements under section (f)(2));

i. All deficiencies applicable to the equivalent previous model year engines, the changes or resolution of each deficiency for the current model year engines, and all other known issues that apply to the current model year engines (e.g., issues found on another engines that also apply to these engines, unresolved issues identified during post-certification verification under section (i) from a previous model year); and

j. A statement of compliance indicating that the OR OBD system(s) on the engines in the application complies with the requirements of section 2422, with the exception of issues indicated under section (h)(2)(B)1.i. above (if applicable), and indicating that the manufacturer will comply with the required deadlines for submission of results/data for post-certification verification according to section (i).

2. A written identification of the communication protocol (SAE J1939 or ISO 15765-4) utilized by the engine for communication with a scan tool.

3. A timeline showing the start of engine production for the engine rating (or for each engine rating in an OR OBD certification documentation group), the start of equipment production for each equipment used with the engine (or for each equipment used by the engines in an OR OBD certification documentation group), and the required deadlines for post-certification verification (according to section (i)).

4. A diagram of the emission control system on the engine.

5. A description of the functional operation of the OR OBD system consisting of a complete written description for each diagnostic strategy required under section (f) that outlines every step in the decision-making process of the diagnostic. The manufacturer shall include algorithms, diagrams, or samples of data where necessary to adequately describe the information.

6. A table that meets the following requirements:

a. For each monitor or diagnostic required under section (f), the table shall include the following information:

i. The name of the monitored component or system;

ii. The corresponding fault code for the monitor or diagnostic;

iii. The monitor or diagnostic strategy description (e.g., “filtering performance emission threshold” for the PM filter, “circuit high” for a sensor);

iv. The malfunction criteria parameter used to detect a malfunction (e.g., pressure sensor reading);

v. The malfunction criteria threshold for the malfunction criteria parameter used to determine if there is a malfunction (e.g., pressure sensor reading is below a specific level);

vi. The secondary parameters and their corresponding enable conditions necessary to run the monitor or diagnostic (e.g., engine speed < 1000 revolutions-per-minute), and the fault code(s) that disable the diagnostic;

vii. The time required for the monitor or diagnostic to run and complete;

viii. Whether the diagnostic runs on the NRTC, the applicable steady-state cycle, or neither the NRTC nor the applicable steady-state cycle;

ix. The number of times the diagnostic can run in an operating cycle (e.g., continuously/under all operating conditions, once per operating cycle, anytime the monitoring conditions are met in an operating cycle);

x. The criteria for storing each fault code (e.g., malfunction detected two times in an operating cycle before a pending fault code is stored); and

xi. The number of operating cycles required to illuminate the MIL (i.e., the number of operating cycles in which the monitor or diagnostic has to run and detect a malfunction to illuminate the MIL).

b. The table shall use the following engineering units:

i. Degrees Celsius (°C) for temperature criteria;

ii. KiloPascals (kPa) for pressure criteria;

iii. Grams (g) for intake air mass criteria;

iv. Miles-per-hour (mph) for vehicle speed criteria;

v. Relative percent (%) for relative throttle position criteria (as defined in SAE J1939 or SAE J1979-2 (whichever is applicable));

vi. Voltage (V) for absolute throttle position criteria (as defined in SAE J1939 or SAE J1979-2 (whichever is applicable));

vii. Milligrams-per-stroke (mg/stroke) for fuel quantity-based per ignition event criteria and per stroke (/stroke) for other changes per ignition event based criteria (e.g., airflow in g/stroke instead of g/rev or g/firing);

viii. Per second for changes per time based criteria (e.g., g/sec); and

ix. Percent of nominal tank volume (%) for fuel tank level criteria.

c. If the application is for an OR OBD certification documentation group (as described in section (h)(1)(B)), the table shall include the information for all the diagnostics covered by all the engines within the group. For a diagnostic that is not implemented on all the engines in the group (e.g., a diagnostic that is implemented on the representative engine but not on all other engines in the group, a diagnostic that is not implemented on the representative engine but is implemented on another engine in the group), the table shall indicate the engine rating(s) and engine family(ies) that the diagnostic is implemented on.

7. A scale drawing of the MIL which specifies the location (in the instrument panel or elsewhere on the equipment), wording, color, and intensity.

8. A listing of all electronic powertrain input and output signals (including those not monitored by the OR OBD system) that identifies which signals are monitored by the OR OBD system.

9. For each diagnostic required to detect a malfunction when a specific emission threshold is exceeded in sections (f)(1) and (f)(2):

a. Data supporting the criteria used to detect a malfunction,

b. The test cycle and standard used as the “applicable emission test cycle” and “applicable standard” of which the malfunction criteria emission threshold is based on (e.g., for engines that are certified to transient test standards, the test cycle and standard determined by the manufacturer to be the most stringent in accordance with section (f)(5)(A)3.),

c. The malfunction criteria emission threshold level (e.g., 0.060 g/kW-hr), and

d. For engines with emission controls that experience infrequent regeneration events, the adjustment factors determined by the manufacturer and all details of how each adjustment factor was calculated for each applicable diagnostic in accordance with section (f)(5)(B).

10. A list of all the malfunction criteria required to be detected in section (f) and the corresponding diagnostic noted by fault code that detects each malfunction criterion.

11. A list of the test results required to be made available under section (e)(3)(D).

a. For engines using the SAE J1939 protocol for the standardized functions required in section (e), the information shall include all of the following for each test result:

i. Suspect Parameter Number (SPN) Description;

ii. SPN;

iii. Failure Mode Identifier (FMI) Description;

iv. FMI;

v. Minimum test value;

vi. Maximum test value; and

vii. Unit for the minimum and maximum test values.

b. For engines using the ISO 15765-4 protocol for the standardized functions required in section (e), the information shall include all of the following for each test result:

i. Monitor ID Name;

ii. Monitor ID (MID);

iii. Test ID Name;

iv. Test ID (TID);

v. Minimum test value;

vi. Maximum test value;

vii. Unit for the minimum and maximum test values; and

viii. The corresponding diagnostic noted by fault code.

12. A written description of all parameters and conditions necessary to begin closed-loop/feedback control of emission control systems (e.g., fuel system, EGR flow, PM filter regeneration).

13. Data displaying the net brake torque reported by the engine dynamometer and the "calculated net brake torque" during the NRTC and the steady-state cycle used for certification for engines that certify to the transient test standard and during the steady-state cycle for engines that do not certify to the transient test standard. To generate the data, the manufacturer shall use an engine with no malfunctions on the system (engine, engine emission controls, aftertreatment). The manufacturer shall determine the "calculated net brake torque" using data stream signals "reference engine maximum torque," "actual indicated engine torque," and "nominal engine friction torque," and the following equation:

$$Calculated\ net\ brake\ torque = (reference\ engine\ maximum\ torque) \times \frac{[(actual\ indicated\ engine\ torque) - (nominal\ engine\ friction\ torque)]}{100}$$

14. A written description of each AECD utilized by the engine including the sensor signals and calculated values used to invoke each AECD, the engineering data and analysis demonstrating the need for such an AECD, the actions taken when each AECD is activated, the expected in-use frequency of operation of each AECD, and the expected emission impact from each AECD activation. The manufacturer is not required to include the AECD information in the OR OBD system certification documentation if the information has been submitted to the Executive Officer as part of the application for tailpipe emissions certification of Tier 5 off-road engines. If the manufacturer does not include the AECD information in the OR OBD system certification documentation, the manufacturer shall provide a statement indicating that the AECD information has been submitted as part of the application for tailpipe emissions certification.

15. Information about the CVN algorithm used (CRC-16 or CRC-32).

16. For engines equipped with an SCR system, a description of each of the DEF dosing modes employed by the engine, the conditions under which each

mode is activated, and an explanation of how each mode is represented in the associated standardized data stream signal required in section (e)(2)(C)2.a.xl.

17. For the demonstration testing required under section (g):

a. The manufacturer shall provide the following information:

i. The baseline emissions test data (section (g)(3)(B));

ii. A description of the testing sequence (e.g., the number and types of malfunction preconditioning cycles used, the number and types of malfunction detection cycles used, if and when a regeneration emission test is used) for each tested monitor or diagnostic (section (g)(4)(D));

iii. A description of the method used for implanting the malfunction for each tested monitor or diagnostic (e.g., description of the modified or deteriorated component/system, computer modifications) (section (g)(3)(D)2.);

iv. The test data required to be collected in section (g)(3)(D)4. For each tested monitor or diagnostic; and

v. A summary of any issues that were found during testing under section (g), including issues where the engine does not meet one or more of the requirements in section 2422 (e.g., a diagnostic does not detect a malfunction when emissions exceed the applicable emission threshold malfunction criteria in section (f)).

b. If the manufacturer does not have all the information required in section (h)(2)(B)17.a. above at the time of the OR OBD certification application submission, the manufacturer may request Executive Officer approval for conditional certification of the OR OBD system prior to the submittal of the information. The manufacturer shall include with the request the reason for the delay in the information submission and the length of time until the information will be available. The Executive Officer will approve the request if the delay is due to unforeseen circumstances outside of the manufacturer's control, the information will be available and submitted to the Executive Officer within 3 months from the date of the OR OBD system conditional certification, and, if applicable, the manufacturer has shown previous success in submitting the information prior to certification for previous OR OBD systems. If the Executive Officer approves the conditional certification for the OR OBD system, the conditional certification shall expire 4 months after the date of the OR OBD system conditional certification.

(C) For engines equipped with an SCR system or a tailpipe NOx sensor:

1. Information on Pausing of OR-REAL Tracking.

a. For Stage 1 engines, a list of manufacturer diagnostics and respective fault codes for malfunctions that pause tracking of OR-REAL data under sections (e)(2)(D)1.f.ii. and iii.

b. For Stage 2 engines, a list of diagnostics and respective fault codes for malfunctions that pause tracking of OR-REAL data under sections (e)(2)(D)1.g.ii. and iii.

2. 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 all parameters and conditions that are technically necessary to cause each NOx sensor to subsequently cease or pause reporting NOx concentration data.

3. Data identifying the NOx sensor status information(for each NOx sensor during the test cycle the engine uses for emissions certification.

a. For engines that certify to the transient test standard, the manufacturer shall provide these data by operating the engine over the cold-start NRTC and hot-start NRTC.

b. For engines that do not certify to the transient test standard, the manufacturer shall provide these data by operating the engine over a steady-state test cycle (i.e., the discrete-mode cycle or RMC).

c. The data shall identify the NOx sensor status (i.e., if the NOx sensor is actively reporting NOx concentration data and if the NOx sensor is not reporting NOx concentration data) and, for each change in NOx sensor status, 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 NOx concentration data due to the exhaust temperature exceeding a certain value, from actively reporting NOx concentration data to not reporting NOx concentration data due to sensor instability).

d. The manufacturer shall use an engine with no malfunctions on the system (engine, engine emission controls, and aftertreatment).

4. Data collected during tailpipe NOx mass accuracy testing as described in the demonstration testing requirements in section (g)(3)(C).

a. Data from the OR OBD System.

i. A file in CSV format with all the data that were continuously logged over both the preconditioning cycle and the test cycle.

ii. For NRTC or RMC-based testing, the summed values over the test cycle (not the preconditioning cycle) for engine-out NOx mass (if equipped), system-out NOx mass, and engine output energy.

iii. For discrete-mode cycle based testing, a table which contains (1) for each mode, the summed values for engine-out NOx mass (if equipped), system-out NOx mass, and engine output energy for the portion of the mode over which the test facility conducted emissions sampling; and (2) the weighted sum of all these values using the standard weighting factors defined in Appendix II to 40 CFR Part 1039.

b. *Data from the Test Facility for NRTC or RMC-Based Testing*.

i. A file in CSV format with all the data that were continuously logged over the test cycle.

ii. The summed values over the test cycle for system-out NOx mass and net brake work.

c. *Data from the Test Facility for Discrete-Mode Cycle-Based Testing*.

i. A table with all the data that were collected for each mode of the test cycle with one row of data per mode.

ii. The weighted sum of system-out NOx mass and net brake work over all modes using the standard weighting factors defined in Appendix II to 40 CFR Part 1039.

d. *NOx Data Plot*. A plot of the system-out NOx mass emission rate from the OR OBD system and the system-out NOx mass emission rate from the test facility versus time over the test cycle (not the preconditioning cycle). For discrete-mode cycle-based testing, the test facility data shall be rendered as a dot for each mode.

e. *Absolute Error Calculation*. The test facility system-out NOx mass value shall be subtracted from the OR OBD system-out NOx mass value. The resulting value shall be divided by the test facility's net brake work. The resulting value shall be the absolute error (in units of g/kWh) of the tailpipe NOx mass emission rate of the OR OBD system relative to the test facility.

(3) *Certification Documentation Submission*. The manufacturer shall submit the certification documentation described in sections (h)(1) and (h)(2) above to CARB through XXXX@arb.ca.gov.

(i) *Post-Certification Verification Requirements*.

(1) *Verification of Standardized Requirements*.

(A) *Requirement*. For engines required to meet the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall perform testing to verify that engines installed in equipment meet the standardization requirements of section (e) relevant to proper communication of required OR OBD-related messages between DEC ECUs and to an SAE J1939/J1978-2 scan tool.

1. The manufacturer shall perform the testing each model year on engines installed in the applicable equipment (i.e., production equipment).

2. The manufacturer shall perform the testing in section (i)(1)(D) no later than 3 months after the start of engine production or 1 month after the start of equipment production, whichever is later. The manufacturer shall submit the test log file and test report to the Executive Officer in accordance with the deadlines specified in section (i)(1)(E) below.

3. The manufacturer is not required to test and submit the test log file and test report for a production equipment in accordance with section (i)(1) if:

a. The manufacturer has previously submitted the data for production equipment from all engine ratings and power categories in all engine families, and

b. The engine, emission control system, and calibrations of the OR OBD system in all the previously tested engines have not changed to the extent that the standardized functions are affected since the engine was tested.

4. The manufacturer may request Executive Officer approval to carry over data from testing of previous model year engines. The Executive Officer shall approve the request upon finding that the software and hardware designed to comply with the standardization requirements of section (e) are identical to those of the previous model year and no other hardware or software changes that affect compliance with the standardization requirements have been made.

(B) *Test Engine and Equipment*. The manufacturer shall perform this testing every model year on 1 production engine per engine family with the engine installed in the applicable equipment.

1. For an engine family with more than one engine with a unique calibration, the manufacturer shall test the calibration for the engine with the highest projected California sales number in the engine family for the given model year.

2. For an engine that is intended to be installed in more than one type of equipment, the manufacturer shall perform the testing with the engine installed in the applicable equipment with the highest projected California sales number for the given model year of the engine.

3. When determining the engine with the highest projected California sales number in section (i)(1)(B)1., the manufacturer shall exclude engines that are not required to meet the Stage 2 requirements under section (d)(2).

4. For the engine with the highest projected California sales number in a given model year, if the manufacturer had already tested this engine but had not tested all the engine/equipment combinations for that engine in the previous model years, the manufacturer shall exclude the equipment used in the engine/equipment combinations already tested when determining the equipment with the highest projected California sales number.

5. For a given engine model year, if the manufacturer had tested the engine with the highest projected California sales number and with all engine/equipment combinations for that engine in the previous model years, the manufacturers shall exclude this engine when determining the engine with the highest projected California sales number.

(C) *Off-Board Device for Testing*.

1. For the testing required in section (i)(1)(D), the manufacturer shall utilize an Executive Officer-approved off-board device to conduct the testing.

2. Prior to conducting testing, the manufacturer shall request Executive Officer approval of the off-board device that the manufacturer will use to perform the testing. The Executive Officer shall approve the off-board device if the manufacturer submitted data, specifications, or engineering analysis that are complete and accurate and demonstrate that the device will verify that the production equipment will be able to perform all of the required functions in section (i)(1)(D) for the specific engine. The manufacturer shall not perform the testing with an off-board device that has not been approved by the Executive Officer.

(D) *Required Testing*.

1. The testing shall verify that communication can be properly established between any DEC ECU and a SAE J1939/ J1978-2 scan tool.

2. The testing shall verify that all applicable information required in section (i)(1)(D)3. is properly communicated between any DEC ECU and a SAE J1939/J1978-2 scan tool in accordance with the requirements in section (e) and the applicable ISO and SAE specifications (e.g., specifications for physical layer, network layer, message structure, and message content).

3. The testing shall verify that the following information can be properly communicated to a SAE J1939/J1978-2 scan tool:

a. The MIL status while the MIL is commanded off and while the MIL is commanded on (as required in section (e)(3)(E)) in accordance with SAE J1939/J1979-2 under the following conditions:

i. In the key on, engine off position, during the functional check of the MIL (section (e)(3)(A)4.); and

ii. While the engine is running,;

b. All data stream signals required in sections (e)(2)(C) and (e)(3)(E) in accordance with SAE J1939/J1979-2 including the proper identification of each data stream signal as supported in SAE J1939/J1979-2;

c. All tracking data required in sections (e)(2)(D) and (e)(3)(F) in accordance with SAE J1939/J1979-2;

d. All test results required in section (e)(3)(D) in accordance with SAE J1939/J1979-2;

e. The CAL ID and CVN in accordance with SAE J1939/J1979-2 and sections (e)(2)(E) and (e)(2)(F); and

f. Except as provided for in section (i)(1)(D)5. below, a pending fault code and MIL-on/confirmed fault code, the correct number of stored fault codes, MIL status, and freeze frame information for each DEC ECU in accordance with SAE J1939/J1979-2.

4. The testing shall verify that all DEC ECUs can properly respond to a SAE J1939/J1978-2 scan tool request to erase emission-related diagnostic information in accordance with section (e)(3)(G).

5. The manufacturer may be exempt from verifying a fault code from a specific DEC ECU can be properly communicated to a SAE J1939/J1978-2 scan tool under section (i)(1)(D)3.f. above if the malfunction cannot be implanted without damaging the engine or its components.

(E) *Reporting of Results*.

1. For each test, the manufacturer shall submit to the Executive Officer the test log file and a report containing all information described in sections (i)(1)(E)2. within the deadlines described in sections (i)(1)(E)3. and 4. below for each test.

2. The manufacturer shall include the following information in the report for each test:

a. Test log filename,

b. Date the test log file was submitted to CARB,

c. Date the test was conducted,

d. Engine manufacturer,

e. Engine model year,

f. OR OBD certification documentation group (if applicable),

g. Engine Family,

h. Engine Rating,

i. Power category,

j. Powertrain type (i.e., conventional, hybrid electric),

k. Start of engine production date,

l. Start of equipment production date,

m. Testing tool name and release number,

n. Number of warnings,

o. Number of failures,

p. For each warning:

i. Warning message,

ii. Description/explanation of warning,

iii. Test number,

q. For each failure:

i. Failure message,

ii. One of the following failure classifications:

I. Non-compliance failure (i.e., failure that is a non-compliance described under section (k)(8)),

II. Section 2422 standardization failure (i.e., failure due to the OR OBD system not complying with the standardization requirements of section 2422),

III. Testing tool specification failure (i.e., failure incorrectly identified by the tool's software),

IV. Operator/user error failure, or

V. Other failure (e.g., incorrect failure due to the equipment not meeting the requirement based on the implementation schedule),

iii. Description/explanation of failure,

iv. Test number,

r. For each warning and failure identified, any additional notes, including corrective actions taken (e.g., running changes, field fixes, future model year updates) and titles and dates of presentations describing the issues/failures for a test.

3. If the production equipment meets or passes all the required testing in section (i)(1)(D), the manufacturer shall submit to the Executive Officer the following information within three months of testing: the test log file, the report containing all information described in section (i)(1)(E)2., and a statement specifying that the production equipment passed all the tests.

4. If the production equipment fails any of the required testing in section (i)(1)(D), the manufacturer shall submit to the Executive Officer the following information within one month of identifying the issue: the test log file, the report containing all information described in section (i)(1)(E)2., information about the problem(s) identified, and a corrective action plan to remedy the problem(s).

(F) *Test Report Submission*. The manufacturer shall submit the test log file, test report, and other information described in section (i)(1)(E) above to CARB through XXXX@arb.ca.gov.

(2) *Verification of Diagnostic Requirements*.

(A) *Requirement*. For engines required to meet the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall perform testing to verify that engines installed in equipment meet the diagnostic requirements of section (f) relevant to the ability of the OR OBD system to detect a malfunction, illuminate the MIL, and store pending and MIL-on/confirmed fault codes readable by a scan tool

conforming to SAE J1939/J1978-2 when a malfunction is present for each individual diagnostic required by section (i)(2)(C)2. below.

1. The manufacturer shall perform the testing each model year on engines installed in the applicable equipment (i.e., production equipment).

2. The manufacturer shall perform the testing in section (i)(2)(C) and submit the test report (described in section (i)(2)(D)) no later than 6 months after the start of engine production or equipment production, whichever is later.

3. The manufacturer is not required to test and submit the test log file and test report for a production equipment in accordance with section (i)(2) if:

a. The manufacturer has previously submitted the data for all engine/equipment combinations for all engine ratings in all engine families, and

b. The engine, emission control system, and calibrations of all the diagnostics required to be tested in section (i)(2)(C)2. in all the previously tested engines have not changed to the extent that the diagnostics are affected since the engine was tested.

(B) *Test Engine and Equipment*.

1. For each engine selected for baseline emissions testing and diagnostic testing under the demonstration testing requirements in section (g)(2)(A), manufacturers shall perform this testing on an engine from the same engine family and rating as the demonstration test engine, with the engine installed in the applicable equipment. For an engine that is intended to be installed in more than one type of equipment, the manufacturer shall perform the testing with the engine installed in the applicable equipment with the highest projected California sales number.

2. For a given test engine, if the manufacturer had already tested this engine but had not tested all the engine/equipment combinations for that engine in the previous model years, the manufacturer shall exclude the equipment used in the engine/equipment combination already tested when determining the equipment with the highest projected California sales number.

(C) *Required Testing*.

1. Test Plan. The manufacturer shall submit a proposed test plan to the Executive Officer for approval prior to performing the testing. The test plan shall identify the method used to induce a malfunction for each required diagnostic, and the conditions under which the production equipment will be operated to run each diagnostic (e.g., on the NRTC, with the engine idling for 5 minutes). The

Executive Officer shall approve the plan upon determining that the test diagnostics, method to induce the malfunction, and the operating conditions meet the requirements in sections (i)(2)(C)2. and (i)(2)(C)3.a.

2. Test Diagnostics. The manufacturer shall test all diagnostics in the OR OBD system on the production equipment except for the following diagnostics:

a. Diagnostics that were tested on the engine as part of the demonstration testing in section (g) (i.e., emission threshold monitors/diagnostics), and

b. Diagnostics for which the testing cannot be reasonably performed without causing physical damage to the engine or equipment (e.g., on-board computer internal circuit faults) or jeopardizing the safety of personnel performing the testing.

3. Test Protocol. For each test diagnostic, the manufacturer shall meet the following testing requirements:

a. The manufacturer shall mechanically implant or electronically simulate the malfunction. The manufacturer shall not use internal on-board computer hardware or software changes to simulate malfunctions.

b. The manufacturer shall operate the production equipment so that all the required monitoring conditions for the diagnostic are satisfied to execute the diagnostic and detect the malfunction. The manufacturer shall operate the engine over the number of operating cycles necessary to store the appropriate MIL-on/confirmed fault code and illuminate the MIL.

c. During testing of a test diagnostic, if another diagnostic detects the malfunction and illuminates the MIL before the test diagnostic, the manufacturer shall retest the test diagnostic to verify if the test diagnostic is able to detect the malfunction and illuminate the MIL (e.g., retest with another method to implant the malfunction to prevent the other diagnostic from detecting the malfunction before the test diagnostic). If the manufacturer is unable to verify that the test diagnostic is able to detect the malfunction and illuminate the MIL during the retest (e.g., if the other diagnostic still detects the malfunction and illuminates the MIL before the test diagnostic), **<TBD>**.

(D) *Test Report*. For each test production equipment, the test report shall include the following information:

1. Report of the results filename;

2. Engine manufacturer;

3. Engine model year;

4. OBD certification documentation group (if applicable);

5. Engine family;

6. Engine rating;

7. Power category;

8. Equipment type;

9. Powertrain type (i.e., conventional, hybrid electric);

10. Start of engine production date;

11. Start of equipment production date;

12. Number of diagnostics tested;

13. Number of problems identified during testing; and

14. For each problem identified:

a. Fault code (SAE J1939, SAE J2012, or manufacturer-defined),

b. Fault code description,

c. Method used to induce malfunction,

d. Fail reason (e.g., diagnostic is unable to detect a malfunction, diagnostic is unable to store a fault code or illuminate the MIL when a malfunction is detected, a different diagnostic detected the malfunction and illuminated the MIL before the tested diagnostic),

e. Description/explanation of problem, and

f. For each problem identified, any additional notes, including corrective actions taken (e.g., running changes, field fixes, future model year updates) and titles and dates of presentations describing the issues/failures for a test.

(E) *Test Report Submission*. The manufacturer shall submit the test report described in section (i)(2)(D) above to CARB through XXXX@arb.ca.gov.

(3) *Verification of Monitor Activity Data Requirements*.

(A) *Requirement*. For engines required to meet the Stage 2 requirements in accordance with section (d)(2), the manufacturer shall collect and report monitor activity data (described in section (e)(3)(F)2.) and other standardized data to verify that engines installed in equipment meet the monitor activity data requirements of sections (e)(3)(F)2. and (f).

1. The manufacturer shall collect the data each model year from engines installed in equipment (i.e., production equipment) that have been operated in the field for at least 9 months.

2. The manufacturer shall collect and submit the data described in section (i)(3)(B) no later than 12 months after the production equipment was first introduced into commerce.

3. The manufacturer is not required to collect and submit data for an engine in accordance with section (i)(3) if the data specified in section (i)(3)(C)12. and 13. (i.e., the monitor activity data and OR OBD data snapshot) are required to be submitted for the same engine elsewhere in title 13, CCR (e.g., the off-road in-use testing requirements in title 13, CCR section 2423.1(d)(6)).

(B) *Engine and Equipment Requirement*.

1. The manufacturer shall collect data from five production equipment in each of the following applicable power categories or from one production equipment per engine family in each applicable power category, whichever is less:

a. Engines less than 19 kW,

b. Engines greater than or equal to 19 kW and less than 56 kW,

c. Engines greater than or equal to 56 kW and less than 130 kW,

d. Engines greater than or equal to 130 kW and less than or equal to 560 kW, and

e. Engines greater than 560 kW.

2. Out of all the datasets that the manufacturer collects from production equipment for a given model year, at least one dataset must be from an engine with the engine rating that has the highest projected California sales number in its engine family.

(C) *Data Collection Requirements*. The manufacturer shall collect the following data from each production equipment:

1. Engine manufacturer;

2. Engine model year;

3. Engine power category;

4. Engine family;

5. Engine rating;

6. Engine serial number;

7. Equipment type;

8. Date the data were collected;

9. Equipment odometer reading (if equipped);

10. Total engine run time (section (e)(2)(D)2.);

11. Engine control module software CAL ID;

12. Monitor activity data specified in section (e)(3)(F)2. (i.e., monitor activity data mini-numerator, mini-denominator, and monitor activity ratio); and

13. OR OBD data snapshot.

(D) *Test Data Submission*. The manufacturer shall submit the data described in section (i)(3)(C) above to CARB through XXXX@arb.ca.gov.

(4) *Verification of Other Requirements.*

(A) Requirement. The manufacturer shall meet the following verification requirements:

1. Diagnostic Link Connector Information:

a. Required Information: For each engine family, the manufacturer shall provide a pictorial representation (including any covers or labels) of the diagnostic link connector and its location representative of every equipment the engines covered by the engine family are installed in. The manufacturer may submit one set of information for a group of equipment if the diagnostic link connectors have the same design, orientation, and location on all the equipment in the group.

b. Deadline: The manufacturer shall provide the information in subsection (i)(4)(A)1.a. no later than 12 months after the start of engine production.

(B) Information Submission. The manufacturer shall submit the information described in section (i)(4)(A) above to CARB through XXXX@arb.ca.gov.

(j) *Deficiencies*.

(1) *General Requirements*.

(A) If the OR OBD system of an engine does not comply with one or more of the requirements of title 13, CCR section 2422, the Executive Officer may certify

the OR OBD system with a deficiency for each issue. The Executive Officer shall grant the certification with the deficiency if the following factors are met:

1. The OR OBD system satisfies the majority of the requirements of title 13, CCR section 2422;

2. The manufacturer has demonstrated a good-faith effort to: (1) meet the requirements in full by evaluating and considering the best available monitoring technology (for issues related to monitors/diagnostics) and software capacity, and (2) come into compliance as expeditiously as possible with regards to the issue; and

3. The issue is not described under section (k)(8).

(B) *Carry Over of Deficiency*.

1. If an issue that had been granted a deficiency from a previous model year is still applicable to the current model year, the manufacturer shall re-apply for Executive Officer approval of the deficiency for the current model year. The Executive Officer shall approve the carry-over of the deficiency if the factors identified in section (j)(1)(A) are met and the manufacturer's plan for addressing the deficiency ensures the deficiency is corrected before the deadlines specified in section (j)(1)(B)2. below.

2. For all deficiencies, the Executive Officer shall not allow manufacturers to carry over deficiencies for more than two model years unless the manufacturer can demonstrate that substantial equipment 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 (e.g., if the deficiency was first granted in the 2030 model year, the deficiency may be carried over up to and including the 2033 model year if substantial equipment hardware modifications are needed but shall not be carried over to the 2034 and later model years).

3. When determining the model years a deficiency can be carried over in section (j)(1)(B)2. above, the initial model year the deficiency was granted to an engine rating shall be considered the first model year the deficiency is granted for the engine rating and any other engine rating in future model years with the same deficiency (e.g., if the deficiency was first granted to an engine rating in the 2030 model year and a new 2031 model year engine rating has the same deficiency, the new 2031 model year engine may carry over the deficiency up to and including the 2033 model year but not for 2034 and later model years).

(C) Except as allowed in section (j)(3), deficiencies shall not be retroactively granted after certification.

(2) *Deficiency Fines*. Manufacturers of OR OBD systems with deficiencies are subject to fines pursuant to section 43016 of the California Health and Safety Code. The fines apply to engines specified in section (j)(2)(A) below that are produced and delivered for sale in California.

(A) *Applicability*. The deficiency fines specified in section (j)(2) apply to 2039 and subsequent model year engines.

(B) *Deficiency Fine Determination and Amounts*.

1. The deficiency fines apply as follows:

a. For 2039 through 2041 model year engines, except as provided for in section (j)(2)(B)1.c. below, fines shall apply to the fifth and subsequently identified deficiencies.

b. For 2042 and subsequent model year engines, except as provided for in section (j)(2)(B)1.c. below, fines shall apply to the third and subsequently identified deficiencies.

c. Fines shall apply to a deficiency where a required diagnostic (except for emission threshold monitors/diagnostics) is completely absent from the OR OBD system (i.e., there are no diagnostics specifically designed to detect malfunctions of a component or system). The deficiency shall not be included in the count of deficiencies used in sections (j)(2)(B)1.a. and b. above to determine the number of deficiencies subject to fines. An OR OBD system with an emission threshold monitor or diagnostic that is completely absent is considered non-compliant and subject to the enforcement provisions of section (k).

2. The following fine amounts apply for each deficiency per engine:

Table 4. Deficiency Fine Amounts for OR OBD Engines

Power Category	*Fine Amount Per Deficiency Per Engine*
< 19 kW	$5
19 ≤ kW < 56	$20
56 ≤ kW < 130	$50
130 ≤ kW ≤ 560	$150
> 560 kW	$550

3. The total fines per engine shall not exceed the following amounts:

Table 5. Maximum Total Deficiency Fine Amounts for OR OBD Engines

Power Category	*Maximum Total Fine Amount Per Engine*
< 19 kW	$50
19 ≤ kW < 56	$200
56 ≤ kW < 130	$500
130 ≤ kW ≤ 560	$1,500
> 560 kW	$5,500

(C) *Deficiency Fine Payment*.

1. Fines are payable to California Air Resources Board for deposit in the Air Pollution Control Fund.

2. The manufacturer shall submit the fines payment using one of the following schedules:

a. The manufacturer shall submit the fines payment not more than 30 calendar days after the close of a calendar quarter. Within 30 days from the end of the calendar quarter, a manufacturer shall report the number of affected engines produced and delivered for sale in California during the quarter and submit the total payment for the engines produced and delivered for sale during that quarter.

b. The manufacturer shall submit the fines payment within 30 calendar days after the end of production for the engine.

3. Prior to certification of the OR OBD system, the Executive Officer shall inform the manufacturer of the deficiency fines per engine, and the manufacturer shall notify the Executive Officer agreeing to pay the deficiency fines.

(3) *Retroactive Deficiencies*.

(A) The Executive Officer may grant a deficiency after certification of the OR OBD system for the engine and amend an engine's certification to conform to the granting of the deficiency for each aspect of the OR OBD system that is functioning differently than the certified system or otherwise not meeting any requirement of section 2422. The Executive Officer may grant the retroactive deficiency if:

1. The conditions in section (j)(1)(A) are satisfied;

2. The manufacturer could not have reasonably anticipated the identified issue before commencement of production; and

3. Within the timeframe specified in section (j)(3)(B) below, the manufacturer found the issue (e.g., during testing required by section (i)), notified the Executive Officer of the issue, and requested a retroactive deficiency, or another party (e.g., the Executive Officer) found the issue.

(B) The Executive Officer shall not grant a retroactive deficiency if the manufacturer's request for the deficiency or the identification of the issue by other parties occurred after the later of the following dates:

1. When the last affected engine is produced (no later than December 31 of the calendar year for which the model year of the engine is named); or

2. Six months after commencement of equipment production for the affected engine and equipment combination.

(C) If the Executive Officer grants the deficiency and amends the certification, the approval would be retroactive to include all affected engines within the model year.

(D) In granting the amended certification for engines subject to deficiency fines under section (j)(2), the Executive Officer shall include all approved retroactive deficiencies with all previously approved deficiencies when computing fines in accordance with section (j)(2).

(4) *Non-Compliance Determination*.

(A) An OR OBD system installed on production engines that fails to conform with the certified OR OBD system for that engine or otherwise fails to meet the requirements of section 2422 and has not been granted a deficiency pursuant to the provisions of section (j)(1) through (j)(3) is considered non-compliant and subject to the enforcement provisions of section (k).

(B) For OR OBD systems certified with a deficiency, if it is confirmed (e.g., through testing) that the details of the issue for which the deficiency was granted are not the same as those disclosed by the manufacturer at the time the deficiency was granted, the OR OBD system shall be considered non-compliant and subject to enforcement in accordance with section (k).

(k) *Enforcement*.

(1) Failure to comply with any requirement of this section 2422 constitutes a separate violation of this section, including, but not limited to, failure to retain or produce any records or submit required reports.

(2) Submitting or producing inaccurate information or record(s) that are required to be submitted or retained by this section 2422 constitutes a separate violation of this section.

(3) Falsifying any information or record required to be submitted or retained by this section 2422constitutes a separate violation of this section.

(4) Violations of this section 2422 are subject to penalties under the Health and Safety Code, Division 26, Part 5 (commencing with section 43000).

(5) Any violation of this section 2422 may be enjoined pursuant to Health and Safety Code section 41513.

(6) Each day or portion thereof that any requirement is not met, or each day or portion thereof that any registration, report, or plan required by this section 2422 remains unsubmitted, is submitted late, or contains incomplete or inaccurate information, shall constitute a single, separate violation of this section.

(7) Failure to pay the full amount of any fee required by this section 2422 shall constitute a single, separate violation of this section for each day or portion thereof that the fee has not been paid after the date the fee is due.

(8) *Non-Compliance Criteria*.

(A) The Executive Officer shall consider an OR OBD system non-compliant (i.e., the Executive Officer shall not certify the OR OBD system or, if the OR OBD system is already certified, the OR OBD system is subject to the

enforcement provisions of sections (k)(1) through (k)(7)) if the system has an issue that meets any of the following conditions:

1. For monitors/diagnostics that are required to detect a malfunction when emissions exceed a certain emission threshold (e.g., 2.0 g/kW-hr, 1.5 times the applicable standards) on engines required to meet the Stage 2 requirements (in accordance with section (d)(2)):

a. The monitor or diagnostic is absent or deactivated on the engine;

b. The monitor or diagnostic is not able to detect a malfunction (e.g., the monitor or diagnostic cannot run, the malfunction threshold is calibrated such that a malfunction can never fail the threshold);

c. The monitor or diagnostic is able to run and detect a malfunction but is unable to store a fault code or illuminate the MIL in accordance with section (f);

d. For the first 3 model years the engine is required to meet the Stage 2 requirements but no later than the 2040 model year, a representative sample of engines indicates that the monitor or diagnostic does not detect a malfunction or illuminate the MIL when emissions exceed 3 times the malfunction criteria (e.g., 6.0 times the standard if the malfunction criterion is 2.0 times the standard); or

e. For all other model years not described in section (k)(8)(A)1.d. above, a representative sample of engines indicates that the monitor or diagnostic does not detect a malfunction or illuminate the MIL when emissions exceed 2 times the malfunction criteria (e.g., 4.0 times the standard if the malfunction criterion is 2.0 times the standard).

2. A generic scan tool or a tool designed to access the standardized parameters under section (e) cannot obtain valid and correct data for any of the following:

a. One or more signals/data that are described under section (e)(2)(C)1.a. or (e)(2)(D)1., or

b. Stored fault codes for any monitor or diagnostic.

3. For diagnostics required to meet a minimum MAR (e.g., 0.05) as specified in section (f), **<TBD>**

4. The OR OBD system is not designed to operate, without any required scheduled maintenance, for the actual life of the engine in which it is installed or is programmed or otherwise designed to deactivate based on age or hours of operation of the engine or equipment during the actual life of the engine. This

section is not intended to alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its useful life, except where an engine has been programmed or otherwise designed so that an OR OBD system deactivates based on age or hours of operation of the engine or equipment.

(l) *Severability*.

If any subsection, paragraph, subparagraph, sentence, clause, phrase, or portion of this regulation is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct, and independent provision, and such holding shall not affect the validity of the remaining portions of the regulation.

Note: Authority cited: Health and Safety Code (HSC) sections 38501, 38505, 38510, 38560, 39600, 39601, 43013, 43016, 43018, 43101, 43102, 43104, and 43105; CCR, title 13, sections 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2139.1, 2139.5, 2420.1, and 2423.1.

Reference: HSC sections 38501, 38505, 38510, 38560, 39002, 39003, 43000, 43009.5, 43013, 43016, 43017, 43018, 43100, 43101, 43101.5, 43102, 43103, 43104, 43105, 43106, 43107, 43150, 43151, 43152, 43153, 43154, 43204, 43205, 43205.5, 43210, 43210.5, 43211, 43212, and 43213.

24. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2423.05 to read as follows:

Note: The entire text of section 2423.05 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2423.05. Supplemental Exhaust Emission Standards and Test Procedures for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Purpose and Applicability.*

(1) This section 2423.05 contains supplemental California exhaust emission standards and in-use compliance requirements for new 2031 and subsequent model year off-road compression-ignition engines that are certified to the Tier 4 final emission standards in title 13, CCR, section 2423, subsection (b)(1)(B) and marine compression-ignition engines below 37kW that are certified to Tier 2 emission standards in title 13, CCR, section 2423, subsection (b)(1)(A).

(2) The requirements in this section 2423.05 shall apply in addition to the applicable emission standards in title 13, CCR, section 2423, subsection (b)(1)(B) and other requirements that are applicable to Tier 4 engines.

(3) Unless otherwise noted, terms in this section shall have the definitions provided in title 13, CCR, section 2421. Unless otherwise noted, any reference to a "section" shall mean a section in title 13, CCR and any reference to a "subsection" shall mean a subsection in this section 2423.05.

(b) *Test Procedures*.

(1) The certification requirements and test procedures for determining compliance with the requirements in subsections (c) through (e) are set forth in the "2011 and Later Test Procedures", which is incorporated by reference in section 2421, subsection (a)(4)(B).

(2) The certification requirements and test procedures for determining compliance with the in-use compliance requirements in subsection (f) are set forth in the "California In-Use Compliance Test Procedures for All Tier 4 Off-Road Compression-Ignition Engines and Marine Engines that are Certified to Title 13, CCR, Section 2423," which is incorporated by reference in section 2139.

(c) *Certification of 2031 and Subsequent Model Year Hydrogen-Fueled Internal Combustion Engines (H_2-ICE), Except Marine Internal Combustion Engines with a Power Rating Below 37 kW*.

Off-road engines designed to operate using hydrogen as a combustion fuel source, H_2-ICE, shall be subject to all the requirements in title 13, CCR, section 2423 if any of the following criteria apply:

(1) The H_2-ICE employs boosted air induction, including turbochargers, superchargers, or any variant thereof, e.g., electric-turbo chargers.

(2) The H_2-ICE is designed to operate in equipment previously powered with an off-road compression-ignition engine certified to the standards in title 13, CCR, section 2423.

(3) The H_2-ICE is derived from existing diesel cycle engines. For example, engines that share the same engine block configuration but utilize different cylinder head designs to convert from compression-ignition diesel-fueled engines to spark-ignition hydrogen-fueled engines would be considered derived from existing diesel cycle engines.

(d) *Replacement Engines*.

For purposes of this subsection (d), a replacement engine is a new compression-ignition off-road engine that is used to replace an engine that has already been placed into service (whether the previous engine is replaced in whole or in part with a new engine). Manufacturers of replacement engines, both complete and partially complete, shall comply with the requirements of this section 2423.05, subsection (d), and Part V: 40 CFR PART 1068, Subpart C, section 1068.240, Part I-F of the “2011 and Later Test Procedures.”

(1) A replacement engine shall not be subject to the emission requirements that are applicable to the model year in which the engine is replaced if the following conditions are met. In addition, engines that were originally certified in a previous model year to the same standards that apply for the current model year shall not be subject to the emission requirements of section 2423 if the following conditions are met:

(A) The engine manufacturer has ascertained that no engine produced by itself or the manufacturer of the engine that is being replaced, if different, and certified to the requirements of this article, is available with the appropriate physical or performance characteristics to repower the equipment;

(B) In making the determination in subsection (d)(1)(A), the engine manufacturer shall also consider whether any cleaner tier engines are being produced with the appropriate physical or performance characteristics for replacing the original engine so that the cleanest available engine is used as the replacement;

(C) Unless an alternative control mechanism is approved in advance by CARB, the engine manufacturer or its agent takes ownership and possession of the engine being replaced or confirms that the engine has been destroyed;

(D) The engine manufacturer does not use the replacement-engine exemption to circumvent the regulations;

(E) The replacement engine is clearly labeled with the language in either subsection (d)(1)(E)1 or subsection (d)(1)(E)2, below, or similar alternate language approved in advance by CARB:

1. If the replacement engine is built to a configuration that was not subject to any emission standards under title 13, CCR, division 3, chapter 9, article 4, add a permanent label with your corporate name and trademark and the following language:

"THIS ENGINE DOES NOT COMPLY WITH CALIFORNIA OFF-ROAD EMISSION REQUIREMENTS. SALE OR INSTALLATION OF THIS ENGINE FOR ANY PURPOSE OTHER THAN AS A REPLACEMENT ENGINE FOR AN ENGINE MANUFACTURED PRIOR TO JANUARY 1 [Insert appropriate year reflecting when the earliest tier of emission standards began to apply to engines of that size and type] MAY BE A VIOLATION OF CALIFORNIA LAW SUBJECT TO CIVIL PENALTY."

The following additional information shall also be included on the emission control label:

ENGINE POWER:	{insert the advertised power of the specific engine configuration or the applicable power category for the engine family in kilowatts}
DATE OF MANUFACTURE:	{insert the engine build date}

In lieu of including "Engine Power" or "Date of Manufacture" on the emissions control label, manufacturers may provide this information on a supplemental label attached to the engine in accordance with the provisions of title 13, CCR, section 2424.

2. If the replacement engine is built to a configuration that was subject to emission standards under title 13, CCR, division 3, chapter 9, article 4, add a permanent label with your corporate name and trademark and the following language:

"THIS ENGINE COMPLIES WITH CALIFORNIA OFF-ROAD EMISSION REQUIREMENTS FOR [Identify the appropriate emission standards (by model

year, tier, or emission levels) for the replaced engine] ENGINES UNDER 13 CCR § 2423.05(d). SELLING OR INSTALLING THIS ENGINE FOR ANY PURPOSE OTHER THAN TO REPLACE A [Identify the appropriate emission standards (by model year, tier, or emission levels) for the replaced engine] OFF-ROAD ENGINE MAY BE A VIOLATION OF CALIFORNIA LAW SUBJECT TO CIVIL PENALTY.

The following additional information shall also be included on the emission control label:

ENGINE POWER:	{insert the certified power in kilowatts of the specific engine configuration, if applicable, otherwise insert advertised power in kilowatts}
REFERENCE FAMILY NAME:	{insert the engine family name of the replacement engine as recorded in the Executive Order for the engine family to which the replacement engine was originally certified}
DATE OF MANUFACTURE:	{insert the engine build date}

3. In lieu of including “Engine Power,” “Reference Family Name,” or “Date of Manufacture” on the emissions control label, manufacturers may provide this information on a supplemental label attached to the engine in accordance with the provisions of title 13, CCR, section 2424. Manufacturers may alternatively state the applicable power category in kilowatts for the certified engine family on the emission control or supplemental label when indicating “Engine Power.” Additionally, manufacturers may indicate the “Emissions Tier” of the replacement engine on the emissions control or supplemental label instead of the “Reference Family Name.” For the purpose of this section, “Emissions Tier” is the emissions standard designation (e.g., Tier 1, Tier 2, Tier 3, Tier 4i, Tier 4f) of the engine recorded in the Executive Order for the engine family to which the replacement engine was originally certified. Certified power means the configuration-specific power of the replacement engine as originally identified in the application for certification of the reference engine family (see Part III: 40 CFR Part 1039, Subpart C, section 1039.205(a)). Advertised power means engine power as stated by the manufacturer in sales literature.

(F) The engine manufacturer makes the replacement engine in a configuration identical in all material respects to the engine being replaced (or that of another certified engine of the same or later model year as long as the engine is not certified with a family emission limit higher than that of the old engine). This

requirement applies only if the old engine was certified to emission standards less stringent than those in effect when you produce the replacement engine; and

(G) The engine manufacturer has completed and submitted a checklist to CARB as a condition to sell new replacement engines in California, unless the engine(s) will be built to current model year emission requirements. This checklist shall contain the following information and be submitted, beginning with model year 2031, for each of the estimated numbers of replacement engines by engine family and engine model to be produced for California and identified in subsection (d)(3).

1. Identify the equipment, including serial number, for which the engine(s) is to be replaced;

2. Identify all the engines, by family, model number, power category, and emissions tier, that you investigated in determining that a cleaner engine was not available with the physical or performance characteristics necessary to repower the equipment (replacement engine shall meet the cleanest feasible standards, or match the tier of the engine being replaced if no other cleaner engines are available);

3. Identify the specific characteristic(s) that you found incompatible with the cleaner engines including a comparison of part numbers, part dimensions, applicable chassis dimensions, and any other unsuitable parameters;

4. Provide specifications justifying the identified incompatibilities;

5. Identify the modifications needed to alter the equipment to be able to use the cleaner engines you rejected as incompatible. Software or EPROM modifications are not considered incompatible modifications;

6. Attest in a letter under the penalties of the California Health and Safety Code, Division 26, and corresponding regulations, that this information is true, accurate, and complete under penalty of perjury, and you have performed due diligence in selecting the cleanest emissions configuration that the engine can be replaced with according to this checklist.

(2) CARB shall evaluate the information provided by the engine manufacturer pursuant to subsections (d)(1)(G)1 through (d)(1)(G)6. If CARB concludes that the information provided does not support the use of the replacement engine under the criteria set forth in subsections (d)(1)(A) through (d)(1)(G), CARB shall notify the engine manufacturer in writing. As of the date of the written notification, it shall be a violation of this section, which may be subject to civil penalties, for the engine manufacturer to sell or use or cause to be used the replacement engines identified in CARB's written notice.

(3) By September 30 of the year following the end of each model year, the engine manufacturer shall send the following information to CARB:

(A) A list of the replacement engines for both complete and partially complete replacement engines, by engine family name, engine model, unique engine serial number, power category, and tier level, produced for California during the model year, paired with a list of the engines being replaced described by engine family name, engine model, unique engine serial number, power category, and tier level;

(B) A completed checklist for each complete and partially complete replacement engine produced and sold during the model year;

(C) The total number of both new replacement engines, separated by complete and partially complete replacement engines, and new certified engines produced and sold for California; and

(D) The attestation letter required in subsection (d)(1)(G).

(4) Replacement engines under subsection (d) may not generate or use emission credits nor be part of any associated credit calculations.

(e) *Practices, Labeling, Recordkeeping, and Reporting Requirements for Rebuilt Engines*.

This subsection shall apply as provided in paragraph (1) below to all off-road compression-ignition engines subject to the requirements of title 13, CCR, section 2423 that are rebuilt after December 31, 2006, including those engines that were originally manufactured on, or prior to, December 31, 2006.

(1) *Practices*.

The rebuilding practices described in Part I-F of the “2011 and Later Test Procedures” shall apply. These practices are summarized in subsections (e)(1)(A) and (e)(1)(B) below, which are provided as respective references for the labeling requirements in subsections (e)(2)(A) and (e)(2)(B).

(A) Any person who rebuilds an engine that either remains installed in a piece of equipment during the rebuilding process or will be reinstalled after the rebuilding process has been completed shall rebuild the engine to the same certified configuration or the certified configuration of a later model year engine. For the purposes of this section, these engines shall be referred to as “rebuilt original engines.”

(B) Any person who replaces the engine in a piece of equipment with a rebuilt engine (this includes engines that have been substantially assembled from parts originally belonging to one or more other engines) shall use a replacement engine with a certified configuration that is at least equivalent, from an emissions

standpoint, to that of the engine being replaced. For the purposes of this section, these engines shall be referred to as “rebuilt replacement engines.”

(2) *Labeling Requirements*.

(A) Rebuilt Original Engines. Any person who rebuilds engines for which the practices in subsection (e)(1)(A) apply shall ensure that the rebuilt engines are labeled as follows:

1. An original engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued an Executive Order shall retain the emissions control label described in section 2424. The rebuilder shall not remove or deface in any manner the original label and must take care to protect it from the effects of sandblasting, acid dipping, or any other restorative processes. Notwithstanding the preceding requirements and prohibitions of this subsection (e)(2)(A)1., the rebuilder shall substitute a new permanent label containing the text in subsection (e)(2)(A)2. below for the original emission control label if the rebuilder determines that the label has been irreparably corrupted due to extreme and unintentional circumstances (e.g., fire or collision). The rebuilder shall provide to CARB annually a list of all rebuilt engines for which original labels have been removed under this provision no later than two months after the end of each calendar year. The rebuilder shall retain all removed labels, or otherwise document the degree to which the labels were damaged or missing (e.g., photographic proof of the corruption), for a period of no less than eight years following the date of renovation, and shall make these available to CARB upon request. The rebuilder shall be subject to civil penalty under State law should CARB determine that the original emission control label did not warrant replacement or that the rebuilder is abusing this provision;

2. An original engine that is rebuilt to a more stringent emissions configuration shall be permanently re-labeled using the following text:

“THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR 2423.05(e) USING MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE OF A CERTIFIED TIER [insert the numerical tier designation of the rebuilt engine] OFF-ROAD COMPRESSION-IGNITION ENGINE. IF PLACED INTO SERVICE IN AN OFF-ROAD APPLICATION, THIS ENGINE MUST BE INSTALLED IN EQUIPMENT ORIGINALLY SOLD WITH A TIER [insert the numerical tier designation of the rebuilt engine] OR EARLIER ENGINE. [insert the engine family name of the reference engine].

For the purpose of this label, “MATCHED” means a complete set of components corresponding to the certified emissions configuration being referenced (see the definition of “certified emissions configuration” in section 2421, subsection

(a)(13)). The reference engine is the engine family name corresponding to the certified emissions configuration to which the engine has been rebuilt. The label shall conform to the provisions of section 2424 regarding location and visibility.

(B) Rebuilt Replacement Engines. Any person who rebuilds engines for which the practices in subsection (e)(1)(B) apply shall ensure that the rebuilt engines are labeled as follows:

1. A replacement engine that is rebuilt to the same California emissions configuration employed by the engine at the time it was issued an Executive Order shall either retain the emission control label described in Section 2424 or be permanently re-labeled using the text in subsection (e)(2)(A)2 of this subsection. A replacement engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued a federal Certificate of Conformity, and for which no Executive Order exists, shall be permanently re-labeled using the text in subsection (e)(2)(A)2 prior to being installed in equipment that was originally sold with a California certified engine;

2. A replacement engine that is rebuilt to a more stringent emissions configuration shall be permanently re-labeled using the text in subsection (e)(2)(A)2;

3. An incomplete rebuilt replacement engine shall be permanently relabeled using the text specified below. For the purposes of this subsection, “incomplete rebuilt replacement engine” means a rebuilt replacement engine that is sold or offered for sale in California without all the necessary components to enable engine operation including, but not necessarily limited to, the fuel system and the air system:

“THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR 2423.05(e) AS AN INCOMPLETE ENGINE USING ONLY MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE FOUND IN OFF-ROAD COMPRESSION-IGNITION ENGINES CERTIFIED TO THE [insert the numerical tier or multiple tiers designation of the rebuilt engine].”

Any person who completes an incomplete rebuilt replacement engine with components that are not matched components, and the resulting engine is placed into service in California, is in violation of the rebuilding practices referenced under subsection (e)(1) and subject to civil penalty under State law.

(C) Supplemental Labeling Requirements. Except as noted below, any person who sells or offers for sale any rebuilt engine subject to the provisions of subsection (e) shall affix a supplemental label to the rebuilt engine that:

1. states the name of the rebuilder, year of rebuild, and other pertinent information as determined by the rebuilder or specified by CARB; and

2. is clearly visible without the need to remove any engine components; and

3. does not obscure in any way the visibility of the original emission control label or the labels required under subsections (e)(2)(A)2. or (e)(2)(B)3. of this subsection; and

4. does not state or imply that the rebuilt engine is “new” or that it belongs to an engine family other than the one to which it was originally certified; and

5. has sufficient durability to remain intact and legible throughout all mandatory record keeping periods for rebuilt engines.

The requirement for a supplemental label shall be waived in cases where the rebuilder alternately chooses to incorporate the information in subparagraph (e)(2)(C)1. into the new permanent label specified in subsection (e)(2)(A)2. or (e)(2)(B)3.

(D) Rebuilt New Engines. Notwithstanding any other requirement of this subsection (e), any person who rebuilds an engine to comply with current-year emission requirements (including, but not limited to, durability and warranty), with the intent to sell or offer for sale the rebuilt engine as “new” under the coverage of a new and unique Executive Order, shall replace the original emission control label on that engine with one identifying the engine as belonging to a family meeting current-year emission requirements in accordance with the provisions of Section 2424. If desired, the rebuilder of a such an engine may optionally affix to it a supplemental label, but such a label would be required to comply with the same requirements specified in subsection (e)(2)(C) for any other rebuilt engine.

(3) *Recordkeeping and Reporting*.

(A) Recordkeeping requirements specified in section 1068.120, subsections (j) and (k) of the “2011 and Later Test Procedures, Part I-F” shall apply to rebuilt off-road compression-ignition engines subject to the requirements of section 2423 and shall be followed by businesses that provide engine rebuilding services for profit.

(B) On and after January 1, 2031, specific reporting requirements in this section 2423.05, subsection (e)(3)(B) shall be followed by anyone who manufactures or sells off-road compression-ignition engines or equipment and rebuilds off-road compression-ignition engines. A report shall be submitted to CARB by September 30 of the calendar year following the end of a model year that includes:

1. A numbered list of rebuilt original engines by engine family name, engine model, power category, and tier level, that you worked on for California during the model year,

2. A numbered list of rebuilt replacement engines by engine family name, engine model, power category, and tier level, that you worked on for California during the model year,

3. Any changes to the emissions configuration of the engine,

a. Including the engine family name of the engine being rebuilt,

b. Including the reference engine family name corresponding to the emissions configuration of the rebuilt engine,

4. Product number (or other identifier) of the rebuild kit and the replacement components

5. Serial number of the engine,

6. Hours of operation (or mileage) at the time of rebuild,

7. Work done on the engine or any emission-related control components, including a listing of parts and components that were used,

8. Any engine parameter adjustments,

9. Any emission-related codes or signals that were responded to and reset, and

10. Equipment, including serial number, for which each engine is replaced.

(f) *In-Use Compliance*.

(1) All engines in all power categories that are certified to the Tier 4 final emission standards in section 2423, subsection (b)(1)(B) and for marine compression-ignition engines below 37kW that are certified to Tier 2 emission standards in title 13, CCR, section 2423, subsection (b)(1)(A) shall be subject to the in-use compliance requirements in the "California In-Use Compliance Test Procedures for All Tier 4 Off-Road Compression-Ignition Engines and Marine Engines that are Certified to Title 13, CCR, Section 2423."

(2) *Definitions Specific to Engines that are Certified to this Section*.

The following definitions apply to engines that are certified to this section 2423.05 for the purpose of implementing the provisions in title 13, CCR, division 3, chapter 2.

(A) "*Corrective action*" means any action taken by a manufacturer to remedy a noncompliance or nonconformity with the specified emission standard in title 13, CCR, section 2423, performance standards in title 13, CCR, section 2143, or in-use emission compliance requirements in Part II: IN-USE EMISSIONS COMPLIANCE, Subpart A of the "California In-Use Compliance Test Procedures for All Tier 4 Off-Road Compression-Ignition Engines and Marine Engines that are Certified to Title 13, CCR, Section 2423" incorporated by reference in title 13, CCR, section 2139. Corrective action may include recall, extended warranty, or other action ordered by CARB. CARB shall require direct notification of corrective action to vehicle or engine owners.

(B) "*Nonconformity*" or "*noncompliance*" exists whenever:

1. a substantial number of a class or category of engines, or equipment, although properly maintained and used, experience a failure of the same emission-related component within their useful lives which, if uncorrected, results in the engines' or equipment's failure to meet the applicable standards; or

2. a class or category of engines, although properly maintained and used, fails to comply with the emission standards specified in title 13, CCR section 2423, exceeds the failure thresholds specified in title 13, CCR, section 2143, or fails to comply with the in-use emissions compliance requirements specified in Part II: IN-USE EMISSIONS COMPLIANCE, Subpart A of the "California In-Use Compliance Test Procedures for All Tier 4 Off-Road Compression-Ignition Engines and Marine Engines that are Certified to Title 13, CCR, Section 2423" incorporated by reference in title 13, CCR, section 2139..

(g) *Severability.*

Each provision of this section is severable, and in the event that any provision of this section is held to be invalid, the remainder of this section and this article remains in full force and effect.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, and 43104, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43104, 43211, and 43212, Health and Safety Code.

25. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2423.1 to read as follows:

Note: The entire text of section 2423.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2423.1. Tier 5 Exhaust Emission Standards and Test Procedures – Off-Road Compression-Ignition Engines.

(a) *Purpose and Applicability.*

(1) This section 2423.1 contains the California "Tier 5" exhaust emission standards for new 2031 and subsequent model year off-road compression-ignition engines, excluding marine compression-ignition engines with a power rating below 37 kW, except non-integrated auxiliary marine compression-ignition engines. A manufacturer shall certify all compression-ignition engines, including non-integrated auxiliary marine compression-ignition engines, to the Tier 5 standards described below, except as indicated in subsections (a)(1)(A) and (a)(1)(B). For the purposes of this section 2423.1, the engines subject to this section shall be called "off-road compression-ignition engines."

(A) A manufacturer of marine compression-ignition engines with a power rating below 37 kW, except non-integrated auxiliary marine compression-ignition engines, shall certify these engines to the applicable exhaust emission standards in title 13, CCR, section 2423.2, in accordance with Part VII: 40 CFR PART 1042 of the "Tier 5 Test Procedures."

(B) A manufacturer of off-road compression-ignition engines used in transportation refrigeration units shall certify these engines in accordance with the following requirements:

1. Compression-ignition engines used in both transportation refrigeration units and other equipment applications shall comply with the requirements of this section 2423.1, except as required in subsection (a)(1)(B)3.

2. Compression-ignition engines used exclusively in transportation refrigeration units may certify to applicable Tier 4 final standards in title 13, CCR, section 2423, subsection (b)(1)(B), Table 1b as an alternative to complying with the requirements in this section 2423.1, except as required in subsection (a)(1)(B)3.

3. All compression-ignition engines used in trailer transportation refrigeration units, domestic shipping container transportation refrigeration units, railcar transportation refrigeration units, and transportation refrigeration unit

generator sets shall certify to the PM emission standard of 0.02 g/hp-hr or lower, as required by title 13, CCR, section 2477.5, subsection (d).

(2) Unless otherwise noted, terms in this section shall have the definitions provided in title 13, CCR, section 2421.1. Unless otherwise noted, any reference to a "section" shall mean a section in title 13, CCR and any reference to a "subsection" shall mean a subsection in this section 2423.1.

(3) A manufacturer shall comply with the exhaust emission standards in subsection (d) that are applicable to specific engine families.

(4) Engine families that are certified to this section 2423.1 are deemed to be in compliance with title 13, CCR, section 2423.

(b) *General Provisions.*

(1) *Certification Requirements and Test Procedures.*

(A) The certification requirements and test procedures for determining compliance with both the Tier 5 final emission standards and the Tier 5 interim emission standards in this section are set forth in the "California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts" ("Tier 5 Test Procedures"), as adopted [INSERT DATE OF ADOPTION], which is incorporated by reference herein.

(B) Wherever this section 2423.1 requires data to be "rounded," the rounding conventions in Part IV: 40 CFR PART 1065, Subpart A, section 1065.20 of the "Tier 5 Test Procedures" shall apply.

(C) Wherever this section 2423.1 requires that "a manufacturer shall notify CARB in writing," the specified information shall be addressed to the Chief of the Emissions Certification and Compliance Division, or designee, at 4001 Iowa Avenue, Riverside, California, 92507.

(D) Wherever this section 2423.1 requires that a manufacturer shall submit information to CARB or the manufacturer shall apply to use a specific provision of this regulation, but does not specify that this information shall be submitted "in writing" or that the manufacturer shall apply "in writing," the specified information shall be submitted to CARB through XXXX@arb.ca.gov.

(E) *Attestation.*

Unless otherwise specified, where this section allows for or requires a manufacturer to provide an attestation, attestation means a statement signed and dated by an individual, who is employed by a manufacturer and authorized to affirm the attested statement on behalf of the manufacturer, certifying under penalty of perjury under

the laws of the State of California that the attested statement is true, accurate, and complete.

(F) *Reporting.*

Within 45 days after the end of the model year, manufacturers shall send CARB a report describing the total number of engines it produced in each engine family by maximum engine power, total displacement, and the type of fuel system. Break down the total number of engines by U.S.-directed production volumes and California-directed production volumes. For California-directed production volumes, separate the data into California-certified engines and engines that are exempt from California regulation under section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. 7543(e)(1) but sold in California.

(2) *Useful Life.*

For purposes of certification, a manufacturer shall demonstrate compliance with the standards set forth in subsection (d) over the full useful life of the engine, as defined in title 13, CCR, section 2421.1, subsection (b)(2).

(3) *Adjustable Parameters*.

Manufacturers that design engines with adjustable parameters shall meet all the requirements of Part V: 40 CFR PART 1068, Subpart A, section 1068.50 of the “Tier 5 Test Procedures.”

(4) *Prohibited Controls.*

A manufacturer shall not design engines with emission control devices, systems, or elements of design that adversely affect public health, welfare, or safety while operating. For example, for engines equipped with vanadium-based SCR catalysts, you must design the engine and its emission controls to prevent vanadium sublimation and protect the catalyst from high temperatures.

(5) *Defeat Devices.*

Engines equipped with a defeat device shall not be certified for sale in California. A defeat device is a component or system that reduces the effectiveness of emission controls under conditions that the engine may reasonably be expected to encounter during normal operation and use. This prohibition does not apply to auxiliary-emission control devices identified in the certification application if one or more of the following is true:

(A) The operating conditions where the auxiliary-emission control device is active were substantially encountered during all testing requirements as described in Part III: 40 CFR PART 1039 of the “Tier 5 Test Procedures.”

(B) The design of the auxiliary-emission control device is shown to be necessary for preventing engine (or equipment) damage or accidents.

(C) The auxiliary-emission control device only reduces the effectiveness of emissions control during engine starting.

(6) *Hybrid Electric Equipment.*

For the 2036 and subsequent model years, an engine manufacturer shall certify any off-road compression-ignition engine used in hybrid electric equipment to the Tier 5 final exhaust emission standards in this section 2423.1.

(c) *Abbreviations and Acronyms*.

The following abbreviations and acronyms are used in this section 2423.1:

"40 CFR" means Title 40, Code of Federal Regulations.

"CA-ABT" means California averaging, banking, and trading program.

"CARB" means California Air Resources Board.

"CCR" means California Code of Regulations.

"CFR" means Code of Federal Regulations.

"CO" means carbon monoxide.

"CO_2" means carbon dioxide.

"DARAP" means Diesel Aftertreatment Rapid Aging Protocol.

"DMC" means Discrete Mode Cycle.

"ELSE" refers to all mobile machinery excluding generator engines.

"Federal ABT program" means the Averaging, Banking, and Trading program in 40 CFR, Part 1039, subpart H, which includes § 1039.701 (October 25, 2016), § 1039.705 (October 25, 2016), § 1039.710 (October 25, 2016), § 1039.715 (April 30, 2010), § 1039.720 (April 30, 2010), § 1039.725 (October 25, 2016), § 1039.730 (October 25, 2016), § 1039.735 (October 25, 2016), § 1039.740 (June 29, 2021), and § 1039.745 (June 29, 2004).

"FEL" means family emission limit.

"g/kW-hr" means grams per kilowatt-hour.

"GEN" means equipment in which generator-set engines are installed, where "generator-set engines" are defined in Part III: 40 CFR PART 1039, Subpart I, section 1039.801 of the "Tier 5 Test Procedures."

“kW” means kilowatt.

“L/cyl” means liters per cylinder.

“MY” means model year.

“NMHC” means non-methane hydrocarbons.

“n/a” means not applicable.

“NOx” means oxides of nitrogen.

“NRTC” means the Nonroad Compression-Ignition Composite Transient Cycle.

“P” means the emission-data engine’s declared maximum power for the engine family, in units of kW.

“PM” means particulate matter.

“RMC” means the Steady-State Ramped Modal Cycles.

“SCR” means selective catalytic reduction.

“SOS” means Sum over Sum.

“Tier 4” means the Tier 4 exhaust emission standards in title 13, CCR, section 2423.

“U.S. EPA” means the United States Environmental Protection Agency.

(d) *Tier 5 Criteria Pollutant Exhaust Emission Standards.*

The requirements set forth in subsections (d)(1) through (d)(8) apply to all Tier 5 compression-ignition engines, including non-integrated auxiliary marine compression-ignition engines, except as indicated in subsections (a)(1)(A) and (a)(1)(B).

(1) *Criteria Pollutant Exhaust Emission Standards Applicable to the NRTC and Steady-State Test Cycles.*

(A) The following standards are the maximum Tier 5 exhaust emissions permitted for the full useful life from new off-road compression-ignition engines as sold in the state of California and as appropriate based on model year and maximum engine power as indicated in the table. These standards are applicable to off-road compression-ignition engines that are less than or equal to 560 kW, except for constant-speed engines, and certification testing shall be conducted using both the NRTC and the applicable steady-state duty cycle. For off-road compression-ignition engines that are greater than 560 kW and all constant-speed engines, these standards only apply when an engine is tested using the applicable steady-state duty cycle defined in title 13, CCR, section 2421.1, subsection (b). NOTE: The On-

Board Diagnostics requirements in title 13, CCR, section 2422 may require malfunction detection demonstration over the ramped modal testing duty cycles.

Tier 5 Exhaust Emission Standards (g/kW-hr)

Power Category	Model Year	Type	NOx	PM	NMHC	CO
< 8 kW	2036 +	Final	5.0[2]	0.2	n/a	8.0
8 ≤ kW < 19	2036 +	Final	4.0[2]	0.1	n/a	6.6
19 ≤ kW < 56	2031-2035	Interim[1]	4.4[2]	0.010	n/a	5.0
	2036 +	Final	2.5	0.008	0.19	5.0
56 ≤ kW < 130	2031-2035	Interim[1]	0.35	0.010	0.19	5.0
	2036 +	Final	0.040	0.005	0.080[3]	5.0
130 ≤ kW ≤ 560	2031-2035	Interim[1]	0.35	0.010	0.19	3.5
	2036 +	Final	0.040	0.005	0.080[3]	3.5
> 560 kW (GEN)	2036 +	Final	0.35	0.008	0.080[3]	3.5
> 560 kW (ELSE)	2036 +	Final	3.0	0.040	0.19	3.5

[1] The Tier 5 Interim exhaust emission standards are optional. Manufacturers may comply with either the optional Tier 5 Interim or Tier 4 Final exhaust emission standards in title 13, CCR, section 2423, subsection (b)(1)(B).

[2] Denotes NMHC+NOx.

[3] The NMHC standard for lean-burn natural gas engine families is 0.19 g/kW-hr.

(B) *Family Emission Limits.*

1. For Tier 5 final engine families, a manufacturer may generate or use emission credits, as applicable, under the California Averaging, Banking, and Trading (CA-ABT) program described in subsection (g) for demonstrating compliance with NOx, NOx + NMHC, and PM emission standards in subsection (d). Manufacturers shall meet the NMHC and CO emission standards in subsection (d) without generating or using emission credits.

2. To generate or use emission credits, a manufacturer shall specify a family emission limit for each engine family. A manufacturer shall declare the family emission limit corresponding to full useful life for engine operation over the NRTC duty cycle, FEL_{NRTC}, expressed to the same number of decimal places as the emission standard. If the NRTC is not applicable to the engine family, a manufacturer shall declare the FEL over a steady-state cycle, RMC or DMC,

$FEL_{RMC/DMC}$ to calculate emission credits in subsection (g). FEL_{NRTC} equals $FEL_{RMC/DMC}$.

3. The FEL over the NRTC, RMC, or DMC shall not be higher than the limits in the following table.

Upper Limit for Tier 5 Final FELs

Maximum Engine Power	***PM***	***NMHC + NOx***	***NOx***
	grams per kilowatt-hour		
kW<8	0.40[1]	7.5	n/a
8≤kW<19	0.40	7.5	n/a
19≤kW<56	0.03	n/a	3.8
56≤kW<130	0.02	n/a	0.40
130≤kW≤560	0.02	n/a	0.40
>560 kW (GEN)	0.03	n/a	0.67
>560 kW (ELSE[3])	0.04	n/a	3.5

[1] The Tier 5 final upper limit FEL for hand-startable, air cooled, direct injection engines below 8 kW is 0.60 g/kW-hr.

[2] "GEN" refers to generator engines only.

[3] "ELSE" refers to all mobile machinery excluding generator engines.

4. The NOx, NOx + NMHC, or PM FEL that applies for each duty-cycle, FEL_{cycle}, is calculated using the following equation. This equation shall also be used to calculate the FEL that applies for the NOx emission screening threshold in Part II, Subpart A, section 1 of the "Tier 5 Test Procedures" and the SOS Emissions In-Use Thresholds for PEMS testing in Part II, Subpart A, section 3 of the "Tier 5 Test Procedures."

$$FEL_{cycle} = FEL_{Ref} \cdot \frac{Std_{cycle}}{Std_{Ref}}$$

Where:

FEL_{Ref} is the NOx, NOx + NMHC, or PM reference FEL based on the NRTC, RMC, or Discrete-Mode Cycle, as applicable.

Std_{cycle} is the NOx, NOx + NMHC, or PM emission standard for the applicable cycle or for off-cycle testing. The OR LLC standard in subsection (d)(2) and the idle standard in Part II, Subpart A, section 1 and section 3 of the "Tier 5 Test Procedures" differ from the reference standards, resulting in a FEL_{cycle} value being different from FEL_{REF}. For RMC or Discrete-Mode Cycle, the ratio of cycle standard to reference standard reduces to unity resulting in the FEL for both the reference cycle and the specific cycle being identical.

Std_{Ref} is the NOx, NOx + NMHC, or PM reference emission standard value based on the NRTC, RMC, or Discrete-Mode Cycle, as applicable. The NRTC defines the reference standard whenever the NRTC is required for certification. For other applications that only require steady-state certification, such as constant speed engines and engines > 560 kW, the RMC or discrete mode cycle used for certification defines the reference standard.

(2) *Off-Road Low-Load Cycle Emission Standards.*

(A) The following standards are the maximum Tier 5 Off-Road Low-Load Cycle exhaust emissions for the full useful life from new 2036 and subsequent model year off-road compression-ignition engines greater than or equal to 56 kW and less than or equal to 560 kW that certify to the Tier 5 final standards in subsection (d)(1)(A), except for constant-speed engines. These standards are applicable to off-road compression-ignition engines that are tested using the Off-Road Low-Load Test Cycle in Part VI, Subpart B of the "Tier 5 Test Procedures."

Tier 5 Off-Road Low-Load Cycle Exhaust Emission Standards[1]

Power Category	Model Year	NOx Final Standard (g/kW-hr)	PM Final Standard (g/kW-hr)	NMHC Final Standard (g/kW-hr)
< 19 kW	n/a	n/a	n/a	n/a
19 ≤ kW < 56	n/a	n/a	n/a	n/a
56 ≤ kW < 130	2036 +	0.060	0.005	0.19
130 ≤ kW ≤ 560	2036 +	0.060	0.005	0.19
> 560 kW (GEN)	n/a	n/a	n/a	n/a
> 560 kW (ELSE)	n/a	n/a	n/a	n/a

[1] These standards do not apply to engines that are certified to optional Tier 5 Interim standards.

(B) The FEL for the Off-Road Low-Load Cycle is calculated using the equation described in subsection (d)(1)(B)4. Further details of the CA-ABT program are provided in subsection (g).

(3) *Idle NOx Emission Standards.*

(A) The following standards are the maximum Tier 5 Idle NOx emissions for the full useful life from new off-road compression-ignition engines that certify to the Tier 5 final standards in subsection (d)(1)(A). Idle NOx emission standards do not apply to engines exclusively designed for constant speed applications (including but not limited to generator sets, transportation refrigeration units, pumps, and welders). These Idle NOx emission standards are applicable to off-road

compression-ignition engines that are tested using the Idle Speed Cycle in Part VI, Subpart C of the "Tier 5 Test Procedures."

Tier 5 Idle NOx Exhaust Emission Standards[1]

Power Category	Application	Model Year	Idle NOx Standard (g/hr)
< 19 kW	All	n/a	n/a
19 ≤ kW < 56	All	2036 +	0.536*P[2]
56 ≤ kW < 130	All	n/a	n/a[3]
130 ≤ kW ≤ 560	All	n/a	n/a[3]
> 560 kW	GEN	n/a	n/a
> 560 kW	ELSE	2036 +	50

[1] These standards do not apply to engines that are certified to optional Tier 5 Interim standards.

[2] "P" means the emission-data engine's declared maximum power for the engine family, in units of kW.

[3] Idle testing is not required for certification in these power categories. However, engines shall meet the "SOS Emissions In-Use Threshold" for PEMS Bin A in Part II, Subpart A, section 3.5.1.2 of the "Tier 5 Test Procedures."

(B) *Compliance Requirements*.

1. For each model year, engines within the power categories greater than or equal to 56 kW and less than or equal to 560 kW shall comply with the applicable low-load cycle NOx emission standards in subsection (d)(2)(A) for each engine family for each model year for the purpose of certification. The "SOS Emissions In-Use Thresholds" in Part II, Subpart A, section 3.5.1.2 of the "Tier 5 Test Procedures" apply for in-use testing [screening and portable emissions measurement system (PEMS) testing].

2. For each model year, engines within a power category less than 56 kW or greater than 560 kW shall comply with subsection (d)(3) in accordance with either subsection (d)(3)(B)2.a or subsection (d)(3)(B)2.b for the model year for the purpose of certification.

a. A manufacturer shall certify each engine family to the applicable idle NOx standard in subsection (d)(3)(A) based on engine testing; or

b. As an alternative to engine testing, a manufacturer may demonstrate that an engine family complies with the applicable idle NOx standard in subsection (d)(3) by demonstrating that the engines within the engine family are equipped with a system that automatically shuts down the

engine during idling in accordance with the Part VI, Subpart C, section 2 of the “Tier 5 Test Procedures.”

(4) *Opacity.*

(A) The opacity of smoke emissions from new off-road compression-ignition engines sold in this State shall not exceed the following, based on the applicable measurement techniques specified in Part III: 40 CFR Part 1039 of the “Tier 5 Test Procedures”:

1. 20 percent during the engine acceleration mode;

2. 15 percent during the engine lugging mode; or

3. 50 percent during the peaks in either mode.

(B) The following engines are exempt from the requirements of this subsection (d)(4):

1. Single-cylinder engines;

2. Marine compression-ignition engines;

3. Constant-speed engines; and

4. Engines certified to a PM emission standard or FEL of 0.07 grams per kilowatt-hour or lower.

(5) *In-Use Compliance*.

All manufacturers of Tier 5 off-road compression-ignition engines shall comply with the in-use compliance requirements in Part II of the “Tier 5 Test Procedures.”

(A) Requirements for Tier 5 Final Engine Families within a Power Category < 56 kW or > 560 kW.

1. All Tier 5 final engines within a power category < 56 kW or > 560 kW shall comply with the in-use “not-to-exceed” NMHC, NOx, CO, and PM emission limits and test procedures in Part II, Subpart B, section 1 of the “Tier 5 Test Procedures.”

2. For each Tier 5 final engine family, a manufacturer shall submit with its application for certification an attestation that the engine family is compliant with all “not-to-exceed” emission limits specified in Part II, Subpart B, section 1 of the “Tier 5 Test Procedures.”

(B) Requirements for Tier 5 Final Engine Families within a Power Category 56 ≤ kW ≤ 560 kW.

1. All Tier 5 final engines within a power category 56 ≤ kW ≤ 560 kW shall comply with the SOS Emissions In-Use Thresholds for NMHC, NOx, CO, and PM in accordance with Part II, Subpart A, section 3.5.1.2 of the "Tier 5 Test Procedures" and the moving average window test procedures in Part II, Subpart C of the "Tier 5 Test Procedures."

2. For each Tier 5 final engine family, a manufacturer shall submit with its application for certification an attestation that the engine family is compliant with all SOS Emissions In-Use Thresholds specified in Part II, Subpart A, section 3.5.1.2 of the "Tier 5 Test Procedures."

(C) Requirements for Tier 5 Interim Engine Families in All Power Categories.

1. All Tier 5 interim engines in all power categories shall comply with the in-use "not-to-exceed" NMHC, NOx, CO, and PM emission limits and test procedures in Part II, Subpart B, section 3 of the "Tier 5 Test Procedures."

2. For each Tier 5 interim engine family, a manufacturer shall submit with its application for certification an attestation that the engine family is compliant with all "not-to-exceed" emission limits specified in Part II, Subpart B, section 3 of the "Tier 5 Test Procedures."

(6) *In-Use Testing*.

All manufacturers of 2036 and subsequent model year Tier 5 final off-road compression-ignition engines within a power category 56 ≤ kW ≤ 560 kW shall comply with the manufacturer-run in-use testing requirements in Part II, Subparts A, B, and C of the "Tier 5 Test Procedures." Engines within a power category < 56 kW or > 560 kW are not subject to manufacturer-run in-use testing requirements in Part II, Subpart A of the "Tier 5 Test Procedures.".

(7) *Voluntary Blue Sky Series Engines Requirements*.

(A) *Voluntary Standards*.

Engines subject to the standards in subsection (d)(1)(A) shall be designated "Blue Sky Series" engines by meeting the voluntary standards contained in the following table, which apply to all certification and in-use testing.

Voluntary Emission Standards

Maximum Rated Power (kW)	***NMHC+NOx (g/kW-hr)***	***NMHC (g/kW-hr)***	***NOx (g/kW-hr)***	***PM (g/kW-hr)***
kW < 8	2.50	n/a	n/a	0.10
8 ≤ kW < 19	2.00	n/a	n/a	0.05
19 ≤ kW < 56	n/a	0.10	1.25	0.004
56 ≤ kW ≤ 560	n/a	0.04	0.02	0.003
kW > 560 (GEN)	n/a	0.04	0.175	0.004
kW > 560 (ELSE)	n/a	0.10	1.5	0.020

(B) *Additional Standards*.

Blue Sky Series engines are subject to all provisions under title 13, CCR, division 3 that would otherwise apply to engines that are certified to Tier 5 final emission standards.

(C) *CA-ABT Credit Eligibility*.

Blue Sky Series engines shall be eligible to earn emission credits under the CA-ABT program in subsection (g). However, credit multipliers for early introduction shall not apply.

(8) *Crankcase Emissions.*

No crankcase emissions shall be discharged directly into the ambient atmosphere from any engine, unless the sum of those discharged emissions is added to the exhaust emissions (either physically or mathematically) during all emissions testing. To be eligible for this option, a manufacturer shall design its engines so that all crankcase emissions can be routed into the applicable sampling systems specified in the “Tier 5 Test Procedures” and shall account for deterioration in crankcase emissions when determining exhaust deterioration factors. Crankcase emissions that are routed to the exhaust upstream of exhaust aftertreatment during all operations are not considered to be discharged directly into the ambient atmosphere.

(e) *Implementation for Tier 5 Requirements.*

(1) *General.*

(A) An engine manufacturer other than a California small volume engine manufacturer shall comply with this section 2423.1 using the following implementation schedules, as applicable. The applicable implementation schedule shall apply to all engines by engine family produced and delivered for sale in

California by that manufacturer. California small volume engine manufacturers may comply with subsection (h) as an alternative to complying with this subsection (e).

(B) All engines in all power categories that certify to the Tier 5 final exhaust emission standards in subsection (d)(1) shall comply with the applicable OR OBD requirements in title 13, CCR, section 2422.

(C) *Limited Production of Tier 4 Final or Tier 5 Interim Engines.*

1. For each of the implementation schedules in this subsection (e), a manufacturer may continue to produce a limited number of engine families that meet all of the requirements that apply to engines that meet the Tier 4 final emission standards under title 13, CCR, section 2423, subsection (b)(1) and engine families that meet all of the requirements that apply to engines that meet the Tier 5 interim emission standards under subsection (d)(1)(A) of this section. The combined number of engines produced and delivered for sale in California that are certified to the Tier 4 final emission standards and engines that are certified to the Tier 5 interim emission standards may not exceed 5 percent of a manufacturer's annual total California production volume each year across all or any power categories.

2. This allowance shall only apply for five model years starting with the first model year in which "Tier 5 Final Compliance" is required.

3. A manufacturer that elects to produce engines that meet the Tier 4 final emission standards or Tier 5 interim emission standards under this subsection (e)(1)(C) shall offset the emissions from these engines using CA-ABT credits, in accordance with the provisions in Part III: 40 CFR PART 1039, Subpart H of the "Tier 5 Test Procedures."

4. A manufacturer that elects to certify Tier 4 final engines or Tier 5 interim engines, as applicable, under this provision, subsection (e)(1)(C), shall notify CARB of that decision (before January 1, 2035).

(D) *Tier 5 Requirements Referenced in this Subsection (e).*

1. References to "Criteria Pollutant Standards" mean the exhaust emission standards in subsection (d)(1)(A).

2. References to "Enhanced Defects Reporting" mean the requirements in Part V: 40 CFR PART 1068, Subpart F, section 1068.501, subparagraph (e) of the "Tier 5 Test Procedures."

3. References to "Idle Reduction Provisions" mean compliance with subsection (d)(3).

4. References to “In-Use Testing Program” mean the Manufacturer-Run Off-Road In-Use Testing (ORIUT) Program requirements in Part II, Subpart A, and applicable sections of Subpart C of the “Tier 5 Test Procedures.” All engines certified for all model years are subject to the CARB-Run Off-Road In-Use Compliance (ORIUC) Program requirements in Part II, Subpart B of the “Tier 5 Test Procedures.”

5. References to “Longer Useful Life and Warranty” mean the requirements in title 13, CCR, section 2421.1, subsection (b)(2) for useful life and title 13, CCR, section 2425.2 for warranty.

6. References to “Low-Load Cycle Certification” mean compliance with subsection (d)(2).

7. References to “Revised Durability Demonstration” mean the Diesel Aftertreatment Rapid Aging Protocol.

8. References to “SCR Inducements” mean the requirements in Part VI, Subpart A of the “Tier 5 Test Procedures.”

(2) *Tier 5 Interim Implementation*.

A manufacturer may optionally certify its off-road compression-ignition engines in the power category greater than or equal to 19 kW and less than or equal to 560 kW to the Tier 5 interim standards in subsection (d)(1)(A) for the 2031 through 2035 model years. The “Tier 5 Test Procedures” shall be used to certify off-road compression-ignition engines to the Tier 5 interim standards. A manufacturer that elects to comply with the Tier 5 interim standards in this section 2423.1 shall not generate or use CA-ABT credits to comply or use federal ABT credits to comply.

(3) *Tier 5 Final Implementation.*

(A) A manufacturer shall certify its off-road compression-ignition engines in the power category less than 19 kW to the Tier 5 Final requirements in accordance with the implementation schedule shown in the following table.

Tier 5 Final Implementation Schedule for Power Category < 19 kW

Tier 5 Final Requirement	***Tier 5 Final Compliance***
Criteria Pollutant Standards	2036+ MY
Revised Durability Demonstration	2036+ MY
SCR Inducements[1]	2036+ MY
Longer Useful Life and Warranty	2036+ MY
Enhanced Defects Reporting	2036+ MY
Low-Load Cycle Certification	n/a
Idle Reduction Provisions	n/a
In-Use Testing Program	n/a

[1] Only applies to engines certified with selective catalytic reduction.

(B) A manufacturer shall certify its off-road compression-ignition engines in the power category greater than or equal to 19 kW and less than 56 kW to the Tier 5 Final requirements in accordance with the implementation schedule shown in the following table.

Tier 5 Final Implementation Schedule for Power Category 19 ≤ kW < 56

Tier 5 Final Requirement	***Tier 5 Final Compliance***
Criteria Pollutant Standards	2036+ MY
Revised Durability Demonstration	2036+ MY
SCR Inducements[1]	2036+ MY
Longer Useful Life and Warranty	2036+ MY
Enhanced Defects Reporting	2036+ MY
Low-Load Cycle Certification	n/a
Idle Reduction Provisions[2]	2036+ MY
In-Use Testing Program	n/a

[1] Only applies to engines certified with selective catalytic reduction.

[2] Does not apply to constant-speed engine families.

(C) A manufacturer shall certify its off-road compression-ignition engines in the power category greater than or equal to 56 kW and less than 130 kW to the Tier 5 Final requirements in accordance with the implementation schedule shown in the following table.

Tier 5 Final Implementation Schedule for Power Category 56 ≤ kW < 130

Tier 5 Final Requirement	***Tier 5 Final Compliance***
Criteria Pollutant Standards	2036+ MY
Revised Durability Demonstration	2036+ MY
SCR Inducements[1]	2036+ MY
Longer Useful Life and Warranty	2036+ MY
Enhanced Defects Reporting	2036+ MY
Low-Load Cycle Certification[2]	2036+ MY
Idle Reduction Provisions[2]	2036+ MY
In-Use Testing Program (NOx)	2036+ MY
In-Use Testing Program (PM)	2036+ MY

[1] Only applies to engines certified with selective catalytic reduction.
[2] Does not apply to constant-speed engine families.

(D) A manufacturer shall certify its off-road compression-ignition engines in the power category greater than or equal to 130 kW and less than or equal to 560 kW to the Tier 5 Final requirements in accordance with the implementation schedule shown in the following table.

Tier 5 Final Implementation Schedule for Power Category 130 ≤ kW ≤ 560

Tier 5 Final Requirement	***Tier 5 Final Compliance***
Criteria Pollutant Standards	2036+ MY
Revised Durability Demonstration	2036+ MY
SCR Inducements[1]	2036+ MY
Longer Useful Life and Warranty	2036+ MY
Enhanced Defects Reporting	2036+ MY
Low-Load Cycle Certification[2]	2036+ MY
Idle Reduction Provisions[2]	2036+ MY
In-Use Testing Program (NOx)	2036+ MY
In-Use Testing Program (PM)	2036+ MY

[1] Only applies to engines certified with selective catalytic reduction.
[2] Does not apply to constant-speed engine families.

(E) A manufacturer shall certify its off-road compression-ignition engines in the power category greater than 560 kW to the Tier 5 Final requirements in accordance with the implementation schedule shown in the following table.

Tier 5 Final Implementation Schedule for Power Category > 560 kW

Tier 5 Final Requirement	***Tier 5 Final Compliance***
Criteria Pollutant Standards	2036+ MY
Revised Durability Demonstration	2036+ MY
SCR Inducements[1]	2036+ MY
Longer Useful Life and Warranty	2036+ MY
Enhanced Defects Reporting	2036+ MY
Low-Load Cycle Certification	n/a
Idle Reduction Provisions[2]	2036+ MY
In-Use Testing Program	n/a

[1] Only applies to engines certified with selective catalytic reduction.
[2] Does not apply to constant-speed engine families.

(f) *Labeling Requirements.*

Engines certified under this section 2423.1 shall be labeled as follows:

(1) For engines certified to the Tier 5 interim emission standards in subsection (d)(1)(A), engine manufacturers shall meet the labeling requirements in title 13, CCR, section 2424.1 and Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the "Tier 5 Test Procedures," but shall use the following in place of the otherwise required statement of compliance in title 13, CCR, section 2424.1, subsection (b)(1): "THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] TIER 5 INTERIM OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR § 2423.1(e)(2)."

(2) For engines certified to the Tier 5 final emission standards in subsection (d)(1)(A), engine manufacturers shall meet the labeling requirements in title 13, CCR, section 2424.1 and Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the "Tier 5 Test Procedures," but shall use the following in place of the otherwise required statement of compliance in title 13, CCR, section 2424.1, subsection (b)(2), as applicable: "THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] TIER 5 FINAL OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR § 2423.1(e)(3)." State the FELs to which the engines are certified.

(3) For limited production Tier 4 final engines certified under subsection (e)(1)(C), engine manufacturers shall meet the labeling requirements in title 13, CCR, section 2424 and Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of

the “Tier 5 Test Procedures,” but shall use the following in place of the otherwise required statement of compliance in title 13, CCR, section 2424, subsection (c)(3): “THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] TIER 4 FINAL OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR § 2423.1(e)(1)(C).” State the FELs to which the engines are certified.

(4) For limited production Tier 5 interim engines certified under subsection (e)(1)(C), engine manufacturers shall meet the labeling requirements in title 13, CCR, section 2424.1 and Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the “Tier 5 Test Procedures,” but shall use the following in place of the otherwise required statement of compliance in title 13, CCR, section 2424.1, subsection (b)(1): “THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] TIER 5 INTERIM OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR § 2423.1(e)(1)(C).” State the FELs to which the engines are certified.

(g) *California Averaging, Banking, and Trading Program.*

Beginning in the 2033 model year, a manufacturer may generate or use CA-ABT emission credits according to the provisions in Part III: 40 CFR PART 1039, Subpart H of the “Tier 5 Test Procedures.” Participation in this program is voluntary. Off-road compression-ignition engines that are certified to the Tier 4 final emission standards in section 2423 or the Tier 5 interim emission standards in this section 2423.1 may not generate or use CA-ABT credits, except as required under subsection (e)(1)(C). Credits that are earned as part of the federal ABT program shall not be used to comply with the Tier 5 interim emission standards in this section 2423.1.

(h) *California Small-Volume Engine Manufacturers.*

(1) A California small-volume engine manufacturer may comply with this section 2423.1 using the provisions in this subsection (h). A California small-volume engine manufacturer that elects to comply with this section 2423.1 using the provisions in this subsection (h) shall notify CARB in writing of the intent to use these provisions before January 1, 2035. A California small-volume engine manufacturer that does not notify CARB in writing of the intent to use the provisions in this subsection (h) before January 1, 2035, may not use any of the provisions herein.

(2) *Tier 5 Implementation Requirements.*

(A) The provisions in subsection (h) shall only apply to California small-volume engine manufacturers as defined in title 13, CCR, section 2421.1.

(B) A California small-volume engine manufacturer may delay compliance with the Tier 5 Final requirements for two model years after the requirement becomes applicable.

(3) California small-volume engine manufacturers shall meet the following requirements for the model years in which compliance with the otherwise applicable implementation requirements in subsection (e)(3) is delayed:

(A) Produce engines that meet either:

1. the Tier 4 final emission standards and all other requirements in title 13, CCR, section 2423, subsection (b)(1) and the incorporated "2011 and Later Test Procedures" or

2. the Tier 5 interim emission standards and all other requirements in subsection (d)(1) of this section and the incorporated "Tier 5 Test Procedures," as applicable, except as noted in this subsection (h).

(B) Meet the labeling requirements in title 13, CCR, section 2424 and the "2011 and Later Test Procedures" or 2424.1 and Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the "Tier 5 Test Procedures," as applicable, but shall use the following in place of the otherwise required statement of compliance in title 13, CCR, section 2424, subsection (c)(3) or title 13 CCR, section 2424.1, subsection, (b)(1) or (b)(2), as applicable: "THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR § 2423.1(h)."

(4) A manufacturer may not circumvent the provisions of title 13, CCR, division 3, chapter 9, article 4 by falsifying California sales volumes in order to qualify as a California small-volume engine manufacturer. A manufacturer that violates this provision shall be subject to civil penalties under Division 26 of the California Health and Safety Code.

(i) *California Transition Program for Equipment Manufacturers (CA-TPEM).*

The provisions of this subsection allow equipment manufacturers to produce equipment with engines that are subject to less stringent emission standards than the Tier 5 final emission standards required in this section 2423.1 after the Tier 5 final emission standards begin to apply.

(1) *General Requirements and Restrictions*.

(A) Only manufacturers that have primary responsibility for designing and manufacturing equipment and have manufacturing procedures for installing engines in equipment, are eligible to participate in the CA-TPEM in accordance with the

provisions in Part III: 40 CFR PART 1039, Subpart G, section 1039.625 of the “Tier 5 Test Procedures.”

(B) Equipment manufacturers participating in the CA-TPEM shall comply with the notification and reporting requirements specified in subsection (i)(8).

(C) A manufacturer of engines produced under the CA-TPEM using FELs greater than the Tier 4 final standards shall offset those emissions using CA-ABT credits.

(2) *Allowances Based on Percent of Historical California Equipment Sales.*

The following allowances apply separately to each engine power category subject to emission standards under subsection (d)(1):

(A) For the applicable portion of a manufacturer’s California-directed sales volume, in accordance with subsection (i)(2)(D) and (i)(2)(E), excluding engines or equipment that fall within the scope of the preemption of Section 209(e)(1) of the Federal Clean Air Act, and as defined by regulation of the U.S. EPA, an equipment manufacturer may produce equipment and vehicles with engines that are exempted from meeting Tier 5 final emission standards for a portion of its California-directed sales volume. For the purposes of this subsection (i), the calculated total number of pieces of equipment that may be exempted from meeting Tier 5 final emission standards is referred to as an “allowance.” The applicable CA-TPEM engine standards and usage period for CA-TPEM allowances for each power category are shown in subsection (i)(3).

(B) An equipment manufacturer shall calculate its historical three-year average of California equipment sales, differentiated by engine power category, using actual 2032 through 2034 calendar year California sales volumes. These sales volumes shall exclude engines or equipment that fall within the scope of the preemption of Section 209(e)(1) of the Federal Clean Air Act, and as defined by regulation of the U.S. EPA. The number of available allowances is a percentage of this calculated average as specified in subsections (i)(2)(D) and (i)(2)(E) below, as applicable. The engine power categories are defined in the table in subsection (i)(3) below:

(C) All CA-TPEM allowances for a power category shall be used as specified in subsection (i)(3). The number of CA-TPEM allowances that an equipment manufacturer may request in accordance with subparagraphs (i)(2)(D) and (i)(2)(E), as applicable, are the total number of allowances that may be used over the entire usage period, not the number of allowances that may be used each calendar year.

(D) *Equipment with Engines Rated at or Above 56 kW*.

For equipment and vehicles that use off-road compression-ignition engines rated at or above 56 kW, a manufacturer's CA-TPEM allowances may not exceed 50 percent of the California-directed historical three-year average equipment sales for each individual power category.

(E) *Equipment with Engines Rated Under 56 kW*.

For equipment and vehicles that use off-road compression-ignition engines with a power rating under 56 kW, a manufacturer's CA-TPEM allowances may not exceed 80 percent of the California-directed historical three-year average equipment sales for each individual power category).

(3) *CA-TPEM Implementation.*

The allowances in the following table are available for the years shown to manufacturers that comply with the requirements of this section 2423.1.

Availability of Allowances		
Power Category	***Usage Period: Calendar Years***	***CA-TPEM Engine Standard[1]***
kW < 19	2036 - 2039	Tier 4 Final
19 ≤ kW < 56	2036 - 2039	Tier 4 Final
56 ≤ kW < 130	2036 - 2038	Tier 4 Final
130 ≤ kW ≤ 560	2036 - 2038	Tier 4 Final
kW > 560	2036 - 2038	Tier 4 Final

[1] For manufacturers that elect to certify engines to the Tier 5 interim standards in subsection (d)(1)(A), the CA-TPEM Engine Standard shall be “Tier 5 Interim” for those engines.

(4) *Inclusion of Engines Not Subject to Tier 5 Requirements.*

Off-road equipment and vehicles built with engines otherwise exempt from the requirements of this section 2423.1 are not required to be counted toward the percentage, or number, of claimed CA-TPEM allowances under the provisions in subsection (i)(2). Such exempted engines include unused inventories produced prior to the effective date of the Tier 5 final standards, excluding stockpiled engines. Nonetheless, manufacturers may choose to include these engines in the count of total equipment produced from which the percentage of CA-TPEM allowances in subsection (i)(2) is derived.

(5) *Labeling Requirements*.

Allowances claimed under the Tier 5 CA-TPEM shall be labeled, as appropriate, per the following:

(A) *Engine Labeling*.

Engine manufacturers shall meet the labeling requirements provided in title 13, CCR, section 2424.1, with the following substitutions:

For CA-TPEM engines meeting previous year emission requirements, the engine manufacturer shall substitute the following for the statement of compliance required in title 13, CCR, section 2424, subsection (c)(3) and title 13, CCR, section 2424.1, subsection (b), as applicable:

"THIS ENGINE COMPLIES WITH CALIFORNIA EMISSION REQUIREMENTS UNDER 13 CCR § 2423.1(i). SELLING OR INSTALLING THIS ENGINE FOR ANY PURPOSE OTHER THAN FOR THE CA-TPEM PROVISIONS CITED MAY BE A VIOLATION OF STATE LAW SUBJECT TO CIVIL PENALTY." [Insert Engine Family Name, CA-TPEM Engine Standard, and state the FELs to which the engines are certified if certification depends on the CA-ABT provisions under subsection (g) and Part III: 40 CFR PART 1039, subpart H of the "Tier 5 Test Procedures."]

(B) *Equipment Labeling*.

For all allowances claimed under the Tier 5 CA-TPEM, equipment manufacturers shall affix a permanent label to the engine or to a readily visible section of the equipment that cannot be easily removed, according to the provisions in title 13, CCR, section 2424.1. The label shall be in the English language, shall supplement the manufacturer's emission control information label, and shall include the following information:

1. The label heading "EMISSION CONTROL INFORMATION."
2. The equipment manufacturer's corporate name and trademark.
3. The calendar year in which the equipment is manufactured.
4. An e-mail address and phone number to contact for further information, or a website that includes this contact information.
5. The following statement:

"THIS EQUIPMENT [or identify the type of equipment] HAS AN ENGINE THAT MEETS CALIFORNIA EMISSION STANDARDS UNDER 13 CCR § 2423.1(i)."

(6) *Technical Hardship Allowances*.

Equipment manufacturers may apply for additional CA-TPEM allowances should extreme and unusual circumstances occur leading to technical obstacles in complying with the Tier 5 requirements. Additional CA-TPEM allowances shall not be provided when the engine and equipment are produced by the same manufacturer, or affiliate. CARB shall review requests for additional CA-TPEM allowances according to the following stipulations:

(A) The manufacturer requesting technical hardship allowances shall demonstrate that the circumstances necessitating them were outside the control of the manufacturer and not the result of negligent business practices or high-risk corporate decisions. An example of legitimate technical hardship may include material shortages caused by verifiable and unanticipated supply chain issues. An example of technical hardship that may not be approved would be a failure to hire skilled employees capable of developing the technical products required. The manufacturer shall also demonstrate that it has taken reasonable steps to minimize the scope of the request.

(B) A manufacturer shall apply for additional CA-TPEM allowances prior to the earliest date in which the applying manufacturer would be in violation of subsection (d)(1). All applications shall provide, at a minimum, the following information:

1. A description of the manufacturer's equipment design process.

2. A description of the relationship with the engine supplier regarding product design.

3. An explanation of the technical hardship leading to this request, why it cannot be addressed without additional CA-TPEM allowances, and an explanation of the circumstances behind the technical hardship and why it was unavoidable.

4. A description of the information and products provided by the engine supplier related to equipment design, including specifications, performance data, prototypes, and the dates of delivery.

5. A comparison of the design processes of the equipment model(s) for which additional allowances are needed versus those of other models that do not need additional allowances, and an explanation of how the technical differences between the models justify the request for additional allowances.

6. A description of all efforts to find and use other compliant engines, or otherwise an explanation why none are available.

7. A description of the steps taken to minimize the scope of the manufacturer's request, and any other relevant information.

8. An estimation of the number of additional allowances needed for each equipment model covered by the request, subject to subsection (i).

Notwithstanding, CARB may require additional information as deemed necessary before making a determination for relief.

(C) The following limits shall apply for technical hardship allowances granted under the CA-TPEM program in subsection (i)(2):

1. The maximum number of CA-TPEM allowances under these technical hardship provisions shall be limited to an additional 50 percent or 80 percent of a manufacturer's three-year average of Historical California Sales, as appropriate, based on the power category of the engine families for which technical hardship is requested.

2. An equipment manufacturer shall use all CA-TPEM allowances granted under subsection (i)(2) prior to using any additional CA-TPEM allowances granted under this subsection (i)(6).

3. All technical hardship allowances shall expire 24 months after the start of the applicable CA-TPEM usage period for each power category, as specified in subsection (i)(3). These allowances shall only be used for the specific equipment models covered in the manufacturer's application for relief.

(7) *Economic Hardship Relief.*

Off-road equipment and vehicle manufacturers may request additional CA-TPEM allowances from CARB, based on economic hardship if the following requirements are met:

(A) An equipment manufacturer or off-road vehicle manufacturer shall submit the application for economic hardship relief to CARB for approval prior to the earliest date on which the applying manufacturer would be in violation of subsection (d)(1). The off-road equipment manufacturer applying for economic hardship relief shall submit evidence for approval, showing that the following requirements have been met:

1. The equipment manufacturer or off-road vehicle manufacturer applying for economic hardship relief shall not be the manufacturer of the engines used in the equipment for which relief is sought.

2. The conditions causing the impending violation shall not be the fault of the applying manufacturer.

3. The conditions causing the impending violation shall be such that the equipment manufacturer or off-road vehicle manufacturer applying for economic hardship relief will experience serious economic hardship, as determined by CARB according to the considerations in Part V: 40 CFR PART 1068, Subpart C, section 1068.255, if relief is not granted.

4. The equipment manufacturer or off-road vehicle manufacturer applying for economic hardship relief shall demonstrate that no allowances under subsection (i) will be available to avoid the impending violation.

(B) Any economic hardship relief granted shall begin within one year after the implementation date of the standard applying to the engines being used in the equipment for which relief is requested and may not exceed 12 months in duration.

(C) As a condition for economic hardship relief, a manufacturer shall submit a plan for recovering the lost environmental benefits from that relief. The labeling requirements in Part V: 40 CFR PART 1068, Subpart C, section 1068.255 of the "Tier 5 Test Procedures" apply.

(8) *Notification and Reporting Requirements for Using Tier 5 CA-TPEM Allowances.*

As a prerequisite to using any Tier 5 CA-TPEM allowances, the equipment manufacturer or off-road vehicle manufacturer shall notify CARB of its intent to use such allowances no fewer than six months prior to the first use of CA-TPEM allowances as provided in subsection (i)(3). The manufacturer shall provide its three-year historical average California sales in accordance with subsection (i)(2)(B) prior to using the allowances, including the total annual California sales for each calendar year that the historical average was calculated. These sales shall be used to verify that the CA-TPEM allowances have been calculated correctly. The manufacturer shall also submit, by March 31 of the following calendar year, an annual report that CA-TPEM allowances have been used to verify that the allowances claimed do not exceed the number of allowances permitted.

(A) A manufacturer shall inform CARB of its intent to use CA-TPEM allowances prior to using CA-TPEM provisions in accordance with subsection (b)(1)(D) and shall provide the following information to CARB:

1. The equipment manufacturer or off-road vehicle manufacturer's name and address, and the name and address of the parent company, if applicable.

2. The name, telephone number, and e-mail address of a person to contact for more information.

3. The calendar years for which the Tier 5 CA-TPEM provisions shall apply.

4. The name and address for each engine manufacturer that is expected to produce the engines that will be used in the equipment or off-road vehicles claimed as CA-TPEM allowances.

5. An accurate estimate of the number of CA-TPEM allowances in each power category that will be produced under the provisions in subsection (i)(2).

6. A tabulation of California-directed CA-TPEM allowances in each power category that have been sold in previous calendar years under the provisions of subsection (i).

(B) For each calendar year that Tier 5 CA-TPEM allowances are used, the equipment manufacturer or off-road vehicle manufacturer shall submit, by March 31 of the following calendar year, a report to CARB in accordance with subsection (b)(1)(D) that documents the utilization of those allowances. In the report, the manufacturer shall identify the total count of equipment and off-road vehicles sold by the manufacturer during the preceding calendar year for each power category, based on actual California-directed sales information, and shall identify the CA-TPEM allowances in each power category by reporting the percentages of California-directed CA-TPEM sales. If the manufacturer(s) of the engine installed in the equipment or off-road vehicles has not already been identified as required in subsection (i)(8)(A)4., the equipment manufacturer and off-road vehicle manufacturer shall identify the name and address of this engine manufacturer(s) in the report. The report shall also identify the cumulative yearly totals and percentages for all CA-TPEM allowances sold for each power category. Alternatively, the percentage figures may be omitted from the report if the report states that CA-TPEM allowances were not used.

(9) *Recordkeeping and Calculation to Verify Compliance.*

The following shall apply to off-road equipment manufacturers that produce CA-TPEM equipment or vehicles under the Tier 5 CA-TPEM provisions of subsection (i), except as otherwise noted:

(A) For each power category in which exempted off-road equipment are produced, a calculation to verify compliance with the requirements of subsection (i) shall be made by the off-road equipment manufacturer. This calculation shall be made for CA-TPEM allowances under the Tier 5 program as indicated in subsection (i)(8)(B). The calculation shall be based on actual California sales information from the subject years. If the CA-TPEM allowances have been exceeded, then the manufacturer is in violation of title 13, CCR, section 2420.1, subsection (c), except as provided under subsection (i)(8) and subsection (i)(7) of this section and is subject to civil penalties under California Health and Safety Code, Division 26.

(B) An off-road equipment manufacturer shall keep records of all off-road equipment and vehicles sold in California under the provisions of subsection (i), for each power category in which CA-TPEM allowances are claimed. These records shall include equipment and engine model numbers, serial numbers, engine family name, dates of manufacture, and maximum engine power for CA-TPEM engines. In addition, the manufacturer shall keep records sufficient to demonstrate the verifications of compliance required in subsection (i)(9)(A) and the notifications and reports specified in subsection (i)(8), as applicable. All records shall be kept for five full calendar years for CA-TPEM allowances under the Tier 5 program after the final year in which allowances are available for each power category and shall be submitted to CARB within one year after the conclusion of the applicable CA-TPEM usage period.

(j) *Replacement Engines.*

For purposes of this subsection (j), a replacement engine is a new compression-ignition off-road engine that is used to replace an engine that has already been placed into service (whether the previous engine is replaced in whole or in part with a new engine). Manufacturers of replacement engines, both complete and partially complete, shall comply with the requirements in this section 2423.1, subsection (j), and Part V: 40 CFR PART 1068, Subpart C, section 1068.240.

(1) A replacement engine shall not be subject to the emission requirements that are applicable to the model year in which the engine is replaced if the following conditions are met. In addition, engines that were originally certified in a previous model year to the same standards that apply for the current model year shall not be subject to the emission requirements of section 2423.1 if the following conditions are met:

(A) The engine manufacturer has ascertained that no engine produced by itself or the manufacturer of the engine that is being replaced, if different, and certified to the requirements of this article, is available with the appropriate physical or performance characteristics to repower the equipment;

(B) In making the determination in subsection (j)(1)(A), the engine manufacturer shall also consider whether any cleaner tier engines are being produced with the appropriate physical or performance characteristics for replacing the original engine so that the cleanest available engine is used as the replacement;

(C) Unless an alternative control mechanism is approved in advance by CARB, the engine manufacturer or its agent takes ownership and possession of the engine being replaced or confirms that the engine has been destroyed;

(D) The engine manufacturer does not use the replacement-engine exemption to circumvent the regulations;

(E) The replacement engine is clearly labeled with the language in either subsection (j)(1)(E)1 or subsection (j)(1)(E)2, or similar alternate language approved in advance by CARB:

1. If the replacement engine is built to a configuration that was not subject to any emission standards under title 13, CCR, division 3, chapter 9, article 4, add a permanent label with your corporate name and trademark and the following language:

"THIS ENGINE DOES NOT COMPLY WITH CALIFORNIA OFF-ROAD EMISSION REQUIREMENTS. SALE OR INSTALLATION OF THIS ENGINE FOR ANY PURPOSE OTHER THAN AS A REPLACEMENT ENGINE FOR AN ENGINE MANUFACTURED PRIOR TO JANUARY 1 [Insert appropriate year reflecting when the earliest tier of emission standards began to apply to engines of that size and type] MAY BE A VIOLATION OF CALIFORNIA LAW SUBJECT TO CIVIL PENALTY."

The following additional information shall also be included on the emission control label:

ENGINE POWER:	{insert the advertised power of the specific engine configuration or the applicable power category for the engine family in kilowatts}
DATE OF MANUFACTURE:	{insert the engine build date}

In lieu of including "Engine Power" or "Date of Manufacture" on the emissions control label, manufacturers may provide this information on a supplemental label attached to the engine in accordance with the provisions of title 13, CCR, section 2424.1.

2. If the replacement engine is built to a configuration that was subject to emission standards under title 13, CCR, division 3, chapter 9, article 4, add a permanent label with your corporate name and trademark and the following language:

"THIS ENGINE COMPLIES WITH CALIFORNIA OFF-ROAD EMISSION REQUIREMENTS FOR [Identify the appropriate emission standards (by model year, tier, or emission levels) for the replaced engine] ENGINES UNDER 13 CCR § 2423.1(j). SELLING OR INSTALLING THIS ENGINE FOR ANY PURPOSE OTHER THAN TO REPLACE AN [Identify the appropriate emission standards (by model year, tier, or emission levels) for the replaced engine] OFF-ROAD ENGINE MAY BE A VIOLATION OF CALIFORNIA LAW SUBJECT TO CIVIL PENALTY.

The following additional information shall also be included on the emission control label:

ENGINE POWER:	{insert the certified power in kilowatts of the specific engine configuration, if applicable, otherwise insert advertised power in kilowatts}
REFERENCE FAMILY NAME:	{insert the engine family name of the replacement engine as recorded in the Executive Order for the engine family to which the replacement engine was originally certified}
DATE OF MANUFACTURE:	{insert the engine build date}

3. In lieu of including “Engine Power,” “Reference Family Name,” or “Date of Manufacture” on the emissions control label, manufacturers may provide this information on a supplemental label attached to the engine in accordance with the provisions of title 13, CCR, section 2424.1. Manufacturers may alternatively state the applicable power category in kilowatts for the certified engine family on the emission control or supplemental label when indicating “Engine Power.” Additionally, manufacturers may indicate the “Emissions Tier” of the replacement engine on the emissions control or supplemental label instead of the “Reference Family Name.” For the purpose of this section, “Emissions Tier” is the emissions standard designation (e.g., Tier 1, Tier 2, Tier 3, Tier 4i, Tier 4f, Tier 5i, Tier 5f) of the engine recorded in the Executive Order for the engine family to which the replacement engine was originally certified. Certified power means the configuration-specific power of the replacement engine as originally identified in the application for certification of the reference engine family (see Part III: 40 CFR Part 1039, Subpart C, section 1039.205(a)). Advertised power means engine power as stated by the manufacturer in sales literature;

(F) The engine manufacturer makes the replacement engine in a configuration identical in all material respects to the engine being replaced (or that of another certified engine of the same or later model year as long as the engine is not certified with a family emission limit higher than that of the old engine). This requirement applies only if the old engine was certified to emission standards less stringent than those in effect when you produce the replacement engine; and

(G) The engine manufacturer has completed and submitted a checklist to CARB as a condition to sell new replacement engines in California, unless the engine(s) will be built to current model year emission requirements. This checklist shall contain the following information and be submitted, beginning with model year 2036, for each of the estimated numbers of replacement engines by engine family and engine model to be produced for California and identified in subsection (j)(3).

1. Identify the equipment, including serial number, for which the engine(s) is to be replaced;

2. Identify all the engines, by family, model number, power category, and emissions tier, that you investigated in determining that a cleaner engine was not available with the physical or performance characteristics necessary to repower the equipment (replacement engine shall meet the cleanest feasible standards, or match the tier of the engine being replaced if no other cleaner engines are available);

3. Identify the specific characteristic(s) that you found incompatible with the cleaner engines including a comparison of part numbers, part dimensions, applicable chassis dimensions, and any other unsuitable parameters;

4. Provide specifications justifying the identified incompatibilities;

5. Identify the modifications needed to alter the equipment to be able to use the cleaner engines you rejected as incompatible. Software or EPROM modifications are not considered incompatible modifications;

6. Attest in a letter under the penalties of the California Health and Safety Code, Division 26, and corresponding regulations, that this information is true, accurate, and complete under penalty of perjury, and you have performed due diligence in selecting the cleanest emissions configuration that the engine can be replaced with according to this checklist.

(2) CARB shall evaluate the information provided by the engine manufacturer pursuant to subsections (j)(1)(G)1 through (j)(1)(G)6. If CARB concludes that the information provided does not support the use of the replacement engine under the criteria set forth in subsections (j)(1)(A) through (j)(1)(G), CARB shall notify the engine manufacturer in writing. As of the date of the written notification, it shall be a violation of this section, which may be subject to civil penalties, for the engine manufacturer to sell or use or cause to be used the replacement engines identified in CARB's written notice.

(3) By September 30 of the year following the end of each of the 2036 and later model years, the engine manufacturer shall send the following information to CARB:

(A) A list of the replacement engines for both complete and partially complete replacement engines, by engine family name, engine model, unique engine serial number, power category, and tier level, produced for California during the model year, paired with a list of the engines being replaced described by engine family name, engine model, unique engine serial number, power category, and tier level;

(B) A completed checklist for each complete and partially complete replacement engine produced and sold during the model year;

(C) The total number of both new replacement engines, separated by complete and partially complete replacement engines, and new certified engines produced and sold for California; and

(D) The attestation letter required in subsection (j)(1)(G).

(4) Replacement engines under subsection (j) may not generate or use emission credits nor be part of any associated credit calculations.

(k) *Allowance for the Production of Previous Model Year Engines.*

(1) To meet the demand for engines created under subsection (i), engine manufacturers may produce engines that do not meet current model year emission requirements. However, engine manufacturers shall receive written assurance from each equipment manufacturer prior to production that a certain number of these engines are needed for the equipment manufacturer's Tier 5 final equipment CA-TPEM allowances. Engine manufacturers shall provide to CARB annually, as part of the certification application, a list of the equipment manufacturers requesting such engines for their Tier 5 final equipment CA-TPEM allowances. The list shall include the equipment manufacturers' names, engine models, the individual serial number of each engine, and estimated California production volumes. A copy of the original correspondence from the equipment manufacturer requesting the production of CA-TPEM engines shall be kept on file by the engine manufacturer in addition to, and in accordance with, the provisions of Part III: 40 CFR PART 1039, Subpart C, section 1039.250 of the “Tier 5 Test Procedures” and shall be provided to CARB as part of the engine manufacturer’s application for certification. Furthermore, all engines produced for sale in California under the CA-TPEM provisions for equipment manufacturers shall be covered by an Executive Order. To obtain an Executive Order for these engines, the engine manufacturer shall comply with the following:

(A) The manufacturer shall submit a request to CARB at: XXXX@arb.ca.gov for certification of CA-TPEM engines intended for sale in California prior to the start of production and

(B) The manufacturer shall provide an attestation to CARB at: XXXX@arb.ca.gov that the CA-TPEM engines to be produced will be identical in all material respects to those for which a valid Executive Order has been issued in a previous model year. The engine family name of the previously certified engine family shall be included in the manufacturer's request for certification.

(2) Upon determination that the conditions in subsection (k)(1)(A) and (k)(1)(B) have been satisfied, CARB shall provide the engine manufacturer with an

Executive Order covering the requested CA-TPEM engine families for the current model year. The engine family names included in the Executive Order shall either be the same as, or a subset of the previously certified engine family names and shall remain the same for as long as the engines continue to qualify as CA-TPEM allowances regardless of model year. These engine family names shall be used by the engine manufacturer to comply with the labeling requirements of subsection (i)(5).

(l) *Allowances for the Use of Certified On-Road Engines in Off-Road Applications*.

(1) An engine manufacturer may introduce new on-road compression-ignition engines into commerce if the engine family meets all of the following requirements:

(A) The engine family has already been certified to the requirements that apply to compression-ignition engines under title 13, CCR, section 1956.8 for the appropriate model year in accordance with the requirements in Part III: 40 CFR PART 1039, Subpart G, section 1039.605 of the "Tier 5 Test Procedures."

(B) The on-road standards shall be at least as stringent as the off-road standards for the power category in question.

(C) The on-road compression-ignition engine manufacturer shall attest that the on-road compression-ignition engine will remain durable throughout the useful life applicable to an off-road engine of the same power category.

(D) The on-road compression-ignition engine manufacturer shall comply with all off-road compression-ignition engine warranty requirements in sections 2425 and 2425.1 and all on-road on-board diagnostics requirements in section 1968.2 or 1971.1, as applicable.

(E) All new on-road compression-ignition engines that are introduced into commerce under the provisions of this subsection (l) are subject to the CARB-run in-use compliance program in Part II, Subpart C of the "Tier 5 Test Procedures."

(m) *Practices, Labeling, Recordkeeping, and Reporting Requirements for Rebuilt Engines*.

This subsection shall apply as provided in subsection (1) below to all off-road compression-ignition engines subject to the requirements of this section 2423.1.

(1) *Practices*.

The rebuilding practices described in Part V: 40 CFR PART 1068 of the "Tier 5 Test Procedures" shall apply. These practices are summarized in subsections (m)(1)(A) and (m)(1)(B), which are provided as respective references for the labeling requirements in subsections (m)(2)(A) and (m)(2)(B).

(A) Any person who rebuilds an engine that either remains installed in a piece of equipment during the rebuilding process or will be reinstalled after the rebuilding process has been completed shall rebuild the engine to the same certified configuration or the certified configuration of a later model year engine. For the purposes of this section, these engines shall be referred to as “rebuilt original engines.”

(B) Any person who replaces the engine in a piece of equipment with a rebuilt engine (this includes engines that have been substantially assembled from parts originally belonging to one or more other engines) shall use a replacement engine with a certified configuration that is at least equivalent, from an emissions standpoint, to that of the engine being replaced. For the purposes of this section, these engines shall be referred to as “rebuilt replacement engines.”

(2) *Labeling Requirements*.

(A) *Rebuilt Original Engines*. Any person who rebuilds engines for which the practices in subsection (m)(1)(A) apply shall ensure that the rebuilt engines are labeled as follows:

1. An original engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued an Executive Order shall retain the emissions control label described in title 13, CCR, section 2424.1. The rebuilder shall not remove or deface in any manner the original label and shall take care to protect it from the effects of sandblasting, acid dipping, or any other restorative processes. Notwithstanding the preceding requirements and prohibitions of this subsection (m)(2)(A)1, the rebuilder shall substitute a new permanent label containing the text in subsection (m)(2)(A)2 for the original emission control label if the rebuilder determines that the label has been irreparably corrupted due to extreme and unintentional circumstances (e.g., fire or collision). The rebuilder shall provide to CARB annually a list of all rebuilt engines for which original labels have been removed under this provision no later than March 1 after the end of each calendar year. The rebuilder shall retain all removed labels or otherwise document the degree to which the labels were damaged or missing (e.g., photographic proof of the corruption), for a period of no less than eight years following the date of renovation and shall make these available to CARB upon request. The rebuilder shall be subject to civil penalty under State law should CARB determine that the original emission control label did not warrant replacement or that the rebuilder is not in compliance with the legal requirements of the provision;

2. An original engine that is rebuilt to a more stringent emissions configuration shall be permanently re-labeled using the following text:

"THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR § 2423.1(m) USING MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE OF A CERTIFIED TIER [*insert the numerical tier designation of the rebuilt engine*] OFF-ROAD COMPRESSION-IGNITION ENGINE. IF PLACED INTO SERVICE IN AN OFF-ROAD APPLICATION, THIS ENGINE MUST BE INSTALLED IN EQUIPMENT ORIGINALLY SOLD WITH A TIER [*insert the numerical tier designation of the rebuilt engine*] OR EARLIER ENGINE. [*insert the engine family name of the reference engine*].

For the purpose of this label, "MATCHED" means a complete set of components corresponding to the certified emissions configuration being referenced (see the definition of "certified emissions configuration" in title 13, CCR, section 2421.1, subsection (b)(2)). The reference engine is the engine family name corresponding to the certified emissions configuration to which the engine has been rebuilt. The label shall conform to the provisions of title 13, CCR, section 2424.1 regarding location and visibility.

(B) *Rebuilt Replacement Engines*.

Any person who rebuilds engines for which the practices in subsection (m)(1)(B) apply shall ensure that the rebuilt engines are labeled as follows:

1. A replacement engine that is rebuilt to the same California emissions configuration employed by the engine at the time it was issued an Executive Order shall retain the emission control label described in title 13, CCR, section 2424.1 and include a supplemental label using the text in subsection (m)(2)(A)2. A replacement engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued a federal Certificate of Conformity, and for which no Executive Order exists, shall be permanently re-labeled using the text in subsection (m)(2)(A)2 prior to being installed in equipment that was originally sold with a California certified engine;

2. A replacement engine that is rebuilt to a more stringent emissions configuration shall be permanently relabeled using the text in subsection (m)(2)(A)2;

3. An incomplete rebuilt replacement engine shall be permanently relabeled using the text specified below.

"THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR § 2423.1(m) AS AN INCOMPLETE ENGINE USING ONLY MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE FOUND IN OFF-ROAD COMPRESSION-IGNITION ENGINES CERTIFIED TO THE [*insert the numerical tier or multiple tiers designation of the rebuilt engine*]."

Any person who completes an incomplete rebuilt replacement engine with components that are not matched components, and the resulting engine is sold, offered for sale, or entered into commerce in California, is in violation of the rebuilding practices referenced under subsection (1) of this subsection and subject to civil penalty under State law.

(C) *Supplemental Labeling Requirements*.

Except as noted below, any person who sells or offers for sale any rebuilt engine subject to the provisions of subsection (m) shall affix a supplemental label to the rebuilt engine that:

1. states the name of the rebuilder, month and year of rebuild, and other information as determined by the rebuilder to be essential to the rebuilding process. An example of such essential information would be documentation that a part from an engine other than an off-road diesel engine, or a part that was modified to fit the off-road diesel engine being rebuilt, was used in the rebuild, but which has identical function to the part being replaced despite different part numbers. Such a part may trigger an enforcement investigation if not identified by the rebuilder as a nonstandard element of the rebuild. Another example would include documenting the installation of an identically performing turbocharger from a locomotive engine to replace the turbocharger on an off-road diesel engine, but with modifications to the mounting bracket being necessary for fitment;

2. is clearly visible without the need to remove any engine components;

3. does not obscure in any way the visibility of the original emission control label or the labels required under subsection (m)(2)(A)2 or subsection (m)(2)(B)3;

4. does not state or imply that the rebuilt engine is “new” or that it belongs to an engine family other than the one to which it was originally certified; and

5. has sufficient durability to remain intact and legible throughout all mandatory recordkeeping periods for rebuilt engines.

The requirement for a supplemental label shall be waived in cases where the rebuilder alternately chooses to incorporate the information in subsection (m)(2)(C)1 above into the new permanent label specified in subsection (m)(2)(A)2 or subsection (m)(2)(B)3.

(D) *Rebuilt New Engines*.

Notwithstanding any other requirement of this subsection (m), any person who rebuilds an engine to comply with current-year emission requirements (including, but

not limited to, durability and warranty), with the intent to sell or offer for sale the rebuilt engine as “new” under the coverage of a new and unique Executive Order, shall replace the original emission control label on that engine with one identifying the engine as belonging to a family meeting current-year emission requirements in accordance with the provisions of title 13, CCR, section 2424.1. If desired, the rebuilder of such an engine may optionally affix to it a supplemental label, but such a label would be required to comply with the same requirements specified in subsection (m)(2)(C) for any other rebuilt engine.

(3) *Recordkeeping and Reporting.*

Recordkeeping requirements specified in Part V: 40 CFR PART 1068, Subpart B, section 1068.120, subsection 1 of the “Tier 5 Test Procedures” shall be followed by rebuilders of off-road compression-ignition engines, and specific reporting requirements in 1068.120, subsection 2 of the same test procedures shall be followed by anyone who manufactures or sells off-road engines or equipment and also rebuilds off-road compression-ignition engines.

(n) *Stockpiling Prohibition*.

Manufacturers may not circumvent the provisions of this article by stockpiling engines with a date of manufacture preceding new or changed emission standards by deviating from normal production and inventory practices. CARB may request that manufacturers submit routine production and inventory records that document normal business practices for up to eight years to aid in determining whether or not a violation of this section has occurred. Other stockpiling prohibitions in Part V: 40 CFR PART 1068, Subpart B, sections 1068.103 and 1068.105 of the “Tier 5 Test Procedures” shall apply.

(o) *Auxiliary Power Units.*

Manufacturers of auxiliary power units installed on tractors subject to greenhouse gas emission standards specified in title 17, CCR, section 95663, subsection (a)(2)(B) shall comply with the emission standards and certification requirements specified in Part III: 40 CFR PART 1039, Subpart G, section 1039.699 of the “Tier 5 Test Procedures.” An “auxiliary power unit” is defined in Part I, Subpart C, section 2 of those test procedures.

(p) *Disclosure of Records.*

(1) *Public Disclosure*.

Unless identified as a trade secret or otherwise confidential under title 17, CCR, section 91011, and supported as such under title 17, CCR, section 91022, records in the Board's possession for the vehicles subject to the requirements of this section 2423.1 are subject to disclosure as public records.

(2) *Disclosure to the U.S. Environmental Protection Agency*.

Records in the Board's possession for the vehicles subject to the requirements of this section 2423.1 shall be subject to disclosure to the federal Environmental Protection Agency, which protects trade secrets as provided in section 114(c) of the Clean Air Act and amendments thereto (42 U.S.C. § 7401 et seq.) and in federal regulations.

(q) *Severability.*

Each provision of this section is severable, and in the event that any provision of this section is held to be invalid, the remainder of this section and this article remains in full force and effect.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, and 43104, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43104, 43211, and 43212, Health and Safety Code.

26. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2423.2 to read as follows:

Note: The entire text of section 2423.2 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2423.2. Exhaust Emission Standards and Test Procedures – 2031 and Subsequent Model Year Marine Compression-Ignition Engines Below 37 kW.

(a) *Purpose and Applicability.*

(1) This section 2423.2 contains the California exhaust emission standards for new 2031 and subsequent model year marine compression-ignition engines with a power rating below 37 kW, except non-integrated auxiliary marine compression-ignition engines. A manufacturer shall certify all marine compression-ignition engines, except non-integrated auxiliary marine compression-ignition engines, to the exhaust emission standards described below, in accordance with Part VII: 40 CFR PART 1042, of the "Tier 5 Test Procedures."

(2) Prior to the 2031 model year, a manufacturer has the option of certifying one or more engine families for marine compression-ignition engines with a power rating below 37 kW to the standards in subsection (d) of this section 2423.2 rather than to the standards in title 13, CCR, section 2423, subsection (b)(1)(B).

(3) Engine families that are certified to this section 2423.2 are deemed to be in compliance with title 13, CCR, section 2423.

(b) *General Provisions.*

The certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California Test Procedures for Tier 5 Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines Below 37 Kilowatts" ("Tier 5 Test Procedures"), which is incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A).

(c) *Abbreviations and Acronyms*.

The following abbreviations and acronyms are used in this section 2423.2:

"40 CFR" means Title 40, Code of Federal Regulations.

"CA-ABT" means California averaging, banking, and trading program.

"CCR" means California Code of Regulations.

"CFR" means Code of Federal Regulations.

"CO" means carbon monoxide.

"Federal ABT program" means the Averaging, Banking, and Trading program in 40 CFR, Part 1039, subpart H, which includes § 1039.701 (October 25, 2016), § 1039.705 (October 25, 2016), § 1039.710 (October 25, 2016), § 1039.715 (April 30, 2010), § 1039.720 (April 30, 2010), § 1039.725 (October 25, 2016), § 1039.730 (October 25, 2016), § 1039.735 (October 25, 2016), § 1039.740 (June 29, 2021), and § 1039.745 (June 29, 2004).

"g/kW-hr" means grams per kilowatt-hour.

"HC" means hydrocarbons.

"kW" means kilowatt.

"L/cyl" means liters per cylinder.

"MY" means model year.

"NOx" means oxides of nitrogen.

"PM" means particulate matter.

(d) *Exhaust Emission Standards for Category 1 Marine Compression-Ignition Engines with a Power Rating Below 37 kW*.

(1) *Duty-Cycle Standards*.

The exhaust emissions from 2031 and subsequent model year Category 1 marine compression-ignition engines shall not exceed the applicable emission standards in subsections (d)(1)(A), (d)(1)(B), and (d)(1)(C). A manufacturer of marine compression-ignition engines shall demonstrate compliance with emission standards by measuring emissions from its engines using the applicable test cycles in Part VII: 40 CFR PART 1042, Appendix II of the "Tier 5 Test Procedures."

(A) The following standards are the maximum exhaust emissions permitted for the full useful life from new Category 1 marine compression-ignition engines with a power rating below 37 kW and a displacement < 0.9 L/cyl.

Exhaust Emission Standards for Category 1 Commercial and Recreational Engines with a Power Rating Below 37 kW and a Displacement < 0.9 L/cyl

Maximum Engine Power	*Power Density (kW/L)*	*PM (g/kW-hr)*	*NOx+HC (g/kW-hr)*	*CO*[2] *(g/kW-hr)*
< 19 kW	All	0.40	7.5	8.0 / 6.6 / 5.5
19 ≤ kW < 37	All	0.30 / 0.20[1]	4.7 / 5.8[1]	8.0 / 6.6 / 5.5

[1] Optional standards allowed under Part VII: 40 CFR PART 1042, Subpart B, section 1042.101, subparagraph (a)(4) of the “Tier 5 Test Procedures.”

[2] CO standards for power categories < 8 kW, 8 ≤ kW < 19, and 19 ≤ kW < 37, respectively, as provided in Part VII: 40 CFR PART 1042, Subpart B, section 1042.101, subparagraph (a)(2) of the “Tier 5 Test Procedures.”

(B) The following standards are the maximum exhaust emissions permitted for the full useful life from new Category 1 commercial marine compression-ignition engines with a power rating below 37 kW and a displacement ≥ 0.9 L/cyl.

Exhaust Emission Standards for Category 1 Commercial Engines with a Power Rating Below 37 kW and a Displacement ≥ 0.9 L/cyl

Displacement	*Power Density (kW/L)*	*PM (g/kW-hr)*	*NOx+HC (g/kW-hr)*	*CO[1] (g/kW-hr)*
0.9 ≤ L/cyl < 1.2	≤ 35	0.12	5.4	8.0 / 6.6 / 5.5
0.9 ≤ L/cyl < 1.2	> 35	0.14	5.8	8.0 / 6.6 / 5.5
1.2 ≤ L/cyl < 2.5	≤ 35	0.10	5.6	8.0 / 6.6 / 5.5
1.2 ≤ L/cyl < 2.5	> 35	0.12	5.8	8.0 / 6.6 / 5.5
2.5 ≤ L/cyl < 3.5	≤ 35	0.10	5.6	8.0 / 6.6 / 5.5
2.5 ≤ L/cyl < 3.5	> 35	0.12	5.8	8.0 / 6.6 / 5.5
3.5 ≤ L/cyl < 7.0	≤ 35	0.10	5.8	8.0 / 6.6 / 5.5
3.5 ≤ L/cyl < 7.0	> 35	0.11	5.8	8.0 / 6.6 / 5.5

[1] CO standards for power categories < 8 kW, 8 ≤ kW < 19, and 19 ≤ kW < 37, respectively, as provided in Part VII: 40 CFR PART 1042, Subpart B, section 1042.101, subparagraph (a)(2) of the “Tier 5 Test Procedures.”

(C) The following standards are the maximum exhaust emissions permitted for the full useful life from new Category 1 recreational marine compression-ignition engines with a power rating below 37 kW and a displacement ≥ 0.9 L/cyl.

Exhaust Emission Standards for Category 1 Recreational Engines with a Power Rating Below 37 kW and a Displacement ≥ 0.9 L/cyl

Displacement	*Power Density (kW/L)*	*PM (g/kW-hr)*	*NOx+HC (g/kW-hr)*	*CO[1] (g/kW-hr)*
0.9 ≤ L/cyl < 1.2	All	0.14	5.8	8.0 / 6.6 / 5.5
1.2 ≤ L/cyl < 2.5	All	0.12	5.8	8.0 / 6.6 / 5.5
2.5 ≤ L/cyl < 3.5	All	0.12	5.8	8.0 / 6.6 / 5.5
3.5 ≤ L/cyl < 7.0	All	0.11	5.8	8.0 / 6.6 / 5.5

[1] CO standards for power categories < 8kW, 8 ≤ kW < 19, and 19 ≤ kW < 37, respectively, as provided in Part VII: 40 CFR PART 1042, Subpart B, section 1042.101, subparagraph (a)(2) of the “Tier 5 Test Procedures.”

(2) *“Not-to-Exceed” Standards*.

The exhaust emissions from 2031 and subsequent model year Category 1 marine compression-ignition engines shall not exceed the applicable Not-to-Exceed emission standards in Part VII: 40 CFR PART 1042, Subpart B, section 1042.101 of the “Tier 5 Test Procedures.” An engine manufacturer shall demonstrate compliance with Not-to-Exceed emission standards by measuring emissions from its engines using the applicable test procedure in Part VII: 40 CFR PART 1042, Subpart F, section 1042.515 of the “Tier 5 Test Procedures.”

(e) *Averaging, Banking, and Trading*.

A manufacturer may generate or use federal ABT emission credits according to the provisions in Part VII: 40 CFR PART 1042, Subpart H of the “Tier 5 Test Procedures.” Participation in this program is voluntary.

Engines certified to this section 2423.2 are not eligible to generate or use CA-ABT credits under title 13, CCR, section 2423.1.

(f) *In-Use Compliance*.

All manufacturers of 2031 and subsequent model year marine compression-ignition engines with a power rating below 37 kW shall comply with the in-use compliance requirements in Part II, Subpart B, section 4 of the “Tier 5 Test Procedures.”

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

(g) *Rebuilt Engines*.

All rebuilders of 2031 and subsequent model year marine compression-ignition engines with a power rating below 37 kW shall comply with the rebuilding provisions in Part VII, Subpart G of the “Tier 5 Test Procedures.”

(h) *Replacement Engines.*

Manufacturers of 2031 and subsequent model year marine compression-ignition replacement engines, both complete and partially complete, shall comply with the requirements in Part VII, Subpart G of the “Tier 5 Test Procedures.”

(i) *Disclosure of Records.*

(1) *Public Disclosure*.

Unless identified as a trade secret or otherwise confidential under title 17, CCR, section 91011, and supported as such under title 17, CCR, section 91022, records in the Board's possession for the vehicles subject to the requirements of this section 2423.2 are subject to disclosure as public records.

(2) *Disclosure to the U.S. Environmental Protection Agency*.

Records in the Board's possession for the vehicles subject to the requirements of this section 2423.2 shall be subject to disclosure to the federal Environmental Protection Agency, which protects trade secrets as provided in section 114(c) of the Clean Air Act and amendments thereto (42 U.S.C. § 7401 et seq.) and in federal regulations.

(j) *Severability.*

Each provision of this section is severable, and in the event that any provision of this section is held to be invalid, the remainder of this section and this article remains in full force and effect.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, and 43104, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43104, 43211, and 43212, Health and Safety Code.

27. Adopt new Title 13, CCR, Chapter 9, Article 4, Section 2424.1 to read as follows:

Note: The entire text of section 2424.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2424.1. Emission Control Labels - Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) The emission control labeling requirements set forth in this section 2424.1, subsections (b) and (c) shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and to marine compression-ignition engines that are certified to title 13, CCR, section 2423.2 in addition to the labeling requirements set forth in title 13, CCR, section 2424.

(2) In case of discrepancy between the requirements set forth in title 13, CCR, section 2424 and this section 2424.1, the requirements in this section 2424.1 shall apply.

(3) The emission control labeling requirements that apply to off-road compression-ignition engines and marine compression-ignition engines that are certified to title 13, CCR, section 2423 are set forth in title 13, CCR, section 2424.

(b) *Label Content and Location*.

(1) For off-road compression-ignition engines that are certified to the Tier 5 interim standards in title 13, CCR, section 2423.1, subsection (d)(1)(A), the label content and location shall comply with the requirements in Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the "Tier 5 Test Procedures."

(2) For off-road compression-ignition engines that are certified to the Tier 5 final standards in title 13, CCR, section 2423.1, subsection (d)(1)(A), the label content and location shall comply with the requirements in Part III: 40 CFR PART 1039, Subpart B, section 1039.135 of the "Tier 5 Test Procedures."

(c) An emission control information label shall not be altered or removed from an engine, subject to civil penalty under California State law, except that a dealer or distributor may remove an incorrect label, prior to the transfer of title of the engine to an ultimate purchaser~~,~~ and replace the incorrect label with the correct label supplied by the certifying manufacturer or an authorized agent. For the purpose of this section, an incorrect label means an emission control information label that was affixed to an engine in good faith by the certifying manufacturer or authorized agent, but which fails to accurately describe the engine's emission performance as required under this Article due to unintentional or clerical error. In this context, good faith means an honest intent

to act without seeking to gain an unfair advantage or to circumvent the regulations. Notwithstanding, an emission control label may be removed and replaced according to the labeling provisions for rebuilt engines in title 13, CCR, section 2423.1, subsection (m)(2). For new replacement engines manufactured in accordance with the provisions of title 13, CCR, section 2423.1, subsection (j), a dealer or distributor may affix supplemental labels, prior to the transfer of title of the engine to an ultimate purchaser, as allowed in title 13, CCR, section 2423.1, subsection (j)(1). Other provisions in Part V: 40 CFR PART 1068, Subpart B, section 1068.101, subsection (b)(7) of the “Tier 5 Test Procedures” may also apply.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, and 43104, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43102, 43104, 43105, and 43154, Health and Safety Code.

28. Adopt new Title 13, CCR, Chapter 9, Article 4, Section 2425.2 to read as follows:

Note: The entire text of section 2425.2 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2425.2. Defects Warranty Requirements for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) This section shall apply to new compression-ignition engines that certify to title 13, CCR, section 2423.1 or section 2423.2 in addition to the defects warranty requirements set forth in title 13, CCR, section 2425.

(2) The requirements in Part III: 40 CFR PART 1039, Subpart B, section 1039.120 and Part V: 40 CFR PART 1068, Subpart B, sections 1068.101, 1068.110, and 1068.115 of the "Tier 5 Test Procedures" shall also apply.

(3) The warranty period shall begin on the date the engine or equipment is delivered to an ultimate purchaser. The use of alternate fuels shall not void the warranties on any engine certified to use such fuel.

(4) In case of discrepancy between the requirements set forth in title 13, CCR, section 2425 and this section 2425.2, the requirements in this section 2425.2 shall apply.

(5) Off-road compression-ignition engines and marine compression engines that are certified to title 13, CCR, section 2423 are subject to the "Defect Warranty Requirements for 1996 and Later Off-Road Compression-Ignition Engines" requirements in title 13, CCR, section 2425.

(b) *General Emissions Warranty Coverage*.

The manufacturer of each off-road compression-ignition engine or marine compression-ignition engine shall warrant to the ultimate purchaser and each subsequent purchaser that the engine is:

(1) Designed, built, and equipped so as to conform with all applicable regulations adopted by the California Air Resources Board pursuant to its authority in Chapters 1 and 2, Part 5, Division 26 of the California Health and Safety Code; and

(2) Free from defects in materials and workmanship that cause any warranted part to fail to conform in all material respects to the specifications described in the engine manufacturer's application for certification as follows:

(A) *Engines Certified to title 13, CCR, section 2423 and Tier 5 interim standards in title 13, CCR, section 2423.1.*

1. The general emission warranty coverage shall apply for a period of five years or 3,000 hours of operation, whichever occurs first, for all engines rated at 19 kW and greater, except as noted below. In the absence of a device to measure hours of use, the engine shall be warranted for a period of five years.

2. For all engines rated less than 19 kW, and for constant-speed engines rated under 37 kW with rated speeds higher than or equal to 3,000 rpm, the general emission warranty coverage shall apply for a period of two years or 1,500 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of two years.

(B) *Engines Certified to Tier 5 final standards in title 13, CCR, section 2423.1*.

1. The emission-related warranty shall cover all components specified in Part III: 40 CFR PART 1039, Subpart B, section 1039.120 (c) of the " Tier 5 Test Procedures."

2. For all engines rated at less than 19 kW, the general emission warranty coverage shall apply for a period of three years or 1,500 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of three years.

3. For constant-speed engines rated at greater than or equal to 19 kW and less than 37 kW that operate at a rotational speed greater than or equal to 3,000 revolutions per minute (RPM), the general emission warranty coverage shall apply for a period of three years or 1,500 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of three years.

4. For constant-speed engines rated at greater than or equal to 19 kW and less than 37 kW that operate at a rotational speed less than 3,000 RPM and for all variable speed engines rated at greater than or equal to 19 kW and less than 37 kW, the general emission warranty coverage shall apply for a period of eight years or 3,000 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of eight years.

5. For all engines rated at greater than or equal to 37 kW, the general emission warranty coverage shall apply for a period of eight years or 3,000 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of eight years.

(C) *Marine Engines Certified to Standards in title 13, CCR, section 2423.2*.

1. The emission-related warranty shall cover all components specified in Part VII: 40 CFR PART 1042, Subpart B, Section 1042.120 (c) of the “Tier 5 Test Procedures.”

2. For all marine compression-ignition engines rated at less than 37 kW, the emission-related warranty shall cover the entire period specified in Part VII: 40 CFR PART 1042, Subpart B, Section 1042.120 (b) of the “Tier 5 Test Procedures.”

(c) *Warranty on Emission-Related Parts Replaced During Scheduled Maintenance.*

(1) Prior to, and not including, the 2036 model year, any warranted part that is scheduled for replacement as required maintenance in the written instructions required in subsection (e) shall be warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part shall be repaired or replaced by the engine manufacturer according to subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.

(2) In 2036 and subsequent model years, all emission-related components covered under this section 2425.2 shall be warranted throughout the full warranty period regardless of their minimum allowable maintenance interval.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104, and 43105, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43102, 43154, and 43205.5, Health and Safety Code.

29. Adopt new Title 13, CCR, Chapter 9, Article 4, Section 2425.3 to read as follows:

Note: The entire text of section 2425.3 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2425.3. Defect Investigation and Reporting Requirements for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) This section shall apply to new off-road compression-ignition engines subject to the standards in title 13, CCR, section 2423.1 or marine compression-ignition engines subject to the standards in title 13, CCR, section 2423.2 and the "Tier 5 Test Procedures," incorporated by reference in title 13, CCR, section 2423.1, subsection (b)(1)(A). The manufacturer of new off-road compression-ignition engines subject to the standards in title 13, CCR, section 2423.1 shall address defects for any of the emission-related components specified in Part III: 40 CFR PART 1039, Subpart B, section 1039.120(c) of the "Tier 5 Test Procedures." The manufacturer of new marine compression-ignition engines subject to the standards in title 13, CCR, section 2423.2 shall address defects for any of the emission-related components specified in Part VII: 40 CFR PART 1042, Subpart B, section 1042.120(c) of the "Tier 5 Test Procedures."

(2) The defects investigation and reporting requirements set forth in title 13, CCR, section 2425.1 shall apply in addition to the requirements set forth in this section 2425.3.

(3) In case of discrepancy between the requirements set forth in title 13, CCR, section 2425.1 and this section 2425.3, the requirements in this section 2425.3 shall apply.

(4) Off-road compression-ignition engines and marine compression engines that are certified to title 13, CCR, section 2423 are subject to the "Defect Investigation and Reporting Requirements" requirements in title 13, CCR, section 2425.1.

(b) *General Requirements*.

Engine manufacturers shall investigate their engines that have been introduced into commerce in California for incorrect, improperly installed, or otherwise defective emission-related components or systems, and shall submit a report to CARB through Fowswarranty@arb.ca.gov based on California triggering thresholds specified in title 13, CCR, section 2143.1, documenting these activities, as required, and their findings. California-specific incidence rates shall also be included in this report.

(c) *Investigation and Reporting Procedures*.

Engine manufacturers shall perform the investigation and reporting procedures specified in Part V: 40 CFR PART 1068, Subpart B, sections 1068.101 and 1068.115 and Subpart F, section 1068.501 of the “Tier 5 Test Procedures,” or Part VII: 40 CFR PART 1042, Subpart J, section 1042.925 of the “Tier 5 Test Procedures,” as applicable.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104 and 43105, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43102, 43154, and 43205.5, Health and Safety Code.

30. Adopt new Title 13, CCR, Division 3, Chapter 9, Article 4, Section 2425.4 to read as follows:

Note: The entire text of section 2425.4 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2425.4. Required Recall and Corrective Action for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) A manufacturer of off-road compression-ignition engines and marine compression-ignition engines with a power rating below 37 kW that are certified to title 13, CCR, section 2423 shall comply with the "Defect Investigation and Reporting Requirements" requirements in title 13, CCR, section 2425.1 in lieu of this section 2425.4.

(2) A manufacturer of off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-ignition engines with a power rating below 37 kW that are certified to title 13, CCR, section 2423.2 shall comply with the "Required Recall and Corrective Action Requirements" in subsection (b) of this section 2425.4.

(b) *Required Recall and Corrective Action Requirements*.

(1) A manufacturer of off-road compression-ignition engines and marine compression-ignition engines with a power rating below 37 kW shall recall an engine family and provide an extended warranty for the components that are replaced to correct the systemic failure, as defined in title 13, CCR, section 2421.1, subsection (b)(2), of an exhaust aftertreatment device, on-board computer or system, urea doser, hydrocarbon injector, exhaust gas recirculation valve, exhaust gas recirculation cooler, turbocharger, fuel injector, or functional equivalent when the number of valid failures meets or exceeds the corrective action thresholds, as determined by CARB pursuant to title 13, CCR, section 2143.1, following the procedures specified in Part V: 40 CFR PART 1068, Subpart F, sections 1068.501 through 1068.535 of the "Tier 5 Test Procedures." The manufacturer shall submit a corrective action plan to CARB no later than 90 calendar days after the corrective action threshold specified in title 13, CCR, section 2143.1 has been exceeded.

(2) A manufacturer of off-road compression-ignition engines and marine compression-ignition engines with a power rating below 37 kW shall perform corrective action when the number of valid failures meets or exceeds the corrective action thresholds, as determined by CARB pursuant to title 13, CCR, section 2143.1. The corrective action shall follow the procedures specified in Part V: 40 CFR PART 1068, Subpart F, sections 1068.501 through 1068.535 of the "Tier 5 Test Procedures." An

example of a corrective action is providing an extended warranty as defined in title 13, CCR, section 2421.1, to correct the systemic failure, as defined in title 13, CCR, section 2421.1, subsection (b)(2), of an emission control component other than an exhaust aftertreatment device, on-board diagnostic computer and system, urea doser, hydrocarbon injector, exhaust gas recirculation cooler, turbocharger, fuel injector, or functional equivalent. The corrective action plan shall be submitted no later than 90 calendar days after the corrective action threshold specified in title 13, CCR, section 2143.1 has been exceeded.

(3) CARB may determine a recall is necessary pursuant to title 13, CCR, section 2148 for the circumstances specified in subsection (b)(2).

NOTE: Authority cited: Sections, 39003, 39500, 39600, 39601, 43000.5, 43013, 43018, 43204, 43205.5, and 43214, Health and Safety Code; Engine Mfrs Assn v. California Air Resources Board, (2014) 231 Cal. App.4th 1022. Reference: Sections 43000, 43016, 43100, 43101, 43102, 43106, 43154, Health and Safety Code.

31. Adopt new Title 13, CCR, Chapter 9, Article 4, Section 2427.1 to read as follows:

Note: The entire text of section 2427.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2427.1. Selective Enforcement Audit for Off-Road Compression-Ignition Engines and Marine Compression-Ignition Engines.

(a) *Applicability*.

(1) This section shall apply to off-road compression-ignition engines that are certified to title 13, CCR, section 2423.1 and marine compression-engines that are certified to title 13, CCR, section 2423.2.

(2) Off-road compression-ignition engines and marine compression engines that are certified to title 13, CCR, section 2423 are subject to the "Selective Enforcement Audit" requirements in title 13, CCR, section 2427, subsection (c).

(b) *Selective Enforcement Audit*.

(1) *Applicable Test Procedures.*

(A) The 2031 and later model year Tier 5 off-road compression-ignition engines that are certified for sale in California under title 13, CCR, section 2423.1 and marine compression-ignition engines with a power rating below 37 kW that are certified for sale in California under section 2423.2 shall be subject to the Selective Enforcement Audit requirements specified in Part V, Subpart E of the "Tier 5 Test Procedures."

(B) These procedures specify the Selective Enforcement Audit test procedures in conjunction with the "Tier 5 Test Procedures." An engine is in compliance with these Selective Enforcement Audit standards and test procedures only when all portions of these Selective Enforcement Audit test procedures are fulfilled.

(2) California Air Resources Board (CARB) personnel and mobile laboratories shall have access to engine or equipment assembly plants, distribution facilities, and test facilities for the purpose of engine selection, testing, and observation. Scheduling of access shall be arranged with the designated manufacturer's representative and shall not unreasonably disturb normal operations.

(c) Any manufacturer obtaining certification under this Article shall supply to CARB, upon request, a reasonable number of production engines selected by CARB that are representative of the engines, emission control systems, fuel systems, and transmissions offered and typical of production models available for sale under the

certificate. These engines shall be supplied for testing at such time and place and for such reasonable periods as CARB may require.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104, and 43105, Health and Safety Code. Reference: Sections 43013, 43016, 43017, 43018, 43101, 43102, 43104, 43154, 43210, 43210.5, 43211, and 43212, Health and Safety Code.

32. Adopt new Title 13, CCR, Chapter 9, Article 4.5, Section 2430.1 to read as follows:

Note: The entire text of section 2430.1 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2430.1. Applicability for Engines that are Designed to Operate Using Hydrogen as a Combustion Fuel Source.

(a) *General Requirements.*

This article shall be applicable to new engines that are designed to operate using hydrogen as a combustion fuel source in accordance with the requirements in this section 2430.1, with the exception of all engines used in equipment that fall within the scope of the preemption of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)) and as defined by regulation of the U.S. Environmental Protection Agency.

(b) *Compliance with Emission Standards.*

(1) Off-road engines designed to operate using hydrogen as a combustion fuel source shall be subject to the compression-ignition standards and all the requirements as specified in subsections (b)(2) and (b)(3) if any of the following criteria apply:

(A) The engine employs boosted air induction, including turbochargers, superchargers, or any variant thereof, e.g., electric-turbo chargers.

(B) The engine is designed to operate in equipment previously powered with an off-road compression-ignition engine certified to the standards in title 13, CCR, section 2423 or 2423.1.

(C) The engine is derived from existing diesel cycle engines. For example, engines that share the same engine block configuration but utilize different cylinder head designs to convert from compression-ignition diesel-fueled engine to spark-ignition hydrogen-fueled engine would be considered derived from existing diesel cycle engines.

(2) For 2031 through 2035 model years, off-road engines designed to operate using hydrogen as a combustion fuel source meeting any of the criteria specified in subsection (b)(1) above shall be subject to all the requirements in title 13, CCR, section 2423.05 or may optionally comply with Tier 5 interim requirements in title 13, CCR, section 2423.1 or Tier 5 final requirements in title 13, CCR, section 2423.1.

(3) For 2036 and subsequent model years, off-road engines designed to operate using hydrogen as a combustion fuel source meeting any of the criteria specified in subsection (b)(1) above shall be subject to all the requirements in title 13, CCR, section 2423.1.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102 and 43104, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43102, 43104, 43105, 43150, 43151, 43152, 43153, 43154, 43205.5, 43210, 43210.5, 43211, and 43212, Health and Safety Code.

33. Amend Title 13, CCR, Chapter 9, Article 4.8, Section 2449 to read as follows:

§ 2449. General Requirements for In-Use Off-Road Diesel-Fueled Fleets.

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(c) *Definitions*

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(33) *"Job Training Center*" means any program or nonprofit organization established by the U.S. Department of Labor, as described in Section 143 of the Workforce Innovation and Opportunity Act, or by a labor union, that provides training in the operation of off-road equipment subject to this regulation.

(334) *"Local municipality"* means a city, county, city and county, special district, or other public agency, or two or more public entities acting jointly, or the duly constituted body of an Indian reservation or rancheria. Agencies of the United States of America or the State of California, and departments, divisions, public corporations, or public agencies of this State or of the United States are not considered local municipalities.

(345) *"Low-population county local municipality fleet"* means a fleet owned by a local municipality (as defined above) that is located in a county as defined in title 13, CCR, section 2022(b)(4) and identified in section 2022.1(c)(2), Table 2, or, using the criteria set forth in title 13, CCR, section 2022.1(c)(4), a local municipality not located in a low-population county that has requested and has received Executive Officer approval to be treated like a municipality in a low-population county. Fleets owned by such local municipalities shall be treated as small fleets even if their total max hp exceeds 2,500 hp.

(356) *"Maximum power"* (max hp) means the engine's net horsepower (hp) or net flywheel power certified to Society of Automotive Engineers (SAE) Method J1349 or International Organization for Standardization (ISO) Method 9249. If the engine's net hp or net flywheel power certified to SAE Method J1349 or ISO Method 9249 is not readily available, another net hp or net flywheel power from the manufacturer's sales and service literature or hp from the engine label may be used.

(367) *"Model year"* has the same meaning as defined in title 13, CCR, section 2421(a)(38).

(378) *"New fleet"* means a fleet that is acquired or that enters California on or after January 1, 2012. Such fleets may include new businesses or out-of-state businesses that bring vehicles into California for the first time on or after January 1, 2012.

(389) *"Newly reported fleet"* means a fleet that reports to CARB for the first time.

(3940) *"Non-profit training center"* means an ~~entity~~ organization, except an organization established by a labor union, that operates a program for training in the use of off-road vehicles and that (A) is a community college program that trains students in the use of off-road vehicles or (B) qualifies as a non-profit or not for profit organization under title 26 Internal Revenue Code section 501(a), (c)(3), (c)(5), or (c)(6). Any vehicles that are not used for an off-road training program are not considered part of a non-profit training center and must be considered a separate fleet.

(401) *"Off-highway vehicle"* is defined in Veh. Code division 16.5.

(412) *"Operator log"* means a log of the hours that a vehicle operated taken from records of vehicle operator hours.

(43) *"Organization"* means a partnership, corporation, limited liability company, association, trust, or any other legal entity.

(424) *"Oxides of nitrogen"* (NOx) means compounds of nitric oxide, nitrogen dioxide, and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes and are major contributors to smog formation and acid deposition.

(435) *"Permanent low-use vehicle"* means a vehicle that a fleet owner has designated as operating less than 200 hours a calendar year, for all years subsequent to the designation. For example, if a fleet designates a vehicle as permanent low-use at any point in 2014, that vehicle can only be used less than 200 hours in any calendar year from 2015 onwards. To be considered a permanent low-use vehicle, the fleet owner must submit the engine hours of operation from a functioning non-resettable hour meter.

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(446) *"Prime contractor"* means the entity that holds the contract for a project directly with the awarding authority or the owner of the project, to oversee all or part of a project in which vehicles subject to this regulation are operated.

(457) *"Public incentive funds"* or *"Public incentive funding"* means any funding provided by one or more public entities via a grant, voucher, contract, or loan program that includes limitations on using the funding for regulatory benefit or credit.

(468) *"Public works awarding body"* means any public agency (state, county, city, school board, water district, etc.), or official thereof, in the state of California, that awards or enters into a contract for the erection, construction, alteration, repair, removal, or improvement of any public structure, building, road, or other public lands, property, or improvement of any kind.

This text is draft, for purposes of discussion, and may be revised and/or reorganized in the future.

(47~~9~~) *"Queuing"* means the intermittent starting and stopping of a vehicle while the driver, in the normal course of doing business, is waiting to perform work or a service, and when shutting the vehicle engine off would impede the progress of the queue and is not practicable. Queuing does not include the time a driver may wait motionless in line in anticipation of the start of a workday or opening of a location where work or a service will be performed.

(48~~50~~) *"Registered and driven safely on-road"* means a vehicle meets the requirements to be registered for on-road operation in Veh. Code division 3, chap. 1, article 1, sections 4000 et seq. (i.e., required to be registered or could be registered), and the requirements to be driven safely on-road in "Equipment of Vehicles" requirements in Veh. Code division 12, chap. 1, sections 24000 et seq. and "Size, Weight, and Load" requirements in Veh. Code division 15, sections 35000 et seq. Having a California Special Construction Equipment plate as defined in California Veh. Code sections 565 and 570 does not constitute registration.

(49~~51~~) *"Renewable diesel, R99 or R100"* means a diesel fuel substitute produced from non-petroleum renewable sources, including vegetable oils and animal fats, that meets both a) title 40, Code of Federal Regulations, Part 79 -- Registration of Fuels and Fuel Additives (July 2021), which is incorporated by reference herein; and b) American Society for Testing and Materials specification D975 (approved August 1, 2021), which is incorporated by reference herein.

(50~~2~~) *"Replacement"* means the addition of off-road diesel vehicles to a fleet that had retired one or more off-road diesel vehicles of an equivalent hp in a given year.

(51~~3~~) *"Replacement emission control label"* means a label which is identical to the emission control label that was installed on the engine at the time of manufacture, meets the requirements of title 13 CCR section 2424, and was approved at the time of certification.

(52~~4~~) *"Repower"* means to replace the engine in a vehicle with another engine meeting a subsequent engine emissions standard (e.g., replacing a Tier 0 engine with a Tier 2 or later engine).

(53~~5~~) *"Responsible official"* means one of the following:

* * * * *

(54~~6~~) *"Retire or retirement"* means removal of an engine from fleet service, so that the engine is not subsequently operated by the fleet in the State of California. To retire an engine, the vehicle with the engine may be moved outside of California, sold to another fleet (in or outside California), or scrapped. The return of a rented or leased vehicle by a fleet to a rental or leasing company is not considered to be a retirement.

Similarly, the rental or leasing of a vehicle by a rental or leasing company does not count as a retirement for the rental or leasing company.

(5~~57~~) *"Snow removal operations"* means removing snow from public roads, private roads, or driveways.

(5~~68~~) *"Specialty vehicle"* means a vehicle for which no used vehicle with a cleaner engine that can serve an equivalent function and perform equivalent work is available.

(5~~79~~) *"Subcontractor"* means any person or entity who has a contract with the prime contractor or another subcontractor, but does not have a contract directly with an awarding authority or owner, for work involving the operation of vehicles subject to this regulation.

(~~58~~60) *"Tier 0 engine"* means an engine not subject to the requirements in title 13, CCR, section 2423; title 40, Code of Federal Regulations (CFR), Part 89; or title 40, CFR, Part 1039.

(~~59~~61) *"Tier 1 engine"* means an engine subject to the Tier 1 new engine emission standards in title 13, CCR, section 2423(b)(1)(A) and/or title 40, CFR, Part 89.112(a). This also includes engines certified under the averaging, banking, and trading program with respect to the Tier 1 Family Emission Limits (FEL) listed in title 13, CCR, section 2423(b)(2)(A) and/or title 40, CFR, Part 89.112(d).

(6~~0~~2) *"Tier 2 engine"* means an engine subject to the Tier 2 new engine emission standards in title 13, CCR, section 2423(b)(1)(A) and/or title 40, CFR, Part 89.112(a). This also includes engines certified under the averaging, banking, and trading program with respect to the Tier 2 FEL listed in title 13, CCR, section 2423(b)(2)(A) and/or title 40, CFR, Part 89.112(d).

(6~~1~~3) *"Tier 3 engine"* means an engine subject to the Tier 3 new engine emission standards in title 13, CCR, section 2423(b)(1)(A) and/or title 40, CFR, Part 89.112(a). This also includes engines certified under the averaging, banking, and trading program with respect to the Tier 3 FEL listed in title 13, CCR, section 2423(b)(2)(A) and/or title 40, CFR, Part 89.112(d).

(6~~2~~4) *"Tier 4 final engine"* means an engine subject to the final after-treatment-based Tier 4 emission standards in title 13, CCR, section 2423(b)(1)(B) and/or title 40, CFR, Part 1039.101. This also includes engines certified under the averaging, banking, and trading program with respect to the Tier 4 FEL listed in title 13, CCR, section 2423(b)(2)(B) and/or title 40, CFR, Part 1039.101.

(6~~3~~5) *"Tier 4 Interim engine"* means an engine subject to the interim Tier 4 emission standards (also known as transitional) in title 13, CCR, section 2423(b)(1)(B) and/or title 40, CFR, Part 1039.101. This also includes engines certified under the

averaging, banking, and trading program with respect to the Tier 4 FEL listed in title 13, CCR, section 2423(b)(2)(B) and/or title 40, CFR, Parts 1039.102 and 1039.104(g).

(64~~5~~6) *"Total maximum power"* (total max hp) means the sum of the max hp for all of a fleet's engines that are subject to this regulation. Permanent and year-by-year low-use vehicles, dedicated snow-removal vehicles, and vehicles used solely for emergency operations shall not be included in the sum.

(65~~6~~7) *"Turnover"* means retiring a vehicle, designating a vehicle as a permanent low-use vehicle, repowering a vehicle with a higher tier engine, or rebuilding the engine to a more stringent emissions configuration. Rented or leased vehicles that are returned to a rental or leasing company do not count as turnover for the lessee. Similarly, vehicles leased or rented out by a rental or leasing company do not count as turnover for the rental or leasing company.

(66~~7~~8) *"Two-engine crane"* means a mobile diesel-powered machine with a hoisting mechanism mounted on a specially constructed truck chassis or carrier; one engine provides motive power, and a secondary (auxiliary) engine 50 bhp or greater that is used to lift and move materials and objects.

(67~~8~~9) *"Two-engine vehicle"* means a specially constructed on-road or off-road mobile diesel-powered vehicle that was designed by the original equipment manufacturer to be equipped with 2 diesel engines: 1 engine provides the primary source of motive power of the vehicle while the second engine is an auxiliary engine 50 bhp or greater that is permanently attached and integrated into the design of the vehicle to perform a specific function, which may include providing auxiliary power to attachments, performing special job functions, or providing additional motive power.

(68~~7~~70) *"Two-engine water-well drilling rig"* means a mobile diesel-powered drilling rig owned by a water well drilling contractor with a current, valid C-57 license issued by the Contractors State License Board of California and used exclusively to drill water wells with a drilling mechanism mounted on a specialty constructed truck chassis or carrier; 1 engine provides motive power, and a secondary (auxiliary) engine 50 bhp or greater that is used to power the drilling mechanism.

(69~~6~~71) *"Verified diesel emission control strategy"* (VDECS) means an emissions control strategy that has been verified pursuant to the "Verification Procedures, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emission from Diesel Engines" (Verification Procedure), title 13, CCR, sections 2700-2710. VDECS can be verified to reduce PM emissions, or NOx emissions, or both.

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(70~~1~~2) *"Verified percent NOx reduction"* means the verified percent reduction in NOx emissions from the engine achieved by the VDECS verified to reduce NOx.

(7~~1~~3) *"VDECS failure"* means the condition of a VDECS not achieving the emissions reductions to which the VDECS is verified. Such a condition could be due to inappropriate installation, damage, or deterioration during use. If a Level 3 VDECS is emitting visible smoke, it shall be assumed to have failed.

(7~~2~~4) *"Workover rig"* means a mobile self-propelled rig used to perform one or more remedial operations, such as deepening, plugging back, pulling and resetting liners, on a producing oil or gas well to try to restore or increase the well's production.

(7~~3~~5) *"Year-by-year low-use vehicle"* means a vehicle that operated in California less than 200 hours during the preceding 12-month calendar year. For example, when reporting in 2014, the hours of use between January 1, 2013 and December 31, 2013, would be used to determine year-by-year low-use status. To be considered a year-by-year low-use vehicle, the fleet owner must annually submit engine operation data from a functioning non-resettable hour meter.

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(7~~4~~6) "Zero-emission vehicle" means a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas under any and all possible operational modes and conditions.

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NOTE: Authority cited: Sections 39002, 39003, 39515, 39516, 39600, 39601, 39602, 39602.5, 39650, 39656, 39658, 39659, 39665, 39667, 39674, 39675, 39730.8(c), 40000, 41511, 42400, 42400.1, 42400.2, 42400.3.5, 42402, 42402.1, 42402.2, 42402.4, 42403, 43000, 43000.5, 43013, 43016, 43018, 43018.2 and 43600, Health and Safety Code. Reference: Sections 39000, 39002, 39003, 39515, 39516, 39600, 39601, 39602, 39602.5, 39650, 39656, 39657, 39658, 39659, 39665, 39667, 39674, 39675, 39730.8(c), 40000, 41511, 42400, 42400.1, 42400.2, 42402.2, 43000, 43000.5, 43013, 43016, 43018, 43018.2, 43154, 43600, 43865 and 43866, Health and Safety Code.

34. Add new Title 13, CCR, Chapter 9, Article 4.8, Section 2449.4 to read as follows:

Note: The entire text of section 2449.4 set forth below is new language and is shown in "normal type" proposed to be added to the California Code of Regulations.

§ 2449.4. General Requirements for In-Use Off-Road Diesel-Fueled Fleets for Adding Vehicles that are not California-Certified.

(a) *General Requirements*.

(1) The requirements set forth in this section 2449.4 apply to in-use diesel-fueled fleets in addition to the requirements set forth in title 13, CCR, section 2449.

(2) In case of discrepancy between the requirements set forth in title 13, CCR, section 2449 and this section 2449.4, the requirements in this section 2449.4 shall apply.

(b) *Performance Requirements*.

(1) *Adding Vehicles to Fleets*.

With the exception noted below for fleets owned by vehicle lessors, the following requirements apply to all fleets. Fleets owned by lessors are not subject to the following requirements for vehicles owned by the lessor and returned to the lessor fleet at the end of a lease if the vehicles were included in the fleet of the lessee for the compliance year in question. Vehicles returned to a lessor fleet must, however, be included in the lessor fleet's fleet average demonstration on subsequent compliance dates. For the purposes of this requirement, a vehicle may be assumed to meet the engine emission standard tier in effect for the model year of the engine.

(2) *Adding vehicles that are not California-certified.*

Beginning January 1, 2036, for large, medium, and small fleets, a fleet shall not add a vehicle with a 2036 or later model year engine that is not certified to the requirements in title 13, CCR, division 3, chapter 9, article 4, section 2423.1, regardless of the number of hours on the engine's hour-meter, with the exception of:

(A) Federally certified engines used in equipment that fall within the scope of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)) and as defined by regulation of the U.S. EPA;

(B) Federally certified engines used in equipment that do not fall within the scope of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)) that have been certified to exhaust emission standards that are at least as stringent as the applicable standards in title 13, CCR, division 3, chapter 9, article 4. The existing

prohibitions for adding vehicles to fleets in section 2449, subsection (d) continue to apply.

(C) New replacement engines produced under the federal provisions in 40 CFR Part 1068.240 to replace 2036 and subsequent model year engines that have the same physical and performance characteristics of the engines being replaced, and which do not fall within the scope of Section 209(e)(1) of the Federal Clean Air Act (42 U.S.C. § 7543(e)(1)).

Note: Authority cited: Sections 39002, 39003, 39515, 39516, 39600, 39601, 39602, 39602.5, 39650, 39656, 39658, 39659, 39665, 39667, 39674, 39675, 39730.8(c), 40000, 41511, 42400, 42400.1, 42400.2, 42400.3.5, 42402, 42402.1, 42402.2, 42402.4, 42403, 43000, 43000.5, 43013, 43016, 43018, 43018.2, and 43600, Health and Safety Code. Reference: Sections 39000, 39002, 39003, 39515, 39516, 39600, 39601, 39602, 39602.5, 39650, 39656, 39657, 39658, 39659, 39665, 39667, 39674, 39675, 39730.8(c), 40000, 41511, 42400, 42400.1, 42400.2, 42402.2, 43000, 43000.5, 43013, 43016, 43018, 43018.2, 43600, 43865, and 43866, Health and Safety Code.