ATTACHMENT II

Proposed Modifications to On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD), Section 1971.1, Title 13, California Code of Regulations

- Section 1971.1, title 13, California Code of Regulations (CCR)
- Changes 3, 4, 6, 7, 19, 20, 21, 22, 24, 25, 26, and 31 reflect changes that have been made since the July 21, 2005 Board Hearing in response to comments submitted at or subsequent to the Hearing.

1. Section (b): A specific reference was added to section (d)(7) because (d)(7) contains the majority of information regarding the phase-in and exceptions to the requirement for all 2010 and subsequent model year engines.

2. Section (c): The names for fault codes for systems using the SAE J1939 protocol were changed *from "active fault code"* and *"previously active fault code"* to *"MIL-on fault code"* and *"previously MIL-on fault code"* at the request of industry to provide more clarity and avoid confusion with the industry's historical usage of the terms "active" and "previously active". Changes were made throughout the regulation to align with these new names.

3. Section (c): The term *"European Stationary Cycle (ESC)"* was renamed *"Supplemental Emission Test (SET) cycle"*. Industry more commonly uses the term SET, and the definition for *"SET standard"* was added. Staff has also made changes to the definition of *"FTP standard"* to align with the changes in the SET standard definition.

4. Section (c): A definition for *"manufacturer"* was added to clarify that the term refers to engine manufacturers and, specifically, the holder of the Executive Order for the engine family.

5. Section (d): Staff has modified the first paragraph to provide notice that there are exceptions elsewhere in the regulation that specifically require pinpointing of the malfunctioning component that may override the general requirement that manufacturers do not need to use unique diagnostics to separately detect every malfunction identified in the regulation. Examples of exceptions that are set forth elsewhere in the regulation would include the requirement to identify the specific cylinder that is misfiring or to separately identify comprehensive component circuit faults from rationality faults.

6. Sections (d)(5.5.2)(B) and (h)(5.2.1)(B): These sections were modified to allow manufacturers to define engine start at an engine speed anywhere between 50 and 150 rpm below normal warmed-up idle speed instead of requiring it to be defined at exactly 150 rpm below normal warmed-up idle speed.

7. Section (d)(6.1.3): This section was modified to remove the sentence that allowed staff to request emission testing of a specific monitor to challenge the manufacturer's decision regarding which of the two emission test cycles (SET or FTP) was more stringent. Under section (d)(6.1.3), the staff still retains the authority to challenge the manufacturer's decision and to request the engineering analysis and/or emission data the manufacturer used to make its decision.

8. Section (d)(6.2): The parenthetical example of "(e.g., 1.5 times any of the applicable standards)" was modified to change the "1.5" to "2.0" to make the example consistent with the change to the monitoring thresholds made elsewhere in the regulation and detailed in item 9 below.

9. Sections (d)(7.1.3)(A) and (7.1.3)(A)(iv): Language was added to clarify that engines in the 2010 through 2012 model year are exempt from the standardization aspects of some requirements but not exempt from the requirements themselves. Specifically, the engines are exempt from items such as using a standardized symbol for the malfunction indicator light (MIL) and from making data such as fault codes or engine parameters available to a scan tool in accordance with SAE specifications. However, the engine is still required to have a MIL and to make the data such as fault codes and engine parameters available in a format of the engine manufacturer's choosing.

10. Sections (e)(1.2.1)-(1.2.3), (2.2.2), (2.2.2)(A), (3.2.1)-(3.2.3), (3.2.5), (4.2.1)-(4.2.4), (9.2.1)(A)(i), (10.2.1), (10.2.2): These sections were revised to increase the emission levels for malfunction detection. Specifically, the thresholds were raised to 2.0 times the standard for NMHC, CO, and NOx emissions and to the PM standard plus 0.02 g/bhp-hr for PM emissions. The higher thresholds provide more flexibility to manufacturers to design compliant systems that robustly detect malfunctions prior to exceeding these emission thresholds. The higher threshold has been changed elsewhere in the regulation in parenthetical examples such as described in item 7 above to be consistent with this modification.

11. Section (e)(2.3.2): This section was added to allow manufacturers to use enable conditions other than the required engine idle conditions to conduct misfire monitoring if they can achieve equivalent levels of diagnostic robustness and in-use monitoring frequency.

12. Sections (e)(8.2.1)(A) and (B): The emission level by which a PM filter malfunction must be detected was changed to a higher level and the higher, interim malfunction threshold was extended through 2015 for the majority of engines. Specifically, the interim threshold emission level was changed from an absolute level of 0.05 g/bhp-hr PM to one of the following two levels, whichever is higher: an absolute level of 0.05 g/bhp-hr PM; or the PM standard (or family emission limit (FEL)) plus an additional 0.04 g/bhp-hr PM. The final malfunction threshold was also changed from an absolute level of 0.025 g/bhp-hr PM to one of the following two levels, whichever is higher: an absolute level of 0.03 g/bhp-hr PM; or the PM standard (or FEL) plus an

additional 0.02 g/bhp-hr PM. This final threshold is not required until 2016 for the majority of engines and in 2013 through 2015 on a small portion of the engines. The parenthetical example "(e.g., cracking)" was also removed because it was unnecessary and did not provide any additional clarity to the requirements.

13. Sections (e)(9.2.1)(B)(i)a. and b.: Changes were made in these sections to the malfunction emission thresholds for air-fuel ratio sensors located downstream of the aftertreatment to make the thresholds consistent with the thresholds used for other monitors. Specifically, the interim 2010 through 2012 threshold for NMHC was changed from 1.5 times the standard to 2.5 times the standard. For PM, the threshold was changed to align with the interim PM filter malfunction threshold emission level. For the final thresholds in 2013 and subsequent model years, the threshold for NMHC was changed from 1.5 times the standard to 2.0 times the standard. For PM, the threshold was changed to align with the final PM filter malfunction threshold emission level.

14. Sections (e)(9.2.2)(A)(i) and (ii): Changes were made in these sections to the malfunction emission threshold for NOx sensors to align the PM emission thresholds with the PM filter malfunction emission thresholds.

15. Sections (e)(10) and (f)(9): Section (g)(1) previously included the monitoring requirements for Variable Valve Timing (VVT) systems for both diesel and gasoline engines. For clarity, section (g)(1) was deleted and the requirements for diesel engines were moved to (e)(10). Requirements for gasoline engines were moved to (f)(9).

16. Section (f)(7.2.2)(B): The malfunction criteria for gasoline engines to detect a leak in the evaporative system was changed from an orifice with a diameter of 0.090 inches to a diameter of 0.150 inches to allow manufacturers more flexibility in designing monitors for the variety of gasoline tanks used on heavy-duty applications.

17. Section (f)(7.3.4): This section was reworded for improved clarity.

18. Sections (g)(3.1.1)(A) and (3.2.1)(C): These sections were reworded to clarify that monitoring of engine idle shut-down systems is only required for engines required under title 13, CCR, section 1956.8 to be equipped with an engine idle shut-down system. This section was further amended to clarify that monitoring is required for input components that cause an alternate strategy to be erroneously deactivated in addition to those that cause the strategy to be erroneously activated.

19. Section (g)(5.1): This section was revised to give the Executive Officer explicit authority to revise the PM filter malfunction criteria to exclude specific failure modes of the PM filter if the most reliable monitoring methods available are unable to detect those failure modes. This allowance was added at the request of manufacturers to alleviate their concerns that certain failure modes of the PM filter, such as combinations of leaks and partially melted substrates, may be unable to be reliably detected at the required emission thresholds.

20. Section (g)(5.2): This section was added to provide a higher, interim malfunction threshold in 2010 through 2012 for the majority of diesel engine monitors. This section establishes an interim malfunction threshold up from 2.0 times the standard to 2.5 times the standard for NMHC, CO, and NOx and applies to the monitors for fuel system, exhaust gas recirculation, boost pressure control, NMHC catalysts, VVT systems, and some aspects of PM filter and exhaust gas sensor monitoring.

21. Section (h)(1.7): The publication date for the SAE J1939 standard was updated to the most recently published version to better reflect the version used by industry.

22. Section (h)(2.1): This section was revised to clarify the location of the diagnostic connector for vehicles without a driver's side door (e.g., buses). The previous language did not account for vehicles without a driver's side door and included requirements that the connector be accessible from outside the driver's door. The revised language requires the connector to be located in the same area but only requires it to additionally be easily accessible by a technician standing outside the driver's door on vehicles that have a driver's side door.

23. Section (h)(4.2.2)(A): At the request of manufacturers, this section was revised to refer to defined SAE J1939 diesel engine parameters by their suspect parameter number (SPN) instead of the paragraph section number in the SAE document because paragraph section numbers could be modified based on editing of the SAE document while the SPN numbers will not be modified.

24. Section (h)(4.2.2)(C): Language was added to this section to clarify that the data parameter reported to a scan tool regarding the OBD requirements to which the engine is certified must distinguish between "full" OBD parent ratings and "extrapolated" OBD child ratings. This distinction is necessary to correctly and easily identify engines that are subject to in-use liability for emission thresholds.

25. Section (h)(4.2.2)(E): This section was modified to provide more specification as to the required accuracy for the calculated engine load and torque parameters required to be made available to a scan tool. Specifically, the accuracy must be of sufficient resolution and accuracy to be used for emission testing of the engine while still in a vehicle. Staff is continuing to work with industry and SAE to define a parameter within SAE J1939 to meet these specifications.

26. Section (h)(4.4.2)(A): The references to specific diagnostic messages (DM) of SAE J1939 were changed to better align with the newly defined DMs in SAE J1939 that are specific to emission-related fault codes.

27. Section (h)(4.8.2): This section was reworded to allow manufacturers to ensure that diagnostic fault information was cleared in conjunction with reprogramming of the VIN rather than simultaneously. This allows manufacturers to implement strategies such as allowing VIN reprogramming only after fault information has been cleared in lieu

of creating a new command that simultaneously erases fault information when the VIN is reprogrammed.

28. Sections (h)(5.2.2)(A)(i) and (iv): These sections were revised and added to provide increased specification as to the required accuracy of the engine run time, idle time, and power take-off (PTO) activation time counters. The minimum resolution was changed from one minute per bit to one second per bit and an accuracy specification was included to ensure sufficiently accurate and consistent counting by all manufacturers. A provision was also added to allow the data to be rescaled when transmitted to a scan tool to fit currently defined SAE J1939 parameters that have less resolution per bit.

29. Section (i)(2.1): The term “engine” was changed to “vehicle” to be consistent with the requirements of section (l)(2) to test production “vehicles”, not engines.

30. Section (i)(2.2.3): To clarify the testing requirements, the former section (i)(2.2.3) was deleted and merged with the former section (i)(2.2.4) to make the requirements for selection of test engines the same for all 2013 and subsequent model years.

31. Section (i)(2.2.4): This section was revised to extend the allowance indefinitely for a manufacturer to test more engines than required in any given model year. For each additional engine tested early by the manufacturer, the number of required engines for testing the following year would be reduced by one. This allowance provides manufacturers extra flexibility in spreading out testing requirements from year to year.

32. Section (i)(2.3): This section was revised at the request of the engine manufacturers to remove the requirement to use an engine aged to the end of useful life for the demonstration testing. Manufacturers are now allowed to use a 125-hour aged engine plus emission control aftertreatment aged to be representative of full useful life. Manufacturers are required to submit aging plans for review and approval by the Executive Officer prior to aging the aftertreatment. The Executive Officer will approve any aging plan that demonstrates equivalence to full useful life performance.

33. Sections (i)(3.1.10) and (3.2.8): Former section (i)(3.3.1) was deleted and split into a separate section for diesel engines and a separate one for gasoline engines. This section covers the monitoring demonstration requirements for VVT systems and because the monitoring requirements for VVT systems were separated for diesel and gasoline engines, this section on monitoring demonstration was also split to better align with the monitoring requirements.

34. Section (j)(1.1): The term “OBD group” was changed to “OBD certification documentation group” to avoid confusion with other groupings in the regulation and make it clear that manufacturers are allowed to group multiple engines and engine families together for the purposes of submitting representative certification documentation.

35. Sections (l)(1.1) and (1.2.4): These sections were modified to be consistent with additional changes made in section (l)(1). Specifically, the requirement to test engines was deleted and, accordingly, the sections were modified to only refer to testing of vehicles.

36. Section (l)(1.2.1): This section was revised to clarify that a maximum of ten vehicles per engine family must be tested in lieu of one vehicle per unique variant.

37. Sections (l)(1.2.2) and (1.2.3): These sections were added to provide an automatic trigger to reduce the number of vehicles tested for an engine manufacturer if the manufacturer has had demonstrated success in previous years of testing. Specifically, the testing will be reduced from ten vehicles per engine family to five vehicles per engine family in 2016 if a manufacturer has no failures in the previous two years. The testing can be further reduced in 2019 to three vehicles per engine family if the manufacturer has no failures in the previous three years.

38. Section (l)(2.1): This section was modified to allow manufacturers to conduct the testing within either the first six months after engine production starts or the first three months after vehicle production with the engine starts. This provides manufacturers additional flexibility and covers situations where vehicle production may lag the start of engine production by more than six months. This section was also modified to refer to vehicle testing instead of engine testing because the requirement to test engines was removed.

39. Section (l)(2.2.1): This section was revised to replace former sections (l)(2.2.1) through (2.2.3). The requirement to test production vehicles and engines was modified to make the selection process simpler and aligned with the engines selected for demonstration testing in section (i). The number of required test vehicles was also reduced from two to six per manufacturer to one to three per manufacturer to reduce the testing burden on manufacturers.

40. Section (l)(2.2.2): This section was added to allow manufacturers required to test two or three vehicles to use engine testing in lieu of vehicle testing for all but one of the required test vehicles. This provides engine manufacturers additional flexibility to use the method (engine or vehicle testing) that is most convenient for them.

41. Sections (l)(2.3.1), (2.3.6), and (2.3.7): These sections were revised to refer to “vehicle” testing instead of vehicle and/or engine testing to be consistent with the changes elsewhere in section (l)(2) to test vehicles.

42. Section (l)(3.1): This section was modified to extend the time period for manufacturers to collect the required data on production vehicles from six months to 12 months after the introduction of vehicles into commerce. This provides manufacturers additional flexibility in the procedure used to gather the data in the required time frame.

43. Sections (l)(3.2), (3.2.1) and (3.2.2): These sections were added to more clearly define the groupings manufacturers are required to use for collection of in-use performance data. Previously, the manufacturer was required to define the groupings and submit them for Executive Officer approval. With this change, the groupings have been pre-defined and manufacturers have clear notice as to the required groupings.

44. Sections (l)(3.3), (3.4) and (3.5): These sections were modified to align with the changes noted above that pre-define the groupings. These sections allow the manufacturer to submit an alternate grouping plan for Executive Officer approval as well as change terminology for the groupings to be consistent throughout section (l)(3).

45. Section (l)(3.6): This section was modified to align it with the changes made to section (l)(3.1). Specifically, this section allows the Executive Officer, upon good cause, to grant manufacturers an additional six months, beyond the required 12 months, to collect the in-use performance data.

46. Section (m)(2.1.1): This section was revised to extend the higher interim in-use compliance emission thresholds to all engines in 2013 to 2015 that are required to have a full OBD system calibrated to the emission thresholds. This provides manufacturers additional margin for error in-use by removing in-use jeopardy of non-compliance until emissions are more than twice the required emission thresholds without detection of a malfunction.

47. Sections (m)(3), (3.1) and (3.2): These sections were added to extend the provisions for a higher interim in-use compliance emission level for some of the 2016 through 2019 vehicles. Specifically, section (m)(3.1) provides additional in-use compliance margin for PM filter monitoring on the majority of engines in the 2016 through 2019 timeframe. Section (m)(3.2) extends the interim in-use compliance thresholds for all other monitors for the majority of engines in the 2016 through 2019 timeframe. These higher interim thresholds provide manufacturer with additional relief from enforcement action during the first few years engines are released with full OBD systems.

48. Section (m)(4): This section was added to also provide manufacturers with relief from enforcement action if the noncompliance was solely due to a failure or deterioration mode that could not have been reasonably foreseen by the manufacturer.