

## UPDATED INFORMATIVE DIGEST

### **REVISIONS TO ON-BOARD DIAGNOSTIC SYSTEM REQUIREMENTS, INCLUDING THE INTRODUCTION OF REAL EMISSIONS ASSESSMENT LOGGING (REAL), FOR HEAVY-DUTY ENGINES, PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES AND ENGINES**

**Sections Affected:** Amendments to California Code of Regulations (CCR), title 13, sections 1968.2, 1971.1, and 1971.5.

#### **Documents Incorporated by Reference (Cal. Code Regs., tit. 1, § 20, subd. (c)(3)):**

The following documents and models would be incorporated in the regulation by reference as specified by section:

1. EMFAC2014; section 1971.5(b)(3)(A)(iv)
2. 40 Code of Federal Regulations (CFR) 86.004-28(i), August 21, 2018; section 1971.1(d)(6)
3. 40 CFR 1065.680, August 21, 2018; section 1971.1(d)(6)
4. 40 CFR 86.004-28(i), as it existed on January 25, 2018; section 1968.2(d)(6.2)
5. 40 CFR 1065.680, as it existed on January 25, 2018; section 1968.2(d)(6.2)
6. 40 CFR 86.082-2, as it existed on January 25, 2018; section 1971.1(c)
7. 40 CFR 86.094-2, as it existed on January 25, 2018; section 1971.1(c)
8. 40 CFR 86.096-24, as it existed on January 25, 2018; section 1971.1(c)
9. 40 CFR 86, Appendix I, section (f)(1), as it existed on January 25, 2018; section 1971.1(c)
10. 40 CFR 86, Appendix I, section (f)(2), as it existed on January 25, 2018; section 1971.1(c)
11. 40 CFR 86.1370, as it existed on January 25, 2018; section 1971.1(c)
12. 40 CFR 86.1370(b)(7), as it existed on January 25, 2018; section 1971.1(c)
13. 40 CFR 86.007-11(a)(4)(iv), as it existed on January 25, 2018; section 1971.1(c)
14. 40 CFR 86.1360, as it existed on January 25, 2018; section 1971.1(c)

15. 40 CFR 86, Appendix I, section (d), as it existed on July 1, 2012; sections 1971.1(j)(2.6.2) and 1968.2(i)(2.32)
16. International Organization for Standardization (ISO) 2575 "Road vehicles – Symbols for controls, indicators and tell-tales," July, 2010; section 1971.1(h)(1.12)
17. ISO 15765-4 "Road Vehicles-Diagnostic communication over Controller Area Network (DoCAN) - Part 4: Requirements for emission-related systems", April, 2016; section 1971.1(h)(1.6)
18. SAE International (SAE) J1699-3 – "Vehicle OBD II Compliance Test Cases," July, 2017; section 1971.1(h)(1.9)
19. SAE J1930 "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms – Equivalent to ISO/TR 15031-2," March, 2017; section 1971.1(h)(1.1)
20. SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet," March, 2017; section 1971.1(h)(1.1.1)
21. SAE J1939 "Serial Control and Communications Heavy Duty Vehicle Network – Top Level Document," August, 2013; section 1971.1(h)(1.7.1)
22. SAE J1939-DA "Digital Annex of Serial Control and Communication Heavy Duty Vehicle Network Data," April, 2019; section 1971.1(h)(1.7.1)(A) and 1968.2(g)(1.10.1)(A)
23. SAE J1939-1 "On-Highway Equipment Control and Communication Network," November, 2012; section 1971.1(h)(1.7.2)
24. SAE J1939-11 "Physical Layer, 250 Kbps, Twisted Shielded Pair," December, 2016; section 1971.1(h)(1.7.3)
25. SAE J1939-13 "Off-Board Diagnostic Connector," October, 2016; section 1971.1(h)(1.7.4)
26. SAE J1939-15 "Physical Layer, 250 Kbps, Un-Shielded Twisted Pair (UTP)," August, 2015; section 1971.1(h)(1.7.5)
27. SAE J1939-21 "Data Link Layer," March, 2016; section 1971.1(h)(1.7.6)
28. SAE J1939-31 "Network Layer," April, 2014; section 1971.1(h)(1.7.7)

29. SAE J1939-71 "Vehicle Application Layer," October, 2016; section 1971.1(h)(1.7.8)
30. SAE J1939-73 "Application Layer – Diagnostics," May, 2017; section 1971.1(h)(1.7.9)
31. SAE J1939-81 "Network Management," March, 2017; section 1971.1(h)(1.7.10)
32. SAE J1939-84 "OBD Communications Compliance Test Cases for Heavy Duty Components and Vehicles," October, 2017; section 1971.1(h)(1.7.11)
33. SAE J1962 "Diagnostic Connector," July, 2016; section 1971.1(h)(1.2)
34. SAE J1979 "E/E Diagnostic Test Modes," February, 2017; section 1971.1(h)(1.4)
35. SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes," May, 2019; section 1971.1(h)(1.4.1) and 1968.2(g)(1.4.1)
36. SAE J2012 "Diagnostic Trouble Code Definitions," December, 2016; section 1971.1(h)(1.5)
37. SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions," December, 2016; section 1971.1(h)(1.5.1)
38. SAE J2403 "Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature," February, 2014; section 1971.1(h)(1.8)
39. SAE J2534-1 – "Recommended Practice for Pass-Thru Vehicle Programming," December, 2004; section 1968.2(g)(1.12)
40. SAE J3162 "Heavy Duty OBD IUMPR Data Collection Tool Process," September, 2018; section 1971.1(h)(1.11)
41. Data Record Reporting Procedures for Over-the-Air Reprogrammed Vehicles and Engines, August 16, 2018; sections 1971.1(h)(6) and 1968.2(g)(8)

**Background and Effect of the Regulatory Action:**

On-Board Diagnostic (OBD) systems serve an important role in helping to ensure that engines and vehicles maintain low emissions throughout their full lives. OBD systems monitor virtually all emission controls on engines and vehicles, including catalysis, particulate matter (PM) filters, exhaust gas recirculation systems, oxygen sensors, evaporative systems, fuel systems, and electronic powertrain components, and other components and systems that can affect emissions when malfunctioning. The systems also provide specific diagnostic information in a

standardized format through a standardized serial data link on-board the vehicles. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance.

The Board originally adopted comprehensive OBD regulations in 1990, requiring all 1996 and newer model year passenger cars, light-duty trucks, and medium-duty vehicles and engines to have OBD II systems. The Board subsequently updated the OBD requirements in 2002 with the adoption of CCR, title 13, sections 1968.2 and 1968.5, which established OBD II requirements (CCR, title 13, §1968.2) and enforcement requirements (CCR, title 13, §1968.5) for 2004 and subsequent model year vehicles. The Board has modified the OBD II regulation in several updates since initial adoption to address manufacturers' implementation concerns and, where needed, to strengthen specific monitoring requirements. In 2005, CARB adopted CCR, title 13, section 1971.1, which established comprehensive OBD requirements for 2010 and subsequent model year heavy-duty engines and vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds), referred to as HD OBD. The Board subsequently updated the HD OBD regulation in 2009 and adopted HD OBD-specific enforcement requirements (CCR, title 13, §1971.5). The Board last adopted updates to the OBD II requirements in 2015 and to the HD OBD regulation in 2012 to address several concerns and issues regarding the regulations.

Since then, CARB staff identified a number of amendments to the HD OBD regulations that it believes are warranted. Some of the amendments address manufacturers' implementation concerns and provide clarification on existing requirements. Staff also identified amendments that it believes are needed to ensure the integrity of the HD OBD systems and to provide valuable information for other CARB programs through the adoption of Real Emissions Assessment Logging (REAL).

CARB released a staff report entitled "Public Hearing to Consider Proposed Revisions to On-Board Diagnostic System Requirements, Including the Introduction of Real Emissions Assessment Logging (REAL), for Heavy-Duty Engines, Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines" on September 25, 2018, and accepted public comments on the proposal beginning September 28, 2018. The substantive amendments to the HD OBD regulation include:

- Clarifying the requirements for intrusive diagnostics
- Revising the in-use monitor performance ratio (IUMPR) requirements, including increasing the minimum required ratio, adding monitors required to track and report the IUMPR data, and revising the requirements to address plug-in hybrid electric vehicles

- Revising the criteria manufacturers must meet to be exempt from monitoring the feedgas generation performance of the non-methane hydrocarbon (NMHC) catalyst and catalyzed PM filter
- Revising the gasoline and diesel crankcase ventilation system monitoring requirements
- Specifying more detailed monitoring requirements for hybrid vehicles
- Updating the SAE and ISO document references
- Revising the readiness status requirements for exhaust gas/oxygen sensors and sensor heaters
- Adding data collection requirements as part of over-the-air reprogramming events
- Adding data stream parameters required to be reported to assist with CARB programs (e.g., REAL)
- Revising the certification demonstration testing requirements to revise the test engine aging requirements, clarify the allowable test sequence procedure, and add more data to be collected during testing
- Adding items required to be submitted as part of the certification application
- Revising the fines applicable to deficiencies
- Revising the production engine/vehicle evaluation testing requirements to require permanent fault code erasure testing and to collect more data from in-use engines/vehicles

The Board also amended the OBD II regulation section 1968.2, where necessary, for medium-duty diesel engines and vehicles to harmonize the requirements of the two regulations. Additionally, while staff was not planning to do an update to the OBD II regulation this year that would affect light-duty vehicles, staff has determined based on comments from manufacturers that a few additional regulation changes were needed immediately in order to ensure manufacturers are able to certify near future vehicles that comply with the OBD II regulation. Staff also found an issue related to the definition of “active off-cycle credit technology” in the OBD II regulation and amended the regulation to address this.

The Board also amended the HD OBD enforcement regulation (section 1971.5) to align with some of the changes to the HD OBD regulation, correct some oversights and errors, and address manufacturers’ workload issues. These include changes to the nonconforming criteria to account for the revised in-use monitor performance ratios, relaxations to the mandatory recall interim thresholds for alternate-fueled engines, and relaxations to the manufacturer self-testing requirements.

At the Board’s November 15, 2018, public hearing, the Board approved for adoption amendments to the CCR, title 13, sections 1968.2, 1971.1, and 1971.5, as modified by staff’s suggested modifications presented to the Board at the November 15, 2018, hearing. The staff suggested modifications were developed

in response to comments received since the staff report was released to the public on September 25, 2018. These modifications include changes to the start dates for the more stringent amendments, the implementation of the REAL requirements, and the deficiency fines. At the hearing, the Board adopted Resolution 18-53 which, among other things, directed the Executive Officer to make the modified regulatory language, and any additional conforming modifications, available for public comment, with any additional supporting documents and information, for a period of at least 15 days as required by Government Code section 11346.8. The Board further directed the Executive Officer to consider written comments submitted during the public review period and to make any further modifications that are appropriate available for public comment for at least 15 days, and to present the regulation to the Board for further consideration if warranted, or to take further action to adopt the regulation after addressing all appropriate modifications.

Subsequent to the hearing, staff identified additional conforming modifications in response to comments received during the hearing and the 45-day period prior to it and other modifications needed to correct errors in the original proposal. Staff also added four additional SAE and ISO technical standards to the rulemaking record because those technical standards were recently updated, and the references in the HD OBD and OBD II regulations have been updated to refer to these newer versions, as is common practice. Further, staff identified other modifications needed to correct grammar, punctuation, and spelling, and modifications to clarify requirements to the HD OBD and OBD II regulations which are considered non-substantive.

These post-hearing modifications were made available for a 15-day public comment period in the staff's Notice of Public Availability of Modified Text and Availability of Additional Documents, released June 4, 2019, with the comment period spanning June 4, 2019, to June 19, 2019. Staff subsequently made further post-hearing modifications to indicate that several CFR documents were "incorporated by reference" in the regulations. These additional modifications were made available for a second 15-day public comment period in the staff's Second Notice of Public Availability of Modified Text and Availability of Additional Documents, released July 19, 2019, with the comment period spanning July 19, 2019, to August 5, 2019.

**Objectives and Benefits of the Regulatory Action:**

The HD OBD and OBD II amendments will provide manufacturers with greater compliance flexibility, and strengthen and clarify the performance requirements they are expected to meet in designing and developing robust OBD systems. This will encourage manufacturers to design and build more durable engines and emission-related components, all of which will help ensure that forecasted emission reduction benefits from adopted light-, medium-, and heavy-duty vehicle and engine emission control programs are achieved in-use. The implementation of REAL through added nitrogen oxide and greenhouse gas emission tracking

requirements will allow CARB to characterize emissions performance in-use, providing information that will allow for better modeling and technology performance evaluation to inform future program adjustments. Ultimately, the action will further the goal of CARB which is to promote and protect public health, welfare and ecological resources through the effective and efficient reduction of air pollutants, and provide safe, clean air to Californians. No quantifiable benefit to worker safety is expected.

CARB developed the regulatory actions through an extensive public process. The OBD regulatory update process began in 2016, when CARB staff started having meetings with stakeholders (mainly engine manufacturers) to discuss the development of amendments for the OBD regulations. CARB held a public workshop in El Monte on November 2, 2017, to discuss the proposal and to seek comments. The workshop notice and workshop presentation were posted on the OBD Program website prior to the workshop, and interested stakeholders participated in the workshop in person or via webinar. Additionally, draft regulatory language was sent to members of the Truck and Engine Manufacturers Association (EMA), which represents the main stakeholders affected by the rulemaking. CARB staff also presented and sought comments regarding elements of the upcoming amendments to the OBD regulations during several SAE OBD symposiums, including symposiums held in March, 2016 (Stuttgart, Germany); September, 2016 (Indianapolis, Indiana); March, 2017 (Turin, Italy); September, 2017 (Anaheim, California); and March, 2018 (Barcelona, Spain). These symposiums were attended by vehicle and engine manufacturers, scan tool manufacturers, and individuals involved in various other aspects of the automotive industry. Throughout the rulemaking process, CARB staff held around 20 meetings, including 1 in-person meeting with EMA held in El Monte, California, as well as numerous meetings and correspondences (comprising of teleconferences, in-person meetings, and e-mail correspondences) with individual manufacturers. CARB staff also participated in numerous teleconferences with SAE committee members to help develop the specifications related to the new data stream parameter and tracking requirements in the SAE standards. The amendments were developed in close collaboration with these stakeholders. As a result of the comments received throughout the regulatory process, staff made significant changes to the amendments to the OBD regulations, which are reflected in the final rulemaking.

#### **Comparable Federal Regulations:**

CARB initially adopted the HD OBD regulation in 2005. A waiver for the regulation was granted by U.S. EPA in 2008.<sup>1</sup> CARB amended the regulation in

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<sup>1</sup> *California State Motor Vehicle Pollution Control Standards; Notice of Waiver of Clean Air Act Preemption; California's 2010 Model Year Heavy-Duty Vehicle and Engine On-Board Diagnostic Standards*, 73 Fed. Reg. 52042 (September 8, 2008).

2010, and was granted another waiver action by U.S. EPA in 2012.<sup>2</sup> On November 7, 2016, the U.S. EPA formally granted California's request for a waiver regarding the HD OBD regulation, as last amended on June 26, 2013,<sup>3</sup> recognizing that the HD OBD regulation is at least as stringent in protecting public health and welfare as the federal regulation, and that unique circumstances exist in California necessitating the need for the State's own motor vehicle regulations program.

The U.S. EPA has also adopted OBD requirements for vehicles and engines above 14,000 pounds, which is the weight range for California's "heavy-duty" class. The federal regulation (40 CFR 86.010-18) was published on February 24, 2009, and subsequently amended on September 15, 2011 and June 17, 2013.

The federal regulation is consistent with CARB's California regulation in the most important aspects. However, the California HD OBD regulation in general still establishes more comprehensive and stringent requirements than the federal OBD regulation. For example, the HD OBD regulation generally requires California OBD systems on diesel engines to detect malfunctions before emissions exceed more stringent thresholds than those required by the federal HD OBD regulation. Further, the federal regulation does not require the OBD system to detect diesel oxidation catalyst malfunctions before a specific emission threshold is exceeded like the California OBD regulations—it is only required to detect a failure if the catalyst completely lacks NMHC conversion capability. As another example, under the federal HD OBD regulation, the malfunction thresholds for the emission threshold monitors are not required to be adjusted to account for emissions due to infrequent regeneration events.

The proposed 2018 amendments continue California's efforts to require more comprehensive and robust monitoring of emission related systems and components than required by federal OBD regulations. The amendments also incorporate some new requirements (e.g., incorporation of REAL for new data parameters required to be tracked by the engine) that would assist other California mobile source emissions programs. Although differences would exist between the state and federal requirements, heavy-duty OBD systems can be designed to comply with both the federal and California programs. In fact, U.S. EPA's regulation directly allows acceptance of systems that have been certified to California's HD OBD regulation and to date, all heavy-duty engine manufacturers have chosen this path for certification.

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<sup>2</sup> *California State Motor Vehicle Pollution Control Standards; Notice of Waiver of Clean Air Act Preemption; California's 2010 Model Year Heavy-Duty Vehicle and Engine On-Board Diagnostic Standards*, 77 Fed. Reg. 73459 (December 10, 2012).

<sup>3</sup> *California State Motor Vehicle Pollution Control Standards; Malfunction and Diagnostic System Requirements for 2010 and Subsequent Model Year Heavy-Duty Engines; Notice of Decision*, 81 Fed. Reg. 78149 (November 7, 2016).



Concerning the OBD II regulation, in 2014, the U.S. EPA adopted Tier 3 regulations that include provisions that generally align federal OBD requirements for 2017 and subsequent model year light duty vehicles, light-duty trucks, medium-duty passenger vehicles, and complete heavy-duty vehicles between 8,501 and 14,000 lbs. GVWR with CARB's California OBD II regulation, as last amended in 2013.

Although the federal OBD regulation (40 CFR 86.1806-5) is now generally harmonized with California's OBD II regulation, the federal requirements differ from corresponding California OBD requirements in several respects. California's OBD II regulation still establishes more comprehensive and stringent requirements than the amended federal regulation. The OBD II regulation requires California OBD systems to comply with monitoring requirements earlier than federal OBD systems must comply with the federal OBD regulation. For example, California's OBD II regulation requires OBD systems in medium-duty diesel vehicles and engines to detect PM filter performance faults before emissions exceed 0.03 grams per brake-horsepower hour (g/bhp-hr) beginning in the 2013 model year, and allows exclusions of specific failure modes until the 2015 model year. However, the federal OBD regulation requires federal OBD systems to detect PM filter performance faults at these same levels beginning in the 2019 model year. Therefore, California OBD systems must comply with this requirement (without excluding specific failure modes) at least three model years earlier than federal OBD systems. Additionally, the federal OBD requirements do not incorporate the anti-tampering provisions of the OBD II regulation (that prevent unauthorized modifications of the computer-coded engine operating parameters of the on-board computer) or the deficiency provisions of the OBD II regulation (that allow certification of vehicles with non-fully compliant OBD systems provided manufacturers demonstrate a good-faith effort to comply with OBD requirements as expeditiously as possible, pay fines, and provided the deficiency would not trigger an ordered recall for the OBD system). The federal OBD regulations, however, retain the provision that allows U.S. EPA to deem California-certified OBD II systems to comply with the federal OBD regulation.<sup>4</sup> Historically, virtually every vehicle sold in the U.S. is designed and certified to California's OBD II requirements in lieu of the federal OBD requirements.

**An Evaluation of Inconsistency or Incompatibility with Existing State Regulations (Gov. Code, § 11346.5, subd. (a)(3)(D)):**

During the process of developing the proposed regulatory action, CARB conducted a search of any similar regulations on this topic and concluded these regulations are neither inconsistent nor incompatible with existing state regulations.

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<sup>4</sup> 40 CFR 86.1806-5 (j)