

State of California
AIR RESOURCES BOARD

**CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES
FOR 2004 AND SUBSEQUENT MODEL
HEAVY-DUTY OTTO-CYCLE ENGINES**

Adopted: [INSERT DATE OF ADOPTION]

Note: These are proposed new test procedures that have been updated with a new format and a 2004 and subsequent model-year applicability date. The proposed test procedures also include amendments to the California exhaust emission standards in Part I Section 10.B. Under the staff's proposal, the preexisting "California Exhaust Emission Standards and Test Procedures for 1987 and Subsequent Model Heavy-Duty Otto-Cycle Engines" would be amended to be applicable through the 2003 model year only. In order to facilitate a comparison of the new test procedures from the preexisting test procedures, this document shows changes to the previous text in underline to indicate additions and ~~strikeout~~ to indicate deletions.

NOTE: This document is incorporated by reference in section 1956(d), title 13 California Code of Regulations (“CCR”) and also incorporates by reference various sections of Title 40, Part 86 of the Code of Federal Regulations, with some modifications. It contains the majority of the requirements necessary for certification of heavy-duty Otto-cycle engines for sale in California, in addition to containing the exhaust emissions standards and test procedures for these Otto-cycle engines.¹ The section numbering conventions for this document are set forth in subparagraph 4 on page 4. Reference is also made in this document to other California-specific requirements which are necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

1. “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1976, title 13, CCR).
2. “California Motor Vehicle Emission Control and Smog Index Label Specifications” (incorporated by reference in section 1965, title 13, CCR).
3. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978(b), title 13, CCR).
4. Warranty requirements (sections 2035, et seq, title 13, CCR).
5. OBDII (section 1968.1, title 13, CCR).

¹ The requirements for Otto-cycle engines used in complete vehicles are contained in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” incorporated by reference in §1961(d), title 13, CCR.

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**CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST
PROCEDURES FOR 2004 AND SUBSEQUENT MODEL
HEAVY-DUTY OTTO-CYCLE ENGINES**

The following provisions of Subparts A, E, N, and P, Part 86, Title 40, Code of Federal Regulations (“CFR”), as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the 40 CFR Part 86 section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty Otto-cycle engines, are adopted and incorporated herein by this reference as the “California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines,” with the following exceptions and additions.

**Part 1. GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE
VERIFICATION OF EMISSIONS**

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy Duty Vehicles

1. General Applicability. [§86.xxx-1]

A. Federal provisions.

1. §86.001-1 ~~May 4, 1999~~. October 6, 2000

1.1 Subparagraph (a). [No change.]

1.2 Delete subparagraph (b) and replace with the following: A manufacturer must certify any complete heavy-duty vehicle of 14,000 pounds gross vehicle weight rating or less in accordance with the medium-duty vehicle provisions contained in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” incorporated herein by reference. Heavy-duty engine or vehicle provisions of subpart A do not apply to such a vehicle.

1.3 Subparagraph (c). [n/a (ADP for LDVs)]

1.4 Subparagraph (d). [n/a. (NLEVs)]

1.5 Amend subparagraph (e) as follows: *Small volume manufacturers.*

Special certification procedures are available for any manufacturer whose projected or actual combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. The small volume manufacturer’s heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

1.6 Subparagraph (f). [n/a; exhaust opacity refers to diesel engines.]

2. §86.005-1 October 6, 2000

2.1 Subparagraph (a). [No change.]

2.2 Delete subparagraph (b) and replace with the following: A manufacturer must certify any complete heavy-duty vehicle of 14,000 pounds gross vehicle weight rating or less in accordance with the medium-duty vehicle provisions contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in §1961(d), title 13, CCR. Heavy-duty engine or vehicle provisions of subpart A do not apply to such a vehicle.

2.3 Subparagraph (c). [No change.]

2.4 Subparagraph (d). [Reserved.]

2.5 Amend subparagraph (e) as follows: *Small volume manufacturers.* Special certification procedures are available for any manufacturer whose projected or actual combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. The small volume manufacturer's heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

2.6 Subparagraph (f). [n/a; exhaust opacity refers to diesel engines.]

B. California provisions.

1. These regulations are applicable to all heavy-duty Otto-cycle methanol-fueled, ethanol-fueled, natural-gas-fueled and liquefied-petroleum-gas-fueled dedicated, dual-fuel and multi-fuel engines (and vehicles) except those engines derived from existing diesel engines. For any engine which is not a distinctly Otto-cycle engine nor derived from such, the Executive Officer shall determine whether the engine shall be subject to these regulations or alternatively to the heavy-duty diesel engine regulations, in consideration of the relative similarity of the engine's torque-speed characteristics and vehicle applications with those of Otto-cycle and diesel engines. Reference to dual fuel vehicles or engines shall also mean bi-fuel vehicles or engines.

2. References in the federal regulations to light-duty vehicles and light-duty trucks do not apply.

3. Any reference to vehicle sales throughout the United States shall mean vehicles and engines sales in California. Any reference to small volume manufacturer shall mean a California small-volume manufacturer as defined in section I.1.A.1.5, above.

4. Regulations concerning U.S. EPA hearings, U.S. EPA inspections, specific language on the Certificate of Conformity, evaporative emissions, high-altitude

vehicles and testing, particulate and oxides of nitrogen averaging and test group standards applicable in such averaging, alternative useful life, selective enforcement audit, and Certification Short Test shall not be applicable to these procedures, except where specifically noted. The regulations pertaining to evaporative emissions are contained in "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," as incorporated in §1976, title 13, CCR.

5. Non-methane hydrocarbon emissions shall be measured in accordance with the "California Non-methane Hydrocarbon Test Procedures" as last amended July 12, 1991, which is incorporated herein by reference.

2. **Definitions.** [§86.xxx-2]

A. Federal provisions. All of the definitions in previous CFR sections continue to apply, except as otherwise noted below. Definitions specific to other requirements such as evaporative emissions are contained in those separate documents.

1. §86.004-2. ~~October 21, 1997~~ October 6, 2000

B. California provisions.

“Administrator” means the Executive Officer of the Air Resources Board.

“Certificate of Conformity” means “Executive Order” certifying vehicles for sale in California.

“Certification” means certification as defined in Section 39018 of the Health and Safety Code.

“EPA Enforcement Officer” means the Executive Officer or his delegate.

“Medium-duty vehicle” means any 1992 through 2006 model-year heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1960.1(h)(2) having a manufacturer’s gross vehicle weight rating of 14,000 pounds or less; any 1995 through 2003 model-year heavy-duty vehicle certified to the standards in section 1960.1(h)(1) having a manufacturer’s gross vehicle weight rating of 14,000 pounds or less; and any 2000 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1961(a)(1) or 1962 having a manufacturer’s gross vehicle weight rating between 8,500 and 14,000 pounds.

Warranty means the warranty provisions set forth in title 13, California Code of Regulations §2036].

3. **Abbreviations** [§86.xxx-3]

A. Federal provisions. §86.000-3 October 22, 1996. All federal abbreviations apply, except as otherwise noted below. Abbreviations specific to other requirements are contained in those separate documents.

B. California provisions.

CCR means California Code of Regulations

LEV means low-emission vehicle

ULEV means ultra-low-emission vehicle

SULEV means super-ultra-low-emission vehicle

MDV means medium-duty vehicle

4. Section numbering; construction. [§86.084-4] September 21, 1994. [No change.]

The section numbering convention employed in these test procedures, in order of priority, is I.1.A.1.1. in order to distinguish California procedures and requirements from those of the U.S. EPA. References in these test procedures to specific sections of the Code of Federal Regulations maintain the same numbering system employed in the Code of Federal Regulations. California-only requirements are set forth in a separate subsection. In the beginning of each section the generic notation §86.xxx-1 is used when there is more than one applicable section to indicate the section being discussed without regard to model year. The years of applicability (denoted generically by “xxx”) are added as applicable in the pertinent subsections.

In cases where the entire CFR section is incorporated by reference with no modifications, the notation “[No change.]” is used. In cases where the federal requirements are modified by California requirements, the notation “Amend (or delete) subparagraph () as follows:” is used. If the federal requirement is not applicable, the notation “[n/a]” is used. In cases where there are California only requirements, the additional California requirements are noted in a separate subsection with the numbering convention set forth above.

If a CFR section for a specific model year is set forth in this document, and that CFR section references previous CFR sections, then all previously referenced CFR sections are deemed incorporated into this document unless otherwise noted.

5. General Standards; increase in emissions; unsafe conditions. [§86.090-5] November 12, 1996 [No change.]

6. Hearings on certification. [§86.078-6] [n/a]

7. Maintenance of records; submittal of information; right of entry. [§86.000-7] October 22, 1996 [No change.]

8. Emission standards for light-duty vehicles [§86.xxx-8] [n/a]

9. Emission standards for light-duty trucks [§86.xxx-9] [n/a]

10. Emission standards for Otto-cycle heavy-duty engines and vehicles [§86.xxx-10]

A. Federal provisions.

1. §86.098-10 October 21, 1997. Amend as follows:

1.1 Amend subparagraph (a) as follows:

1.1.1 Delete subparagraph (a)(1) and replace with emission standards set forth in Section I.10.B below.]

- 1.1.2 Subparagraph (a)(2). [No change.]
- 1.1.3 Subparagraph (a)(3). [No change.]
- 1.2 Subparagraph (b) [n/a] [See evap TPs]
- 1.3 Subparagraph (c) [No change.]
- 1.4 Subparagraph (d) [No change.]
- 2. §86.099-10 August 23, 1995 [n/a; See evap TPs]
- 3. §86.005-10 October 6, 2000 Amend as follows:
 - 3.1 Amend subparagraph (a) as follows:
 - 3.1.1 Delete subparagraph (a)(1). [See emission standards in I.10.B below]
 - 3.1.2 Subparagraph (a)(2). [No change.]
 - 3.1.3 Subparagraph (a)(3). [No change.]
 - 3.1.4 Subparagraph (a)(4). [No change.]
 - 3.2 Subparagraph (b) [n/a] [See evap TPs]
 - 3.3 Subparagraph (c) [No change.]
 - 3.4 Subparagraph (d) [No change.]
 - 3.5 Subparagraph (e) [No change.]
 - 3.6 Subparagraph (f) [No change.]
- 4. §86.008-10 October 6, 2000
 - 4.1 Amend subparagraph (a) as follows:
 - 4.1.1 Delete subparagraph (a)(1). [See emission standards in I.10.B below]
 - 4.1.2 Subparagraph (a)(2). [No change.]
 - 4.1.3 Subparagraph (a)(3). [No change.]
 - 4.1.4 Subparagraph (a)(4). [No change.]
 - 4.2 Subparagraph (b) [n/a] [See evap TPs]
 - 4.3 Subparagraph (c) [No change.]
 - 4.4 Subparagraph (d) [No change.]
 - 4.5 Subparagraph (e) [No change.]
 - 4.6 Subparagraph (f) [No change.]

**B. California provisions.
California Emission Standards for 2004 and Subsequent Model
Heavy-Duty Otto-Cycle Engines^A
(in g/bhp-hr)**

Model Year	Emission Category	NMHC + NOx	CO	HCHO
Standards for Heavy-Duty Otto-Cycle Engines Used In Medium-Duty Vehicles 8,501 to 14,000 pounds GVW^B				
2004 and subsequent	ULEV	2.4 or 2.5 with 0.5 NMHC cap ^C	14.4	0.05
2004 and subsequent	SULEV	2.0	7.2	0.025
Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW				
2004 and subsequent	n/a	2.4 or 2.5 with 0.5 NMHC cap ^C	37.1	0.05 ^D
<u>Standards for Heavy-Duty Otto-Cycle Engines Used In Incomplete Medium-Duty Vehicles 8,500 - 14,000 pounds GVW</u>				
	<u>LEV</u>	<u>1.0^C</u>	<u>37.1</u>	<u>0.05</u>
<u>2005 and subsequent</u>	<u>ULEV</u>	<u>1.0^C</u>	<u>14.4</u>	<u>0.05</u>
	<u>SULEV</u>	<u>0.5</u>	<u>7.2</u>	<u>0.025</u>
<u>Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW</u>				
<u>2005 and subsequent</u>	<u>n/a</u>	<u>1.0^C</u>	<u>37.1</u>	<u>0.05^D</u>

^A These standards apply to petroleum-fueled, alcohol-fueled, liquefied petroleum gas-fueled and natural gas-fueled Otto-cycle engines. Alcohol-fueled engines have the option of certifying to the organic material hydrocarbon equivalent (“OMHCE”) or organic material non-methane hydrocarbon equivalent (“OMNMHCE”) standard.

^B A manufacturer of engines used in incomplete medium-duty vehicles may choose to comply with these standards as an alternative to the primary emission standards and test procedures for complete vehicles specified in section 1961, title 13, CCR. A manufacturer that chooses to comply with these optional heavy-duty engine standards and test procedures shall specify, in the Part I application for certification, an in-use compliance test procedure, as provided in section 2139(c), title 13 CCR.

^C A manufacturer may request to certify to the Option 1 or Option 2 federal NMHC + NOx standards as set forth in 40 CFR §86.005-10(f). However, for engines used in medium-duty vehicles 8,500 - 14,000 lbs. GVW, the formaldehyde and carbon monoxide standards must meet the levels specified above.

^DThis standard only applies to methanol-fueled Otto-cycle engines.

11. **Emission standards for heavy-duty diesel engines and vehicles.** [§86.xxx-11] [n/a]
12. **Alternative certification procedures.** [§86.080-12] April 17, 1980 [No change.]
13. **Alternative durability program.** [§86.xxx-13] [n/a]

14. **Small-volume manufacturers certification procedures.** [§86.xxx-14]
A. Federal provisions. [Note: A small volume manufacturer shall mean a California small volume manufacturer as defined in Section I.1.A., above. Any reference to 10,000 units shall mean 4,500 units in California based on a three year running average as defined in I.1.A., above.]
1. §86.094-14 January 3, 1996. Amend as follows:
 - 1.1 Subparagraphs (a) through (c)(3) [No change.]
 - 1.2 Amend subparagraph (c)(4) as follows: Small volume manufacturers shall include in their records all of the information that EPA requires in §86.094-21. This information will be considered part of the manufacturer's application for certification. [The last sentence is deleted.]
 - 1.3 Subparagraphs (c)(5) through (c)(7)(i)(B) [No change.]
 - 1.4 Amend subparagraph (c)(7)(i)(C)(I) as follows: Manufacturers with aggregated sales of less than 301 motor vehicles and motor vehicle engines per year may use assigned deterioration factors that the Administrator determines and prescribes based on design specifications or sufficient control over design specifications, development data, in-house testing procedures, and in-use experience. [The remainder of the paragraph is the same.]
 - 1.5 Subparagraph (c)(7)(i)(C)(2) through (c)(13)(i) [No change.]
 - 1.6 Add the following test to subparagraph (c)(13)(ii): All running changes that do not adversely affect emissions or the emission control system durability shall be deemed approved unless disapproved by the Executive Officer within 30 days of the implementation of the running change.
 2. §86.096-14 March 24, 1993 [n/a; pertains to evaporative requirements.]
 3. §86.098-14 April 6, 1994 [No change.]
15. **NOx and particulate averaging, trading, and banking for heavy-duty engines.** [§86.xxx-15] [n/a]
16. **Prohibition of defeat devices.** [§86.004-16] October 6, 2000 [No change.]
17. **Emission control diagnostic system for light-duty vehicles and trucks.** [§86.099-17; §86.005-17] Delete; replace with: All heavy-duty Otto-cycle engines up to 14,000 pounds GVW must have an on-board diagnostic system as required in section 1968.1, title 13 CCR.
18. [Reserved.]
19. [Reserved.]
20. **Incomplete vehicles, classification.** [§86.085-20] January 12, 1983. [No change.]
21. **Application for certification** [§86.xxx-21]
A. Federal provisions
 1. §86.004-21 October 21, 1997 October 6, 2000 [No change.]
 2. §86.007-21 October 6, 2000 [No change - diesel only.]**B. California provisions**
 1. ~~For 1992 and subsequent model-year low-emission and ultra-low-emission vehicles and engines not powered exclusively by gasoline, projected California sales data and fuel economy estimates two years prior to certification, and~~

~~projected California sales data for all vehicles and engines, regardless of operating fuel or vehicle emission category, sufficient to enable the Executive Officer to select a test fleet representative of the vehicles (or engines) for which certification is requested at the time of certification. For California vehicles not certified exclusively on gasoline or diesel fuel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the engines are certified.~~

22. **Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certifications and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges.** [§86.xxx-22]
 - A. **Federal provisions**
 1. §86.001-22 April 6, 1994. [No change.]
23. **Required data.** [§86.xxx-23]
 - A. **Federal provisions**
 1. §86.001-23 October 21, 1997 [No change.]
 - B. **California provisions**
 1. ~~Such~~ The data derived from testing to determine the exhaust emission deterioration factors shall be submitted to the Executive Officer for review. If the durability test method is accepted by EPA, it shall also be accepted by ARB, subject to the following condition. If, after certification for the first model year in which the method is used, the Executive Officer determines that a manufacturer's durability test procedures do not conform with good engineering practices, the Executive Officer may require changes to that manufacturer's durability test procedures for subsequent model years. The manufacturer's revised durability test procedures shall be submitted to the Executive Officer for review and approval.
24. **Test vehicles and engines.** [§86.001-24] October 22, 1996 [No change.]
25. **Maintenance.** [§86.004-25] October 21, 1997.
26. **Mileage and service accumulation; emission measurements** [§86.004-26] October 6, 2000
27. **Special test procedures.** [§86.090-27] April 11, 1989. [No change.]
28. **Compliance with emission standards.** [§86.xxx-28]
 - A. **Federal provisions**
 1. §86.004-28 October 6, 2000.
~~(c)(4)(iii)(A)(I)...For transient HC (OMHCE), formaldehyde (methanol-fueled engines and vehicles, low-emission vehicles and engines, and ultra-low-emission vehicles and engines), CO, and NOx, the official exhaust emission...~~
~~(2) ...For transient HC (OMHCE), formaldehyde (methanol-fueled engines and vehicles, low-emission vehicles and engines, and ultra-low-emission vehicles and engines), CO, and NOx, the official exhaust emission...~~
 - B. **California provisions**
 1. All dedicated methanol-fueled and fuel-flexible vehicles and engines shall comply with the requirements which are applicable to heavy-duty gasoline-fueled Otto-cycle vehicles and engines, except where otherwise noted. In particular, for fuel-flexible vehicles and engines, a manufacturer's proposed durability demonstration

program, as required in sections 86.091-21(b)(4)(iii)(A) and 86.091-23(b)(1)(ii), shall provide for the assessment of the durability of the engine in operation with methanol and gasoline, as well as intermediate mixtures of both fuels. A manufacturer's proposed mileage and service accumulation, as required in section 86.090-24(c), shall be conducted on methanol.

2. ~~The provisions of section 86.091-28(c), "Compliance with emissions standards," shall be used to determine the compliance requirements with the emission standards.~~ For fuel-flexible vehicles and engines, the noted deterioration factors shall be determined from testing conducted with gasoline fuel. However, as an assurance that fuel-flexible vehicles and engines will comply with applicable exhaust emission standards throughout their useful lives when operated on methanol fuel, the manufacturer shall demonstrate that exhaust emissions tests conducted with methanol fuel at the beginning, middle, and end of the durability service accumulation schedule do not exceed the applicable exhaust emission standards. For certification to be granted, the vehicle or engine may not exceed applicable certification exhaust emission standards.

3. For dual-fuel or multi-fuel gaseous engines and vehicles, the noted deterioration factors shall be determined separately for operation on each type of fuel or combination of fuels that the engine is designed to use. For certification to be granted, the provisions of 86.091-28(c) must be met separately for emissions using each type and combination of fuels.

29. **Testing by the Administrator.** [§86.091-29] March 24, 1993 [No change.]
30. **Certification.** §86.004-30 October 6, 2000 [No change.]
31. **Separate certification.** [§86.079-31] September 8, 1977. [No change.]
32. **Addition of a vehicle or engine after certification.** §86.079-32 September 8, 1977. [No change.]
33. **Changes to a vehicle or engine covered by certification.** §86.079-33 September 8, 1977. [No change.]
34. **Alternative procedure for notification of additions and changes.** §86.082-34 November 2, 1982. [No change.]
35. **Labeling.** [§86.xxx-35] Delete. Labels shall comply with the requirements set forth in the "California Motor Vehicle Emission Control and Smog Index Label Specifications," incorporated by reference in §1965, title 13, CCR.
36. **Submission of vehicle identification numbers.** [§86.079-36] [n/a]
37. **Production vehicles and engines.** [§86.085-37] June 6, 1997 [No change.]
38. **Maintenance instructions.** [§86.xxx-38]
 1. §86.004-38 October 21, 1997.
 - 1.1 Subparagraphs (a) through (f). [No change.]
 - 1.2 Amend subparagraph (g)(1) as follows:
 - (g) Emission control diagnostic service information:
 - (1) Manufacturers shall furnish or cause to be furnished to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, or the Administrator upon request, any and all information needed to make use of the on-board diagnostic system and such other information, including instructions for making

emission-related diagnosis and repairs, including, but not limited to, service manuals, technical service bulletins, recall service information, data stream information, bi-directional control information, and training information, unless such information is protected by section 208(c) of the Act or California Government Code Section 6250, as a trade secret. No such information may be withheld under section 208(c) of the Act or California Government Code Section 6250, if that information is provided (directly or indirectly) by the manufacturer to franchised dealers or other persons engaged in the repair, diagnosing, or servicing of motor vehicles or motor vehicle engines.

1.3 Subparagraph (h). [No change.]

39. **Submission of maintenance instructions.** [§86.079-39] September 8, 1977 [No change.]

40. **Heavy-duty engine rebuilding practices.** [§86.xxx-40]

1. §86.004-40. October 21, 1997.

1.1 Amend the introductory paragraph as follows: The provisions of this section are applicable to engines subject to the standards prescribed §86.004-10 or §86.004-11 and are applicable to the process of engine rebuilding (or rebuilding a portion of an engine or engine system). The process of engine rebuilding generally includes disassembly, replacement of multiple parts due to wear, and reassembly, and also may include the removal of the engine from the vehicle and other acts associated with rebuilding an engine. Any deviation from the provisions contained in this section is a prohibited act under section 203(a)(3) of the Clean Air Act (42 U.S.C. 7522(a)(3)) or of the California Vehicle Code § 27156, et seq.

1.2 Subparagraphs (a) through (e). [No change.]

Part II - OTHER REQUIREMENTS; TEST PROCEDURES

Subpart N, Emission Regulations for New Otto-cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

- ~~86.1301-84 Scope; applicability. November 16, 1983.~~
~~86.1301-88 Scope; applicability. March 15, 1985.~~
86.1301-90 Scope; applicability. April 11, 1989.
86.1302-84 Definitions. November 16, 1983.
86.1303-84 Abbreviations. November 16, 1983.
~~86.1304-84 Section numbering; construction. November 16, 1983.~~
86.1304-90 Section numbering; construction. ~~April 11, 1989~~ October 6, 2000.
~~86.1305-84 Introduction; structure of subpart. November 16, 1983.~~
~~86.1305-90 Introduction; structure of subpart. April 11, 1989.~~
86.1305-2004 Introduction; structure of subpart. October 6, 2000.
~~86.1306-84 Equipment required and specification; overview. November 16, 1983.~~
~~86.1306-88 Equipment required and specification; overview. March 15, 1985.~~
~~86.1306-90 Equipment required and specification; overview. April 11, 1989.~~
86.1306-96 Equipment required and specification; overview. September 21, 1994.
~~86.1308-84 Dynamometer and engine equipment specifications. December 10, 1984~~ 16, 1987.
~~86.1309-84 Exhaust gas sampling system; gasoline-fueled engines. November 16, 1983.~~
86.1309-90 Exhaust gas sampling system; gasoline-fueled and methanol-fueled Otto-cycle engines. ~~April 11, 1989~~ June 30, 1995.

Amend subparagraph (a)(3) as follows: For methanol-fueled engines, the sample lines for the methanol and formaldehyde samples are heated to $235^{\circ} \pm 15^{\circ}\text{F}$ ($113^{\circ} \pm 8^{\circ}\text{C}$).

- ~~86.1311-84 Exhaust gas analytical system; CVS bag sample. November 16, 1983.~~
~~86.1311-88 Exhaust gas analytical system; CVS bag sample. August 29, 1986.~~
86.1311-94 Exhaust gas analytical system; CVS bag sample. October 21, 1997.
86.1313-94 Fuel specifications September 5, 1997
86.1313-98 Fuel specifications. September 5, 1997 [n/a diesel fuel specifications]

Amend the federal fuel specifications as follows:

1. California Certification Gasoline Specification. Add the following subparagraph which reads: Gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in 86.1313-94(a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications

listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

California Certification Gasoline Specifications		
Fuel Property^(a)	Limit	Test Method^(b)
Octane (R+M)/2	91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01 g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR ^(c)
10% point	130-150 °F	
50% point ^(d)	200-210 °F	
90% point ^(e)	290-300 °F	
EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	30-40 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.7-7.0 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	22-25 vol. %	§2263, title 13 CCR
Benzene	0.8-1.0 vol. % ^(f)	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	12-14 vol. % ^(g)	
MTBE	10.8-11.2 vol. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report ^(h)	
Heat of Combustion	Report ^(h)	
Carbon	Report wt. % ^(h)	
Hydrogen	Report wt. % ^(h)	

- (a) The gasoline must be blended from typical refinery feedstocks.
- (b) ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.
- (c) Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.
- (d) The range for interlaboratory testing is 195-215° F.
- (e) The range for interlaboratory testing is 285-305° F.
- (f) The range for interlaboratory testing is 0.7-1.1 percent by volume.
- (g) "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.
- (h) The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

2. Alcohol Fuel Specifications

Amend §86.1313-94(c) as follows: Delete subparagraphs (c)(1) and (c)(2); replace with:

(c)(1) **Emission test fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust and evaporative emission testing shall meet the specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

Specification	Limit
M-100 Fuel Methanol	
Methanol	98.0 ± 0.5 vol. percent
Ethanol	1.0 ± 0.1 vol. percent
Petroleum fuel meeting the specifications of section 100.3.1.	1.0 ± 0.1 vol. percent
E-100 Fuel Ethanol	
Ethanol	98.0 ± 0.5 vol. percent
Methanol	1.0 ± 0.1 vol. percent
Petroleum fuel meeting the specifications of section 100.3.1.	1.0 ± 0.1 vol. percent

(c)(2) **Mileage accumulation fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for service accumulation shall meet the applicable specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol).

(c)(3) Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

3. Mixtures of Petroleum and Alcohol Fuels for Flexible Fuel Vehicles

Amend §86.1313-94(d) as follows: Delete subparagraphs (d)(1) and (d)(2); replace with:

(d)(1) **Exhaust emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) as modified by the following:

Specification	Limit
M-85 Fuel Methanol	
Petroleum fuel meeting the specifications of section 100.3.1.	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.
E-85 Fuel Ethanol	
Petroleum fuel meeting the specifications of section 100.3.1.	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

(d)(2) **Mileage accumulation fuel.** For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel shall meet the applicable specifications in Part II, subparagraph 1 and methanol or ethanol fuel shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specification for E-85 Fuel Ethanol). Mileage accumulation procedures shall be subject to the requirements set forth in 40 CFR §86.001-26 and §86.1831-01(a) and (b) and are subject to the prior approval of the Executive Officer. A manufacturer shall consider expected customer fuel usage as well as emissions deterioration when developing its durability demonstration.

(d)(3) **Evaporative emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, a blend of methanol or ethanol fuel used for evaporative emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) and gasoline meeting the specifications of Part II subparagraph 1 of these test procedures such that the final

blend is composed of either 35 volume percent methanol (± 1.0 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (± 1.0 volume percent of total blend) for ethanol-fueled vehicles. Alternative alcohol-gasoline blends may be used in place of M35 or E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to prior approval of the Executive Officer.

(d)(4) **Additive requirements.** Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

4. Natural Gas Fuel Specifications

Add the following subparagraphs:

(a) **Exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas) as modified by the following:

Specification	Limit
Compressed Natural Gas Certification Test Fuel	
Methane	90.0 \pm 1.0 mole percent
Ethane	4.0 \pm 0.5 mole percent
C ₃ and higher hydrocarbon content	2.0 \pm 0.3 mole percent
Oxygen	0.5 mole percent maximum
Inert gases (CO ₂ + N ₂)	3.5 \pm 0.5 vol. percent

(b) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for service accumulation shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas).

5. Liquefied Petroleum Gas Fuel Specifications

Add the following subparagraphs:

(a) **Evaporative and exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas) as modified by the following:

Specification	Limit
Liquefied Petroleum Gas Certification Test Fuel	

Propane	93.5 ± 1.0 volume percent
Propene	3.8 ± 0.5 volume percent
Butane and heavier components	1.9 ± 0.3 volume percent

(b) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for service accumulation shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas).

6. Identification of New Clean Fuels to be Used in Certification Testing

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraph 86.1313-94 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NO_x, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels," as adopted September 17, 1993. In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel sold commercially in California.

~~86.1314-84 Analytical gases. December 10, 1984.~~

~~86.1314-94 Analytical gases. June 30, 1995.~~

~~86.1316-84 Calibration; frequency and overview. December 10, 1984.~~

~~86.1316-90 Calibration; frequency and overview. April 11, 1989.~~

~~86.1316-94 Calibration; frequency and overview. September 5, 1997.~~

~~86.1318-84 Engine dynamometer system calibrations. November 16, 1983.~~

~~86.1319-84 CVS calibration. December 10, 1984.~~
~~86.1319-90 CVS calibration. April 11, 1989; May 4, 1998.~~
~~86.1320-88 Gas meter or flow instrumentation calibration; particulate measurement. December 16, 1987.~~
~~86.1320-90 Gas meter or flow instrumentation calibration; particulate, methanol, and formaldehyde measurement. April 11, 1989.~~
~~86.1321-84 Hydrocarbon analyzer calibration. December 10, 1984.~~
~~86.1321-90 Hydrocarbon analyzer calibration. April 11, 1989.~~
86.1321-94 Hydrocarbon analyzer calibration. September 5, 1997.
~~86.1322-84 Carbon monoxide analyzer calibration. November 16, 1983; September 5, 1997~~
~~86.1323-84 Oxides of nitrogen analyzer calibration. December 10, 1984; September 5, 1997~~
~~86.1324-84 Carbon dioxide analyzer calibration. November 16, 1983; September 5, 1997~~
86.1325-94 Methane analyzer calibration. September 5, 1997.
~~86.1326-84 Calibration of other equipment. November 16, 1983.~~
~~86.1326-90 Calibration of other equipment. April 11, 1989.~~
~~86.1327-84 Engine dynamometer test procedures; overview. December 10, 1984.~~
~~86.1327-88 Engine dynamometer test procedures; overview. March 15, 1985.~~
~~86.1327-90 Engine dynamometer test procedure; overview. April 11, 1989.~~
~~_____ * * * * *~~
~~_____ (a)...sample collection impingers (or capsules) for formaldehyde (HCHO). A bag or continuous sample of the dilution air...~~
~~_____ * * * * *~~
86.1327-98 Engine dynamometer test procedures; overview. September 5, 1997.
~~86.1330-84 Test sequence, general requirements. November 16, 1983.~~
~~86.1330-90 Test sequence, general requirements. April 11, 1989; September 5, 1997.~~
~~86.1332-84 Engine mapping procedures. December 10, 1984.~~
~~86.1332-90 Engine mapping procedures. April 11, 1989; September 21, 1994.~~
~~86.1333-84 Transient test cycle generation. November 16, 1983.~~
~~86.1333-90 Transient test cycle generation. April 11, 1989; May 4, 1998.~~
~~86.1334-84 Pre-test engine and dynamometer preparation. December 10, 1984; September 5, 1997.~~
~~86.1335-84 Optional forced cool-down procedure. December 10, 1984.~~
~~86.1335-90 Optional forced cool-down procedure. April 11, 1989; September 5, 1997.~~
~~86.1336-84 Engine starting and restarting. March 15, 1985; September 21, 1994.~~
~~86.1337-84 Engine dynamometer test run. November 16, 1983.~~
~~86.1337-88 Engine dynamometer test run. March 15, 1985.~~
~~86.1337-90 Engine dynamometer test run. April 11, 1989.~~
~~86.1337-96 Engine dynamometer test run. September 5, 1997.~~
~~86.1338-84 Emission measurement accuracy. November 16, 1983; September 5, 1997.~~
~~86.1340-84 Exhaust sample analysis. December 10, 1984.~~
~~86.1340-90 Exhaust sample analysis. April 11, 1989.~~
86.1340-94 Exhaust sample analysis. June 30, 1995.
~~86.1341-84 Test cycle validation criteria. March 15, 1985.~~

~~86.1341-90 Test cycle validation criteria. April 11, 1989.~~

~~86.1341-98 Test cycle validation criteria. September 5, 1997.~~

~~86.1342-84 Calculations; exhaust emissions. March 15, 1985.~~

~~86.1342-90 Calculations; exhaust emissions. April 11, 1989.~~

~~86.1342-94 Calculations; exhaust emissions. September 21, 1994; 1997.~~

Amend subparagraph (d) Meaning of symbols as follows:

(1)(ii) ~~... (101.3 kPa) pressure; or, i~~ If gaseous fuels are being used, 18.64 g/ft³ for natural gas and 17.28 g/ft³ for liquefied petroleum gas, assuming an average carbon to hydrogen ratio of 1:3.803 for natural gas and 1:2.656 for liquefied petroleum gas, at 68° F and 760 mm Hg pressure. The Executive Officer may approve other density values deemed appropriate by a manufacturer when gaseous fuels are being used.

* * * * *

~~(3)(v)(A) $CO_e = (1 - 0.01925CO_{2e} - 0.000323R)CO_{em}$ for gasoline and petroleum diesel fuel, with hydrogen to carbon ratio of 1.85:1.~~

(3)(v)(B) $CO_e = [1 - (0.01 + 0.005HCR)CO_{2e} - 0.00323R]CO_{em}$ for methanol fuel, where HCR is hydrogen to carbon ratio as measured for the fuel used. For natural gas and liquefied petroleum gas, HCR is assumed to be 2.656 and 3.802 respectively.

* * * * *

~~(8)(i) K_H = Humidity correction factor.~~

~~_____ (ii) For gasoline-fueled, gaseous-fuel, and methanol-fueled diesel engines: $K_H =$
1/[1-0.0047(H-75)] (or for SI units, ...~~

~~_____ * * * * *~~

~~86.1344-84 Required information. December 10, 1984.~~

~~86.1344-88 Required information. March 15, 1985.~~

~~86.1344-90 Required information. April 11, 1989.~~

~~86.1344-94 Required information. October 21, 1997.~~

Subpart P - Emission Regulations for New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Heavy-Duty Engines and New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Light-Duty Trucks; Idle Test Procedures

- 86.1501-84 ~~Scope, applicability. December 10, 1984.~~
- 86.1501-90 ~~Scope, applicability. April 11, 1989.~~
- 86.1501-94 Scope, applicability. October 6, 2000.
- 86.1502-84 ~~Definitions. November 16, 1983~~ May 4, 1999.
- 86.1503-84 ~~Abbreviations. November 16, 1983~~ May 4, 1999.
- 86.1504-84 ~~Section numbering; construction. November 16, 1983.~~
- 86.1504-90 ~~Section numbering; construction. April 11, 1989.~~
- 86.1504-94 Section numbering; construction. June 30, 1995.
- 86.1505-84 ~~Introduction; structure of subpart. November 16, 1983.~~
- 86.1505-90 ~~Introduction; structure of subpart. April 11, 1989.~~
- 86.1505-94 Introduction; structure of subpart. June 30, 1995.
- 86.1506-84 ~~Equipment required and specifications; overview. November 16, 1983.~~
- 86.1506-90 ~~Equipment required and specifications; overview. April 11, 1989.~~
- 86.1506-94 Equipment required and specifications; overview. September 21, 1994.
- 86.1509-84 ~~Exhaust gas sampling system. November 16, 1983.~~ June 30, 1995.
- 86.1511-84 ~~Exhaust gas analysis system. November 16, 1983.~~ June 30, 1995.
- 86.1513-84 ~~Fuel specifications. November 16, 1983.~~
- 86.1513-87 ~~Fuel specifications. July 7, 1986.~~
- 86.1513-90 ~~Fuel specifications. January 8, 1988.~~
- 86.1513-94 Fuel specifications. September 21, 1994
- 86.1514-84 ~~Analytical gases. November 16, 1983~~ June 30, 1995.
- 86.1516-84 ~~Calibration; frequency and overview. November 16, 1983.~~
- 86.1519-84 ~~CVS calibration. November 16, 1983.~~
- 86.1522-84 ~~Carbon monoxide analyzer calibration. November 16, 1983.~~
- 86.1524-84 ~~Carbon dioxide analyzer calibration. November 16, 1983.~~
- 86.1526-84 ~~Calibration of other equipment. November 16, 1983.~~
- 86.1527-84 ~~Idle test procedure; overview. November 16, 1983.~~
- 86.1530-84 ~~Test sequence; general requirements. November 16, 1983.~~
- 86.1537-84 ~~Idle test run. November 16, 1983.~~ June 30, 1995.
- 86.1540-84 ~~Idle exhaust sample analysis. November 16, 1983.~~
- 86.1542-84 ~~Information required. December 10, 1984.~~
- 86.1544-84 ~~Calculation; idle exhaust emissions. March 15, 1985~~ July 7, 1986.

Appendix I- Urban Dynamometer Schedules.

(f)(1) EPA Engine Dynamometer Schedule for Heavy-Duty Gasoline-Fueled Engines.
~~December 10, 1984.~~ April 29, 1998.

Appendix XII - Tables for Production Compliance Auditing of Heavy-Duty Engines and Heavy-Duty Vehicles.