

State of California  
**AIR RESOURCES BOARD**

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

Adopted: [INSERT DATE OF ADOPTION]

NOTE: The format of this document has been reorganized and updated from the previous version of these test procedures that were entitled the "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles. The proposed clarifying modifications are non-substantive but are indicated by underline for additions and ~~strikeout~~ for deletions to identify the changes. Staff proposes that the current version of the test procedures end with the 2003 model year and this new version would be effective beginning in the 2004 model year.

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

The following provisions of Subparts A, I, and N, Part 86, Title 40, Code of Federal Regulations, 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 diesel engines and vehicles, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," except as altered or replaced by the provisions set forth below.

**Part I. 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** October 6, 2000.

1.1 Subparagraph (a) [No change.]

1.2 Subparagraph (b) *Optional Applicability.* [No change.]

1.3 Subparagraphs (c) and (d) Reserved

1.4 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 (including all vehicles and engines imported under the provisions of 40 CFR §§85.1505 and 85.1509 of this chapter) 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 a manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. To certify its product line under these optional procedures, the small-volume manufacturer must first obtain the Executive Officer's approval. The manufacturer must meet the eligibility criteria specified in 40 CFR §86.092-14(b) before the

Executive Officer's approval will be granted. The small volume manufacturer's heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

1.5 Subparagraph (f) Optional procedures for determining exhaust opacity. [No change.]

2. **§86.005-1** October 6, 2000

2.1 Subparagraph (a) [No change.]

2.2 Subparagraph (b) Optional Applicability. [No change.]

2.3 Subparagraph (c) [n/a; Otto-cycle]

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 (including all vehicles and engines imported under the provisions of 40 CFR §§85.1505 and 85.1509 of this chapter) 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 a manufacturer certifying for the first time in California, model-year production shall be based on projected California sales. To certify its product line under these optional procedures, the small-volume manufacturer must first obtain the Executive Officer's approval. The manufacturer must meet the eligibility criteria specified in 40 CFR §86.092-14(b) before the Executive Officer's approval will be granted. The small volume manufacturer's heavy-duty engine certification procedures are described in 40 CFR §86.092-14.

2.5 Subparagraph (f) Optional procedures for determining exhaust opacity. [No change.]

## **B. California provisions.**

1. These regulations shall be applicable to all heavy-duty diesel methanol-fueled, ethanol-fueled, natural-gas-fueled and liquefied-petroleum gas-fueled dedicated, dual-fuel and multi-fuel engines (and vehicles) including those engines derived from existing diesel engines. For any engine that is not a distinctly diesel 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 Otto-cycle engine regulations, in consideration of the relative similarity of the engine's torque-speed characteristics and vehicle applications with those of diesel and Otto-cycle engines. Reference to dual fuel vehicles or engines shall also mean bi-fuel vehicles or engines. References to methanol shall also mean ethanol.

2. References in the federal regulations to light-duty vehicles and light-duty trucks do not apply. References to heavy-duty Otto-cycle engines or vehicles do not apply.

3. Any reference to vehicle or engine sales or vehicle or engine production volume throughout the United States shall mean vehicle or engine sales or vehicle or engine volume in each the United States and in California. References to small volume manufacturers shall mean California small volume manufacturer as defined in section I.1.A., above.

4. Regulations concerning U.S. EPA hearings, U.S. EPA inspections, specific language on the Certificate of Conformity, non-conformance penalties, selective enforcement audit, evaporative emission, high-altitude vehicles and testing, alternative useful life, 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 201 and Subsequent Model Motor Vehicles," as incorporated in title 13, CCR §1976. All heavy-duty methanol- and gaseous-fueled vehicles shall comply with the evaporative requirements in title 13, CCR, §1976.

2. Definitions. [§86.xxx-2]

**A. Federal Provisions.**

1. **§86.004-2** January 18, 2001. [All federal definitions apply, except as otherwise noted below. Definitions specific to other requirements are contained in separate documents.]

**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"** shall also mean Air Resources Board or Executive Officer of the Air Resources Board

**"EPA Enforcement Officer"** means the Executive Officer or his delegate.

**"Medium-duty engine"** means a heavy-duty engine that is used to propel a medium-duty vehicle.

**"Medium-duty vehicle"** means 2004 through 2006 model year heavy-duty low-emission vehicle, ultra-low-emission vehicle, super-ultra-low-emission vehicle or zero-emission vehicle certified to the standards in title 13, CCR, section 1960.1(h)(2) having a manufacturer's gross vehicle weight rating of 14,000 pounds or less; and any 2004 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in title 13, CCR section 1956.8(h), having a manufacturer's gross vehicle weight rating between 8,501 and 14,000 pounds.

**"Warranty period"** [For guidance see title 13, CCR, §2036].

3. Abbreviations. [§86.xxx-3]

**A. Federal Provisions.**

1. **§86.000-3 Abbreviations.** October 22, 1996. [All federal abbreviations apply, except as otherwise noted below. Abbreviations specific to other requirements are contained in separate documents.]

**B. California Provisions.**

“CCR” means “California Code of Regulations

“LEV” means low-emission vehicle

“MDV” means medium-duty vehicle

“OBD” means on-board diagnostics

“ULEV” means ultra-low-emission vehicle

“SULEV” means super-ultra-low-emission 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 general notation §86.xxx-# is used when there is more than one applicable section (or when no versions of the section are being incorporated) to indicate the section being discussed without regard to model year. The years of applicability (denoted generically “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] December 12, 1984 [No change.]
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] [n/a]
11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

**A. Federal provisions.**

**1. §86.004-11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles. ~~October 21, 1997~~ October 6, 2000.**

- 1.1 Amend subparagraph (a) as follows:
  - 1.1.1 Amend subparagraph (a)(1) Exhaust emissions from new 2004 ~~and later~~ through 2006 model year diesel HDEs, other than diesel-fueled, dual fuel and bi-fuel urban buses, shall not exceed the following:
    - 1.1.2 Subparagraphs (a)(1)(i) through (a)(iii)(C) [No change.]
    - 1.1.3 Amend subparagraph (a)(2) as follows: The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(2) of appendix I to this part, and measured and calculated in accordance with the procedures set forth in subpart N ~~or P~~ of this part as amended in part II of these test procedures, except as noted in §86.098-28(c)(2) or superseding sections.
  - 1.2 Subparagraph (b). [No change.]
  - 1.3 Subparagraph (c). [No change.]
  - 1.4 Amend subparagraph (d) as follows: Every manufacturer of new motor vehicle engines subject to the standards prescribed in title 13, CCR, §1956.8 (a), §1956.8 (h), and this section shall, prior to taking any of the actions prohibited by California Health & Safety Code section 43211 or as specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with applicable procedures in subpart I or N ~~of this part~~ as amended by these test procedures to ascertain that such test engines meet the requirements of paragraphs (a), (b), (c), and (d) of this section.
  - 1.5 Subparagraph (e). [No change.]

**2. §86.007-11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles. January 18, 2001.**

- 2.1 Add the following sentence to the introductory paragraph: Except as otherwise noted, references in this subsection to heavy-duty engines or HDEs



shall include medium-duty engines as defined in Section I.2.B of these test procedures.

2.2 Subparagraphs (a) and (a)(1). [No change.]

2.2.1 Amend subparagraph (a)(2) as follows: The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(2) of appendix I to this part, and measured and calculated in accordance with the procedures set forth in subpart N ~~or P~~ of this part as amended in part II of these test procedures, except as noted in §86.007-23(c)(2) or superseding sections.

2.2.2. Delete subparagraph (a)(3). [For guidance see Subpart N, §86.1360-2007 of these test procedures].

2.2.3. Delete subparagraph (a)(4). [For guidance see Subpart N, §86.1370-2007 of these test procedures]

2.3 Subparagraphs (b)(1)(i) through (b)(1)(iii). [No change.]

2.3.1 Delete subparagraph (b)(1)(iv). [For guidance see Subpart N, §86.1370-2007 of these test procedures]

2.3.2 Subparagraphs (b)(2)(i). [No change.]

2.3.3 Delete subparagraph (b)(2)(ii). [For guidance see Subpart N, §86.1370-2007 of these test procedures]

2.3.4 Subparagraph (b)(3) and (b)(4). [No change.]

2.4 Subparagraph (c). [No change.]

2.5. Amend subparagraph (d) as follows: Every manufacturer of new motor vehicle engines subject to the standards prescribed in the ~~California Code of Regulations~~, title 13, CCR, §1956.8 (a), §1956.8 (h), and this section shall, prior to taking any of the actions prohibited by California Health & Safety Code section 43211 or as specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with applicable procedures in subpart I or N of the ~~“California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles”~~ as amended in part II of these test procedures to ascertain that such test engines meet the requirements of paragraphs (a), (b), (c), and (d) of this section.

2.6 Subparagraphs (e) through (h). [No change.]

~~§86.007-11 Emission standards and supplemental requirements for 2007 and subsequent model year heavy-duty diesel engines and vehicles. January 18, 2004~~

~~This section applies to new 2007 and later model year heavy-duty diesel engines. Section 86.007-11 includes text that specifies requirements that differ from Sec. 86.004-11. Where a paragraph in Sec. 86.004-11 is identical and applicable to Sec. 86.007-11, this may be indicated by specifying the corresponding paragraph and the statement “[Reserved]. For guidance see Sec. 86.004-11.”~~

(a)(1) Exhaust emissions from new 2007 and later model year heavy-duty diesel engines shall not exceed the following:

(i) Oxides of Nitrogen (NO<sub>x</sub>). (A) 0.20 grams per brake horsepower-hour (0.075 grams per megajoule).

(B) A manufacturer may elect to include any or all of its heavy-duty diesel engine families in any or all of the NO<sub>x</sub> and NO<sub>x</sub> plus NMHC emissions ABT programs for heavy-duty diesel engines, within the restrictions described in Sec. 86.007-15 or Sec. 86.004-15. If the manufacturer elects to include engine families in any of these programs, the NO<sub>x</sub> FELs may not exceed the following FEL caps: 2.00 grams per brake horsepower-hour (0.75 grams per megajoule) for model years before 2010; 0.50 grams per brake horsepower-hour (0.19 grams per megajoule) for model years 2010 and later. This ceiling value applies whether credits for the family are derived from averaging, banking, or trading programs.

(ii)(A) Non-Methane Hydrocarbons (NMHC) for engines fueled with either diesel fuel, natural gas, or liquefied petroleum gas. 0.14 grams per brake horsepower-hour (0.052 grams per megajoule).

(B) Non-Methane Hydrocarbon Equivalent (NMHCE) for engines fueled with methanol. 0.14 grams per brake horsepower-hour (0.052 grams per megajoule).

(iii) Carbon monoxide. (A) 15.5 grams per brake horsepower-hour (5.77 grams per megajoule).

(B) 0.50 percent of exhaust gas flow at curb idle (methanol-, natural gas-, and liquefied petroleum gas-fueled heavy-duty diesel engines only). This does not apply for vehicles certified to the requirements of Sec. 86.005-17

(iv) Particulate. (A) 0.01 grams per brake horsepower-hour (0.0037 grams per megajoule).

(B) A manufacturer may elect to include any or all of its heavy-duty diesel engine families in any or all of the particulate ABT programs for heavy-duty diesel engines, within the restrictions described in Sec. 86.007-15 or other applicable sections. If the manufacturer elects to include engine families in any of these programs, the particulate FEL may not exceed 0.02 grams per brake horsepower-hour (0.0075 grams per megajoule).

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(2) of appendix I to this

part, and measured and calculated in accordance with the procedures set forth in subpart N or P of this part, except as noted in Sec. 86.007-23(c)(2).

~~(3) DELETE~~

~~(4) DELETE~~

\* \* \* \* \*

~~(iv) \*\*\*~~

~~(C) DELETE~~

~~(v) DELETE~~

\* \* \* \* \*

~~(b)(3) and (b)(4) [Reserved]. For guidance see Sec. 86.004-11.~~

~~(c) No crankcase emissions shall be discharged directly into the ambient atmosphere from any new 2007 or later model year heavy-duty diesel engines, with the following exception: heavy-duty diesel engines equipped with turbochargers, pumps, blowers, or superchargers for air induction may discharge crankcase emissions to the ambient atmosphere if the emissions are added to the exhaust emissions (either physically or mathematically) during all emission testing. Manufacturers taking advantage of this exception must manufacture the engines so that all crankcase emission can be routed into a dilution tunnel (or other sampling system approved in advance by the Executive Officer), and must account for deterioration in crankcase emissions when determining exhaust deterioration factors. For the purpose of this paragraph (c), crankcase emissions that are routed to the exhaust upstream of exhaust aftertreatment during all operation are not considered to be "discharged directly into the ambient atmosphere."~~

~~(d) Every manufacturer of new motor vehicle engines subject to the standards prescribed in the California Code of Regulations, title 13, §1956.8 (a), §1956.8 (h), and this section shall, prior to taking any of the actions prohibited by California Health & Safety Code section 43211, test or cause to be tested motor vehicle engines in accordance with applicable procedures in subpart I or N of the "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" to ascertain that such test engines meet the requirements of paragraphs (a), (b), (c), and (d) of this section.~~

~~(e) [Reserved]. For guidance see Sec. 86.004-11.~~

~~(f) DELETE~~

\* \* \* \* \*

**B. California provisions.**

**1. Urban Bus Standards.**

1.1 The exhaust emissions from new 2004 through 2006 model year heavy-duty engines (other than diesel-fueled, dual-fuel and bi-fuel heavy-duty

engines) used in urban buses shall not exceed the standards set forth in 40 CFR §86.004-11(a)(1), above.

1.2 The exhaust emissions, as measured under transient operating conditions, from 2004 through 2006 model year diesel-fueled, dual-fuel and bi-fuel heavy-duty engines used in urban buses shall not exceed:

<b>2004 – 2006 Heavy-Duty Diesel-Fuel, Dual Fuel, and Bi-Fuel Urban Bus Engine Exhaust Emission Standards</b> (grams per brake horsepower-hour or g/bhp-hr)				
<b>NOx<sup>1</sup></b>	<b>NMHC or NMHCE</b>	<b>CO<sup>3</sup></b>	<b>PM<sup>2</sup></b>	<b>HCHO<sup>4</sup></b>
0.5 (0.2 g/megajoule)	0.05 (0.02 g/megajoule)	5.0 (1.9 g/megajoule); [7.0 (2.6 g/megajoule)]	0.01 (0.004 g/megajoule)	0.01(0.004 g/megajoule)

<sup>1</sup> Oxides of Nitrogen (NOx). This standard is for certification testing and selective enforcement audit testing. As an option, manufacturers may choose to meet the NOx standard with a base engine that is certified to the standards in §86.004-11(a)(1), (October 6, 2000), equipped with an aftertreatment system that reduces NOx to 0.5 g/bhp-hr and PM to 0.01 g/bhp-hr. The NMHC, CO, and formaldehyde standards above shall still apply. Manufacturers shall be responsible for full certification, durability, testing, and warranty and other requirements for the base engine. For the aftertreatment system, manufacturers shall not be subject to the certification durability requirements, or in-use recall and enforcement provisions, but are subject to warranty provisions for functionality.

<sup>2</sup> Particulates. This standard is for certification testing, selective enforcement audit testing, and in-use testing. As an option, manufacturers may choose to meet the PM standard with an aftertreatment system that reduces PM to 0.01 g/bhp-hr. Manufacturers shall be responsible for full certification, durability, testing, and warranty and other requirements for the base engine. For the aftertreatment system, manufacturers shall not be subject to the certification durability requirements, or in-use recall and enforcement provisions, but are subject to warranty provisions for functionality.

<sup>3</sup> Carbon monoxide. The 5.0 g/bhp-hr (1.9 grams per megajoule) standard is for certification testing and selective enforcement audit testing, and the 7.0 g/bhp-hr (2.6 grams per megajoule) standard is for in-use testing.

<sup>4</sup> Formaldehyde. This standard is for certification testing, selective enforcement audit testing and in-use testing.

1.3 The exhaust emissions from new 2007 and subsequent model year heavy-duty engines used in urban buses shall not exceed the following standards:

<b>2007 and Subsequent Heavy-Duty Diesel Urban Bus Engine Exhaust Emission Standards*</b> (grams per brake-horsepower-hour or g/bhp-hr)				
<b>NOx</b>	<b>NMHC or NMHCE</b>	<b>CO</b>	<b>PM</b>	<b>HCHO</b>
0.2 (0.075 g/megajoule)	0.05 (0.02 g/megajoule)	5.0 (1.9 g/megajoule)	0.01 (0.004 g/megajoule)	0.01 (0.004 g/megajoule)

**2. Optional HDE and Urban Bus Standards.** A manufacturer may elect to certify 2004 through 2006 model year heavy-duty diesel engines greater than 14,000 pounds gross vehicle weight rating and heavy-duty engines used in urban buses [excluding diesel-fuel, dual-fuel and bi-fuel heavy-duty diesel engines used in urban bus engines] to the following standards, as measured under transient operating conditions. Engines certified to these standards are not eligible to participate in NOx, NOx plus NMHC, or particulate ABT programs.

<b>OPTIONAL STANDARDS</b> <b>Heavy-Duty Diesel Engines &gt;14,000 lbs. GVW</b> <b>(excluding diesel-fueled, dual fuel, and bi-fuel Urban Buses)</b> (grams per brake-horsepower-hour or g/bhp-hr)			
Model Year	NOx plus NMHC (or NMHCE)*	CO	PM
2004–2006*	0.3 to 1.8, inclusive; (in 0.3 g/bhp-hr increments)	15.5	0.01; 0.02; or 0.03

\*NOx plus NMHC are measured as the arithmetic sum of the NOx plus NMHC exhaust component certification values.

**3. Formaldehyde Standards.** Formaldehyde exhaust emissions from new 2004 through 2006 model methanol-fueled diesel engines, shall not exceed 0.05 g/bhp-hr.

**4. Requirements for Dual- and Bi-Fuel Engines.** For the 2004 through 2006 model years, aAn engine family whose design allows engine operation in either of two distinct alternative fueling modes, where each fueling mode is characterized by use of one fuel or a combination of two fuels and significantly different emission levels under each mode, may certify to a different NOx plus NMHC (depending on model year) standard for each fueling mode, provided it meets the following requirements:

- (1) The NOx plus NMHC certification standard used for certification under the higher emitting fueling mode must be the standard contained in paragraph 11.A.1 above as appropriate.
- (2) The NOx plus NMHC certification standard used for certification under the lower emitting fueling mode must be one of the reduced-emission standards contained in paragraph 11.B.2 above, as appropriate.
- (3) The engine family is not used to participate in any manufacturer's averaging, banking or trading program.
- (4) The engine family meets all other applicable emission standards in each fueling mode.
- (5) The higher emitting fueling mode must be intended only for fail-safe vehicle operation in the case of a malfunction or inadvertent fuel depletion which

precludes normal operation in the lower emitting fueling mode. Evidence of such design intent would be a significantly reduced horsepower versus engine speed curve when operating in the higher emitting fueling mode as compared to the curve while operating in the lower emitting fueling mode.

(6) All applicable exhaust emission testing, data submission, and certification application requirements must be met separately for each of the two fueling modes of operation, but should be submitted for ARB approval in a single package.

**5. Standards for Medium-Duty Engines.** A manufacturer of heavy-duty engines used in medium-duty vehicles may choose to comply with the following standards as an alternative to the primary emission standards and test procedures specified in title 13, CCR, §1961. A manufacturer that chooses to comply with these optional heavy-duty standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in title 13, CCR, §2139(c).

The exhaust emissions from new 2004 and subsequent model heavy-duty diesel engines used in ultra-low emission and super-ultra-low emission medium-duty diesel vehicles shall not exceed:

<b>Exhaust Emission Standards for 2004 – 2006 Model Medium-Duty ULEVs and SULEVs</b>					
Vehicle Emission Category	NOx + NMHC		CO	PM	HCHO
ULEV <sup>1</sup> Option A	2.5 (with a 0.5 cap on NMHC)		14.4	0.10	0.05
ULEV <sup>1</sup> ; Option B	2.4		14.4	0.10	0.05
<b>Exhaust Emission Standards for 2007 and Subsequent Model Medium-Duty ULEVs and SULEVs</b>					
Vehicle Emission Category	NOx	NMHC or NMHCE	CO	PM	HCHO
ULEV <sup>1</sup>	See 40 CFR §86.007-11(a)(1)(i)	See 40 CFR §86.007-11(a)(1)(ii)	See 40 CFR §86.007-11(a)(1)(iii)	See 40 CFR §86.007-11(a)(1)(iv)	<del>0.050</del> <u>0.01</u>
SULEV <sup>1</sup>	0.1	0.07	7.7	0.005	<del>0.025</del> <u>0.005</u>

<sup>1</sup> Emissions averaging may be used to meet these standards using the requirements for participation averaging, banking and trading programs, as set forth in Section I.15 of these test procedures.

12. Alternative certification procedures. §86.080-12 April 17, 1980. [No change.]
13. Alternative durability program. §86.xxx-13 April 17, 1980. [n/a; light-duty only.]
14. Small-volume manufacturers certification procedures. §86.xxx-14 April 6, 1994.
- A. Federal provisions.** [A small volume manufacturer shall mean a California small volume manufacturer as defined in §86.001-1 (e), as modified above. Any reference to 10,000 units shall mean 4,500 units in California based on the average number of units sold for the three previous consecutive model years defined in §86.001-1 (e), as modified in Section 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: Delete the last sentence, "However, the manufacturer is not required to submit the information to the Administrator unless the Administrator requests it."
    - 1.3 Subparagraphs (c)(5) through (c)(7)(i)(B) [No change.]
    - 1.4 Amend subparagraph (c)(7)(i)(C)(1) as follows: Manufacturers with aggregated sales of less than 301 motor vehicles and motor vehicles engines per year may use assigned deterioration factors that the Executive Officer 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 Subparagraphs (c)(7)(i)(C)(2) through (c)(13)(i) [No change.]
    - 1.6 Add the following sentence 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. [No change; pertains to evaporative requirements.]
  3. **§86.098-14** April 6, 1994. [No change; pertains to evaporative requirements.]
15. NO<sub>x</sub> plus NMHC and particulate averaging, trading, and banking for heavy-duty engines §86.xxx-15.
- A. Federal provisions.**
1. **§86.004-15** February 6, 2000. Amend as follows:
    - 1.1 Add the following sentence to subparagraph (a)(1): Except as otherwise noted, references in this subsection to engines, heavy-duty engines, or HDEs shall include medium-duty diesel-cycle engines certified under §1956.8(h), title 13 CCR for sale in California for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating.
    - 1.2 Subparagraphs (a)(2) through (b)(1)(ii)(A) [No change.]
    - 1.3 Subparagraph (b)(1)(ii)(B). Add the following sentence: In the case of medium-duty engines certified under §1956.8(h), title 13, CCR, for use in vehicles

of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating, the FEL is subject to the same upper limit as required for heavy-duty engines.

1.4 Subparagraphs (b)(1)(iii) through (b)(1)(iv)(B). [No change.]

1.5 Subparagraph (b)(1)(iv)(C). Add the following sentence: Credits generated before the year 2004 to be used to certify engines in the combined light heavy-duty and medium-duty averaging set, as described in paragraphs (d)(2)(i) and (e)(2), in the year 2004 and later, must have been generated through the sale of engines in California.

1.6 Subparagraph (b)(2)(i). [No change.]

1.7 Subparagraph (b)(2)(ii) Amend as follows: (ii) The source of the credits to be used to comply with the emission standard if the FEL exceeds the standard, or where credits will be applied if the FEL is less than the emission standard. In cases where credits are being obtained, each engine family involved must state specifically the source (manufacturer/engine family) of the credits being used, including the year of generation of the credits being used and whether the credits were generated from engines sold in California or from 49-state engines. In cases where credits are being generated/supplied, each engine family involved must state specifically the designated use (manufacturer/engine family or reserved) of the credits involved. All such reports shall include all credits involved in averaging, trading or banking.

1.8 Subparagraphs (b)(3) through (c)(1)(ii). [No change.]

1.9 Subparagraph (c)(1)(iii). Add the following sentence: For medium-duty diesel-cycle engines certified in the 2004 and 2005 model years under ~~§1956.8(h) title 13 CCR for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating~~, an additional adjustment to the Std value described in this subparagraph (c)(1)(iii) above, allowing for certification using Federal certification fuel may be made on an individual engine family basis as determined by the ARB Executive Officer upon application by the engine manufacturer.

1.10 Subparagraphs (c)(2) through (d)(1). [No change.]

1.11 Subparagraph (d)(2). Amend as follows: For NOx plus NMHC credits from diesel-cycle heavy-duty engines:

(i) Heavy heavy-duty engines and medium heavy-duty engines, as defined in §86.004-2, each constitute an averaging set. Light heavy-duty engines, as defined in §86.004-2, for use in vehicles of more than 14,000 pounds gross vehicle weight rating and medium-duty engines ~~certified under title 13 CCR §1956.8(h) for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating~~, combined constitute an averaging set. Averaging and trading among all diesel-cycle engine families within the same averaging set is allowed.

(ii) Engines intended for use in urban buses constitute a separate averaging set from all other heavy-duty engines. Averaging and trading



between diesel cycle bus engine families within the same averaging set is allowed.

1.12 Subparagraphs (e) and (e)(1). [No change.]

1.13 Subparagraph (e)(2) Amend as follows: (e)(2)

(i) For heavy-duty engines, exclusive of urban bus engines, heavy heavy-duty engines and medium heavy-duty engines, as defined in §86.004-2, each constitute an averaging set. Light heavy-duty engines, as defined in §86.004-2, for use in vehicles of more than 14,000 pounds gross vehicle weight rating and medium-duty engines ~~certified under §1956.8(h) title 13 CCR for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating~~, combined constitute an averaging set.

Averaging and trading between diesel-cycle engine families within the same averaging set is allowed.

1.14 Subparagraphs (e)(3) through (f)(3)(ii). [No change.]

1.15 Subparagraph (f)(3)(iii) Add the following sentences: Banked credits generated before the 2004 model year to be applied toward the certification of engines in the combined light heavy-duty and medium-duty averaging set, as described in paragraphs (d)(2)(i) and (e)(2) above, must have been generated through the sale of eligible engines within California. Credits generated before the 2004 model year from engines sold outside of California may not be used to certify light heavy-duty or medium-duty engines for sale in California. Manufacturers subject to the consent decree shall bank and use credits as allowed in their respective consent decrees.<sup>1</sup>

1.16 Subparagraphs (g) through (i). [No change.]

1.17 Subparagraph (j) Credit apportionment. Delete; replace with: At the manufacturer's option, marketable emission reduction credits for NOx plus NMHC, for use in emission reduction credit programs other than ABT, may be generated based upon engine certification to the optional reduced-emission NOx plus NMHC certification standards of ~~86.004-11(e)~~, section I.11.B.2 of these test procedures except that medium-duty engines certified under title 13, CCR, §1956.8(h) for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating may not be used as the basis for generating marketable emission reduction credits. Use of any marketable emission reduction credits

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<sup>1</sup> Seven of the largest heavy-duty diesel engine manufacturers will be implementing measures to reduce emissions beginning October 1, 2002, to meet the requirements of the Heavy-Duty Diesel Engines Settlement Agreements reached with the ARB. The Heavy-Duty Diesel Engine Settlements were agreements reached in response to lawsuits brought by the United States Environmental Protection Agency and violations alleged by the ARB pertaining to excess in-use emissions caused by the use of defeat devices and unacceptable algorithms. Navistar signed its Settlement Agreement on October 22, 1998. Cummins, Detroit Diesel Corporation, Caterpillar, Volvo, Mack and Renault signed their Settlement Agreements on December 15, 1998.

generated must meet the requirements of the individual emission reduction credit program where the credits will be applied.

- (1) For those engine sales used to generate ABT credits, the manufacturer shall report engine sales in the category "ABT-only credits." For those engine sales certified to generate marketable emission reduction credits for NOx, the manufacturer shall report engine sales in the category "non-manufacturer-owned credits."
  - (i) For engine sales reported as "ABT-only credits," the credits generated must be used solely in the ABT program described in this section.
  - (ii) The engine manufacturer may declare a portion of engine sales "non-manufacturer-owned credits" and any marketable NOx credits generated based upon such sales would belong to the engine purchaser. For ABT, the manufacturer may not generate any credits for the engine sales reported as "non-manufacturer-owned credits."
- (2) Only manufacturer-owned credits resulting from engine sales reported as "ABT-only credits" shall be used in the averaging, trading, and banking provisions described in this section.
- (3) Credits shall not be double-counted. Credits used in the ABT program may not be provided to an engine purchaser for use in another program.
- (4) Manufacturers shall determine and state the number of engines sold as "ABT-only credits" and "non-manufacturer-owned credits" in the end-of-model year reports required under 86.001-23.

1.18 Subparagraphs (k) and (l). [No change.]

2. **§86.007-15.** January 18, 2001. Amend as follows:

- 2.1 Introductory paragraph; subparagraphs (a) through (m)(9). [No change.]
- 2.2 Amend subparagraph (m)(9)(i) as follows:  
~~(m) The following provisions apply for model year 2007 and later engines (including engines certified during years 2007-2009 under the phase-in provisions of Sec. 86.007-11(g)(1), Sec. 86.005-10(a), or Sec. 86.008-10(f)(1)). These provisions apply instead of the provisions of paragraphs Sec. 86.004-15 (a) through (k) to the extent that they are in conflict.~~
- 2.3 ~~Subparagraph (m)(1).~~ [n/a; Otto-cycle engines]
- 2.4 ~~Subparagraph (m)(2) Credits are calculated as NOx or NMHC credits for engines certified to separate NOx and NMHC standards. NOx plus NMHC credits (including banked credits and credits that are generated during years 2007-2009 under the phase-in provisions of~~

~~Sec. 86.007-11(g)(1), Sec. 86.005-10(a), or Sec. 86.008-10(f)(1)) may be used to show compliance with 2007 or later NOx standards (NOx or NMHC standards for Otto-cycle engines), subject to an 0.8 discount factor (e.g., 100 grams of NOx plus NMHC credits is equivalent to 80 grams of NOx credits).~~

~~2.5 Subparagraph (m)(3). [n/a; Otto-cycle engines]~~

~~2.6 Subparagraphs (m)(4) through (m)(8) [No change.]~~

~~2.7 Amend subparagraph (m)(9) as follows: (9) For the purpose of using or generating credits during a phase-in of new standards, a manufacturer may elect to split an engine family into two subfamilies (e.g., one which uses credits and one which generates credits). The manufacturer must indicate in the application for certification that the engine family is to be split, and may assign the numbers and configurations of engines within the respective subfamilies at any time prior to the submission of the end-of-year report required by Sec. 86.001-23.~~

- (i) Manufacturers certifying a split diesel engine family to both the pre-2007 (phased-out) and post-2007 (phased-in) emission standards with equally sized subfamilies may exclude the engines within that split family from end-of-year NOx (or NOx+NMHC) ABT calculations, provided that neither subfamily generates credits for use by other engine families, or uses banked credits, or uses averaging credits from other engine families. All of the engines in that split family must be excluded from the phase-in calculations of Sec. 86.007-11(g)(1) (both from the number of engines complying with the standards being phased-in and from the total number of U.S.-directed production engines.)
  - (ii) [n/a; Otto-cycle]
  - (iii) [No change.]
  - (iv) Notwithstanding the provisions of paragraph (m)(9)(iii) of this section, for split families, the NOx FEL shall be used to determine applicability of the provisions of ~~Sec. §86.1360-2007B.1.2(j)(2) and B.1.3.(j)(3) and Sec.1370-2007A.1.4.1(iii) (d)(1)(iii) and A.1.4.1(iv) (d)(1)(iv)~~, as modified by these test procedures.
- ~~2.3 Subparagraph (m)(10). [No change.]~~

~~§86.007-15 NOx and particulate averaging, trading, and banking for heavy-duty engines. January 18, 2001~~

~~Section 86.007-15 includes text that specifies requirements that differ from Sec. 86.004-15. Where a paragraph in Sec. 86.004-15 is identical and applicable to Sec. 86.007-15,~~

this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see Sec. 86.004-15."

(a) through (l) [Reserved]. For guidance see Sec. 86.004-15.

(m) The following provisions apply for model year 2007 and later engines (including engines certified during years 2007-2009 under the phase-in provisions of Sec. 86.007-11(g)(1)). These provisions apply instead of the provisions of paragraphs Sec. 86.004-15 (a) through (k) to the extent that they are in conflict.

(1) [Reserved]

(2) Credits are calculated as NO<sub>x</sub> or NMHC credits for engines certified to separate NO<sub>x</sub> and NMHC standards. NO<sub>x</sub> plus NMHC credits (including banked credits and credits that are generated during years 2007-2009 under the phase-in provisions of Sec. 86.007-11(g)(1)) may be used to show compliance with 2007 or later NO<sub>x</sub> standards, subject to an 0.8 discount factor (e.g., 100 grams of NO<sub>x</sub> plus NMHC credits is equivalent to 80 grams of NO<sub>x</sub> credits).

(3) [Reserved]

(4) Credits that were previously discounted when they were banked according to paragraph (c) of Sec. 86.004-15, are subject to an additional discount factor of 0.888 instead of the 0.8 discount factor otherwise required by paragraph (m)(2) of this section. This results in a total discount factor of 0.8 ( $0.9 \times 0.888 = 0.8$ ).

(5) For diesel engine families, the combined number of engines certified to FELs higher than 0.50 g/bhp-hr using banked NO<sub>x</sub> (and/or NO<sub>x</sub> plus NMHC) credits in any given model year may not exceed 10 percent of the manufacturer's U.S.-directed production of engines in all heavy-duty diesel engine families for that model year.

(6) The FEL must be expressed to the same number of decimal places as the standard (generally, one-hundredth of a gram per brake horsepower-hour). For engines certified to standards expressed only one-tenth of a gram per brake horsepower-hour, if the FEL is below 1.0, then add a zero to the standard in the second decimal place and express the FEL to nearest one-hundredth of a gram per brake horsepower-hour.

(7) Credits are to be rounded to the nearest one-hundredth of a Megagram using ASTM E29-93a.

(8) Credits generated for 2007 and later model year diesel engine families, are not discounted (except as specified in paragraph (m)(2) of this section), and do not expire.

~~(9) For the purpose of using or generating credits during a phase-in of new standards, a manufacturer may elect to split an engine family into two subfamilies (e.g., one which uses credits and one which generates credits). The manufacturer must indicate in the application for certification that the engine family is to be split, and may assign the numbers and configurations of engines within the respective subfamilies at any time prior to the submission of the end-of-year report required by Sec. 86.001-23.~~

~~(i) Manufacturers certifying a split diesel engine family to both the pre-2007 (phased-out) and post-2007 (phased-in) emission standards with equally sized subfamilies may exclude the engines within that split family from end-of-year NO<sub>x</sub> (or NO<sub>x</sub>+NMHC) ABT calculations, provided that neither subfamily generates credits for use by other engine families, or uses banked credits, or uses averaging credits from other engine families. All of the engines in that split family must be excluded from the phase-in calculations of Sec. 86.007-11(g)(1) (both from the number of engines complying with the standards being phased-in and from the total number of U.S.-directed production engines.)~~

~~(ii) [Reserved]~~

~~(iii) Manufacturers certifying a split engine family may label all of the engines within that family with a single NO<sub>x</sub> or NO<sub>x</sub>+NMHC FEL. The FEL on the label will apply for all SEA or other compliance testing.~~

~~(iv) Notwithstanding the provisions of paragraph (m)(9)(iii) of this section, for split families, the NO<sub>x</sub> FEL shall be used to determine applicability of the provisions of Sec. 86.1360-2007(j)(2) and (j)(3) and Sec. 1370-2007(d)(1)(iii) and (d)(1)(iv), as modified by these procedures.~~

~~(10) For model years 2007 through 2009, to be consistent with the phase-in provisions of Sec. 86.007-11(g)(1), credits generated from engines in one diesel engine service class (e.g., light-heavy duty diesel engines) may be used for averaging by engines in a different diesel engine service class, provided the credits are calculated for both engine families using the conversion factor and useful life of the engine family using the credits, and the engine family using the credits is certified to the standards listed in Sec. 86.007-11(a)(1). Banked or traded credits may not be used by any engine family in a different service class than the service class of the engine family generating the credits.~~

## **B. California provisions**

1. For medium-duty diesel-cycle engines certified under title 13, CCR §1956.8(h): for use in vehicles of more than 8,500 pounds through 14,000 pounds gross vehicle weight rating:

(a) Credits may be generated by an alternative mechanism proposed by the engine manufacturer and approved by the Executive Officer of the ARB. The alternative credit-generating mechanism shall not include any attribute expressly prohibited under the federal ABT program, such as cross-class or cross-fuel trading.

(b) Manufacturers must annually submit a proposed plan for generating credits to the Executive Officer of the ARB and have it approved prior to sale of engines of that model year in California.

16. Prohibition of defeat devices. §86.000-16 January 18, 2001 [No change.]

17. On-board diagnostics. §86.099-17; 86.005-17; [Delete replace with: All heavy-duty diesel cycle engines up to 14,000 pounds GVW must have an on-board diagnostic system as required in title 13, CCR §1968 et seq, as applicable.]

18. §86.xxx-18. [Reserved.]

19. §86.xxx-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 6, 2000. Amend as follows:

1.1 Subparagraphs (a) through (l). [No change.]

1.2 Delete subparagraph (m).

1.3 Subparagraph (n). [No change.]

2. **§86.007-21** October 6, 2000. Amend as follows:

2.1 Subparagraphs (a) through (l). [No change.]

2.2 Delete subparagraph (m).

2.3 Subparagraph (n). [No change.]

2.4 Amend subparagraph (o) as follows: For 2005 and subsequent model year diesel heavy-duty engines, the manufacturer must provide the following additional information pertaining to the supplemental steady-state test conducted under § 86.1360-2007:

2.4.1 Amend subparagraph (o)(1) as follows: Weighted brake-specific emissions data (i.e., in units of g/bhp-hr), calculated according to § 86.1360-2007(e)(5) and (6), for all pollutants for which an emission standard is established in § 86.004-11(a);

2.4.2 Subparagraphs (o)(2) through (o)(6). [No change.] ~~Brake-specific gaseous emission data for each of the 13 test points (identified under § 86.1360-2007(b)(1)) and the 3 ARB-EPA-selected test points (identified under § 86.1360-2007(b)(2));~~

~~(3) Concentrations and mass flow rates of all regulated gaseous emissions plus carbon dioxide;~~

~~(4) Values of all emission-related engine control variables at each test point;~~

~~(5) Weighted break brake-specific particulate matter (i.e., in units of g/bhp-hr);~~  
~~(6) A statement that the test results correspond to the maximum NOx producing condition specified in § 86.1360-2007(e)(4). The manufacturer also must maintain records at the manufacturer's facility which contain all test data, engineering analyses, and other information which provides the basis for this statement, where such information exists. The manufacturer must provide such information to the Executive Officer Administrator upon request;~~

2.4.3 Amend subparagraph (o)(7) as follows: A statement that the engines will comply with the weighted average emissions cap standard and interpolated values comply with the Maximum Allowable Emission Limits emission testing caps specified in §86.1360-2007B.1(j) § 86.007-11(a)(3) for the useful life of the engine. The manufacturer also must maintain records at the manufacturer's facility which contain a detailed description of all test data, engineering analyses, and other information which provides the basis for this statement, where such information exists. The manufacturer must provide such information to the Executive Officer Administrator upon request.

2.5 Amend subparagraph (p) as follows:

2.5.1. (1) The manufacturer must provide a statement in the application for certification that the diesel heavy-duty engine for which certification is being requested will comply with the applicable Not-To-Exceed Limits specified in §86.1370-2007A.1.4(d) §86.007-11(a)(4)-when operated under all conditions which may reasonably be expected to be encountered in normal vehicle operation and use. The manufacturer also must maintain records at the manufacturer's facility which contain all test data, engineering analyses, and other information which provides the basis for this statement, where such information exists. The manufacturer must provide such information to the Executive Officer Administrator upon request.

2.5.2. Subparagraph (p)(2). [No change.]

2.5.3. Amend subparagraph (p)(3) as follows: For each engine model and/or horsepower rating within an engine family for which a manufacturer is applying for an NTE deficiency(ies) under the provisions of §86.1370-2007B.3(i) §86.007-11(a)(4)(iv), the manufacturer's application for an NTE deficiency(ies) must include a complete description of the deficiency, including but not limited to: the specific description of the deficiency; what pollutant the deficiency is being applied for, all engineering efforts the manufacturer has made to overcome the deficiency, what specific operating conditions the deficiency is being requested for (i.e., temperature ranges, humidity ranges, altitude ranges, etc.), a full description of the auxiliary emission control device(s) which will be used to maintain emissions to the lowest practical level; and what the lowest practical emission level will be.

## **A. California provisions**

1. For 2004 and subsequent model-year medium-duty ultra-low

emission and super-ultra-low emission vehicles and engines not powered exclusively by diesel fuel, the manufacturer shall submit projected California sales and fuel economy data two years prior to certification.

22. Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges. [§86.001-22]  
April 6, 1994. [No change.]

23. Required data. [§86.xxx-23]

**A. Federal provisions.**

1. **§86.098-23.** October 21, 1997

1.1 Subparagraphs (a) through (b)(1)(i) [No change.]

1.2 Add the following sentence to subparagraph (b)(1)(ii): ~~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.

1.3 Subparagraphs (b)(2) through (h)(2) [No change.]

1.4 Amend subparagraph (h)(3) as follows:

(h)(3)(i) These reports shall be submitted within 90 days of the end of the model year to: Chief, Mobile Source Operations Division, California Air Resources Board, 9528 Telstar Avenue, El Monte, California 91731.

1.5 Subparagraphs (h)(3)(ii) through (m) [No change.]

2. **§86.001-23** October 21, 1997 [No change, except that the amendments indicated for §86.098-23 above still apply.]

3. **§86.007-23** January 18, 2001 [No change, except that the amendments indicated for §86.098-23 above still apply.]

24. Test vehicles and engines. §86.xxx-24

**A. Federal provisions.**

1. **§86.001-24.** October 22, 1996. [No change except that the reference in subparagraph (e)(2) to 10,000 light-duty vehicles, light-duty trucks, heavy-duty vehicles and heavy-duty engines shall mean 4,500 units based on the average number of vehicles or engines sold for the three previous consecutive model years for which a manufacturer seeks certification in California.]

25. Maintenance. §86.xxx-25

**A. Federal provisions.**



1. **§86.004-25.** October 21, 1997.
  - 1.1 Subparagraphs (a) through (b)(6)(ii). [No change.]
  - 1.2 Add the following phrase to the last sentence of subparagraph (b)(6)(iii): ... or California Vehicle Code 27156, et seq.
  - 1.3 Subparagraphs (b)(7)(i) and (b)(7)(ii). [No change.]
  - 1.4 Add the following sentence to subparagraph (b)(7)(iii): The Executive Officer may also provide the manufacturer a hearing in accordance with title 17, CCR, §00040, et seq., with respect to such issue.
  
2. **§86.007-25.** January 18, 2001. [No change except that the amendments indicated for §86.004-25 above still apply.]

26. Mileage and service accumulation; emission measurements. §86.004-26  
October 6, 2000. [No change.]

27. Special test procedures. §86.090-27 April 11, 1989. [No change.]

28. Compliance with emission standards. §86.xxx-28 January 18, 2001.

**A. Federal provisions.**

1. **§86.004-28.** January 18, 2001. Amend as follows:
  - 1.1 Subparagraphs (a) through (c)(4)(i) [No change.]
  - 1.2 Amend subparagraph (c)(4)(ii) as follows: [No change, except that diesel-cycle smoke testing shall only apply to petroleum-fueled diesel-cycle engines.]
  - 1.3 Subparagraph (c)(4)(iii)(A) [n/a; Otto-cycle engines.]
  - 1.4 Subparagraph (c)(4)(iii)(B): [No change, except that the exhaust emission results for formaldehyde exhaust emission results for methanol-fueled engines and vehicles, ultra-low emission vehicles and super-ultra-low emission vehicles shall also be adjusted by the appropriate deterioration factor (through addition or multiplication as the case may be.)
  - 1.5 Amend subparagraph (c)(4)(iii)(B)(3) as follows: For petroleum-fueled diesel cycle HDEs only: [No change to remainder of paragraph.]
  - 1.6 Subparagraphs (c)(iv) through (i). [No change.]

30. Testing by the Administrator. §86.091-29 ~~April 11, 1989~~ March 24, 1993. [No change.]

31. Certification. §86.xxx-30

**A. Federal provisions**

1. **§86.004-30.** October 21, 1997. Amend as follows:
  - 1.1 Subparagraphs (a) through (a)(2). [No change.]
  - 1.2 Add the following sentence to subparagraph (a)(3)(i). For heavy-duty engines certified under the provisions of ~~§86.004-44(f)~~ section I.11.B.4 of these test procedures two certificates will be issued, one for each fueling mode. [No change to remainder of paragraph.]
  - 1.3 Subparagraphs (a)(3)(ii) through (b)(2). [No change.]

1.4 Subparagraph (b)(3). Add the following sentence: If, after a review of the request and supporting data, the Executive Officer finds that the request raises a substantial factual issue, he shall provide the manufacturer a hearing in accordance with title 17, CCR, §00040, et seq., with respect to such issue.

1.5 Subparagraph (b)(4). [No change.]

1.6 Subparagraph (b)(4)(i). Add the following phrase at the beginning of the paragraph: Request a hearing under title 17, CCR, §00040, et seq.; or...

1.7 Subparagraph (b)(4)(ii) through (b)(5). No change.

1.8 Subparagraph (b)(5)(i). Add the following phrase at the beginning of the paragraph: Request a hearing under title 17, CCR, §00040, et seq.; or...

1.9 Subparagraph (b)(5)(ii) through (c)(5). [No change.]

1.10 Subparagraph (c)(5)(i). Add the following phrase at the beginning of the paragraph: Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with title 17, CCR, §00040, et seq. hereof; and ...

1.11 Subparagraph (c)(5)(ii). [No change.]

1.12 Subparagraph (c)(6). Add the following sentence: The manufacturer may request in the form and manner specified in paragraph (b)(3) of this section that any determination made by the Executive Officer under paragraph (c)(1) of this section to withhold or deny certification be reviewed in a hearing conducted in accordance with title 17, CCR, §00040, et seq. If the Executive Officer finds, after a review of the request and supporting data, that the request raises a substantial factual issue, he will grant the request with respect to such issue.

1.13 Subparagraphs (d) through (e). [No change.]

1.14 Delete subparagraph (f) and replace with the following: All medium-duty diesel cycle engines up to 14,000 pounds GVW must have an on-board diagnostic system as required in title 13, CCR §1968 et seq, as applicable.

32. Separate certification. §86.079-31 September 8, 1977. [No change.]

33. Addition of a vehicle or engine after certification. §86.079-32 September 8, 1977. [No change.]

34. Changes to a vehicle or engine covered by certification. §86.079-33 September 8, 1977. [No change.]

35. Alternative procedure for notification of additions and changes. §86.082-34 November 2, 1982. [No change.]

36. Labeling. §86.xxx-35,

**A. Federal Provisions.**

1. **§86.001-35** January 18, 2001.

1.1 Add the following sentence to the introductory paragraph: The labeling requirements of this section shall apply to all new motor vehicle engines certified according to the provisions of California Health and Safety Code Section 43100.

- 1.2 Subparagraphs (a)(1) through (a)(3)(iii)(G). [No change.]
- 1.3 Add the following language to subparagraph (a)(3)(iii)(H).
  - 1.3.1 For 2004 through 2006 model year heavy heavy-duty diesel-fueled, dual-fuel, and bi-fuel engines to be used in urban buses that are certified to the optional reduced emission standards and are sold to any transit agency exempted under paragraphs (c)(8) and (d)(7), title 13, CCR, §1956.2 from the requirements of paragraphs (c)(5) and (d)(4), title 13, CCR §956.2.

“This engine conforms to California regulations applicable to XXX model year new urban bus or heavy-duty diesel engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standards of 0.01 g/bhp-hr).”
  - 1.3.2 For all other 2004 through 2006 model year heavy-duty diesel cycle engines, including those used in urban buses, that are certified to the optional reduced-emission standards, the label shall contain the following statement:

“This engine conforms to California regulations applicable to XXX model year new (specify urban bus or heavy-duty diesel) engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standard of 0.03 g/bhp-hr, 0.02 g/bhp-hr, or 0.01 g/bhp-hr).”
- 1.4 Subparagraphs (a)(3)(l) through (i). [No change.]

2. **§86.007-35.** January 18, 2001.

- 2.1 Subparagraphs (a) through (i). [No change except that the amendments set forth in §86.001-35 apply.]

**B. California provisions.**

1. For 2004 and later model year heavy-duty diesel engines certified under the requirements of title 13, CCR, §1956.8(a)(3), the statement of compliance requirements of this subsection shall be repeated for each of the two fueling modes of operation. Appended to the statement for the lower emitting fueling mode of operation shall be the following sentence:

“This certification is valid only while operating on \_\_\_\_ (indicate the fuel or fuel combination under which this mode of operation was certified) fuel. Operation using any other fueling mode will result in significant increases in exhaust emissions and significantly reduce engine performance.”

2. Manufacturers may elect to use a supplemental label in addition to the original label if there is not sufficient space to include all the required information. The supplemental label must conform to all specifications as the original label. In the case that a supplemental label is used, the original label shall be numbered "1 of 2" and the supplemental label shall be numbered "2 of 2."

3. Statements shall not be used on labels placed on engines that, in fact, do not comply with all applicable California regulations.

37. Submission of vehicle identification numbers. §86.079-36 [n/a]

38. Production vehicles and engines. §86.085-37 ~~January 12, 1983~~ June 6, 1997. [No change.]

39. Maintenance instructions. §86.xxx-38

**A. Federal provisions**

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 Subparagraphs (g)(2) through (h). [No change.]

2. **§86.007-38** January 18, 2001.

2.1 Subparagraphs (a) through (h) [No change, except as amended in §86.004-38, above.]

2.2 Amend subparagraph (i) as follows: For each new diesel-fueled engine subject to the standards prescribed in ~~the California Code of Regulations~~, title 13, CCR §1956.8(a), §1956.8(h), and Sec. 86.007-11, as applicable, the manufacturer shall furnish or cause to be furnished to the ultimate purchaser a statement that "This engine must be operated only with low

sulfur diesel fuel (that is, diesel fuel meeting ARB specifications for highway diesel fuel, including a 15 ppm sulfur cap).”

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

41. Heavy-duty engine rebuilding practices. §86.xxx-40

**A. Federal Provisions.**

1. **§86.004-40** October 21, 1997.

1.1 Add the following sentence to the introductory paragraph: Any deviation from the provisions contained in this section is also a prohibited act under California Vehicle Code §27156, et seq.

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

## PART II TEST PROCEDURES

### Subpart I - Emission Regulations for New Diesel-Fueled Heavy-Duty Engines; Smoke Exhaust Test Procedure

86.884-1 General Applicability. ~~April 11, 1989~~ September 21, 1994.

The provisions of this subpart are applicable to new petroleum-fueled diesel heavy-duty engines beginning with the 1984 model year.

The provisions of this subpart are not applicable to new heavy-duty diesel gaseous-fuel engines and those gaseous-fuel engines derived from diesel engines, except dual-fuel and multi-fuel engines which use petroleum fuel.

86.884-2 Definitions. November 16, 1983.

86.884-3 Abbreviations. November 16, 1983.

86.884-4 Section numbering. ~~November 16, 1983~~ September 21, 1994.

86.884-5 Test Procedures. April 11, 1989.

86.884-6 Fuel specifications. April 11, 1989.

86.884-7 Dynamometer operation cycle for smoke emission tests. ~~November 16, 1983~~ September 5, 1997.

86.884-8 Dynamometer and engine equipment. ~~November 16, 1983~~ September 5, 1997.

86.884-9 Smoke measurement system. ~~November 16, 1983~~ September 5, 1997.

86.884-10 Information. ~~November 16, 1983~~ September 5, 1997.

86.884-11 Instrument checks. ~~November 16, 1983~~ December 11, 1984.

86.884-12 Test run. ~~November 16, 1983~~ December 16, 1987.

86.884-13 Data analysis. ~~November 16, 1983~~ September 5, 1997.

86.884-14 Calculations. ~~November 16, 1983~~ September 5, 1997.

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

- 86.1301-90 Scope; applicability. April 11, 1989.  
86.1302-84 Definitions. November 16, 1983.  
86.1303-84 Abbreviations. November 16, 1983.  
86.1304-90 Section numbering; construction. ~~April 11, 1989~~ October 6, 2000.  
86.1305-04 Introduction; structure of subpart. October 6, 2000.  
86.1306-96 Equipment required and specifications; overview. September 21, 1994.  
86.1306-2007 Equipment required and specifications; overview. January 18, 2001.  
86.1308-84 Dynamometer and engine equipment specifications. December 10, 1987.  
86.1309-90 Exhaust gas sampling system; Otto-cycle and non-petroleum fueled engines. January 18, 2001.

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

- 86.1310-90 Exhaust gas sampling and analytical system; diesel engines. ~~April 11, 1989~~  
September 5, 1997.  
86.1310-2007 Exhaust gas sampling and analytical system for gaseous emissions from heavy-duty diesel-fueled engines and particulate emissions from all engines. January 18, 2001 [No change.]

~~(2) The THC analytical system for diesel engines requires a heated flame ionization detector (HFID) and heated sample system (191 plus or minus (+/-) 11 deg.C) using either:~~

~~(i) Continuously integrated measurement of diluted THC meeting the minimum requirements and technical specifications contained in paragraph (b)(3) of this section. Unless compensation for varying mass flow is made, a constant mass flow system must be used to ensure a proportional sample; or~~

~~(ii) Heated (191 plus or minus (+/-) 11 deg.C) proportional bag sampling systems for hydrocarbon measurement will be allowed if the bag sampling system meets the performance specifications for outgassing and permeability as defined in paragraph (b)(2) of this section.~~

~~\* \* \* \* \*~~

~~(8) The mass of particulate in the exhaust is determined via filtration. The particulate sampling system requires dilution of the exhaust to a temperature of 47 deg.C plus or~~

minus (+/-) 5 deg.C, measured upstream of a single high-efficiency sample filter (as close to the filter as practical).

~~(9) Since various configurations can produce equivalent results, exact conformance with these drawings is not required. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the components of the system. Other components, such as snubbers, which are not needed to maintain accuracy on some systems, may be excluded if their exclusion is based upon good engineering judgment.~~

~~(10) Other sampling and/or analytical systems may be used if shown to yield equivalent results and if approved in advance by the Executive Officer (see Sec. 86.1306-07).~~

~~(b) Component description. The components necessary for exhaust sampling shall meet the following requirements:~~

~~(1) Exhaust dilution system. The CVS shall conform to all of the requirements listed for the exhaust gas CVS systems in Sec. 86.1309(b), (c), and (d). With respect to PM measurement, the intent of this measurement procedure is to perform the sample cooling primarily via dilution and mixing with air rather than via heat transfer to the surfaces of the sampling system. In addition the CVS must conform to the following requirements:~~

~~(i) The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream at the temperatures required for the measurement of particulate and hydrocarbon emission noted below and at, or above, the temperatures where aqueous condensation in the exhaust gases could occur. This is achieved by the following method. The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream in the primary dilution tunnel at a temperature of 19± deg.C or less at the sampling zone and as required to prevent condensation at any point in the dilution tunnel. Gaseous emission samples may be taken directly from this sampling point. An exhaust sample must then be taken at this point to be diluted a second time for use in determining particulate emissions. The secondary dilution system must provide sufficient secondary dilution air to maintain the double-diluted exhaust stream at a temperature of 47 C plus or minus (+/-) 5 C, measured at a point located between the filter face and 16 cm upstream of the filter face.~~

~~\* \* \* \* \*~~

~~(B) Primary dilution air shall be filtered at the dilution air inlet. The manufacturer of the primary dilution air filter shall state that the filter design has successfully achieved a minimum particle removal efficiency of 98% (less than 0.02~~



penetration) as determined using ASTM test method F 1471-93). Secondary dilution air shall be filtered at the dilution air inlet using a high-efficiency particulate air filter (HEPA). The HEPA filter manufacturer shall state the HEPA filter design has successfully achieved a minimum particle removal efficiency of 99.97% (less than 0.0003 penetration) as determined using ASTM test method F 1471-93. It is recommended that the primary dilution air be filtered using a HEPA filter. EPA intends to utilize HEPA filters to condition primary dilution air in its test facilities. It is acceptable to use of a booster blower upstream or downstream of a HEPA filter in the primary dilution tunnel (and upstream of the introduction of engine exhaust into the CVS) to compensate for the additional pressure loss associated with the filter. The design of any booster blower located downstream of the filter should minimize the introduction of additional particulate matter into the CVS.

(C) Primary dilution air may be sampled to determine background particulate levels, which can then be subtracted from the values measured in the diluted exhaust stream. In the case of primary dilution air, the background particulate filter sample shall be taken immediately downstream of the dilution air filter and upstream of the engine exhaust flow (Figure N07-1). The provisions of paragraphs (b)(7) of this section, and of Sec. 86.1312-2007 also apply to the measurement of background particulate matter, except that the filter temperature must be maintained below 52 deg.C.

(2) Heated proportional bag sampling systems. If a heated (191 plus or minus (+/-) 11 deg.C) proportional bag sampling system is used for THC measurement, sample bags must demonstrate minimal outgassing and permeability by passing the following performance test:

\* \* \* \* \*

(A) Maintain a wall temperature of 191 deg.C plus or minus (+/-) 11 deg.C as measured at every separately controlled heated component (i.e., filters, heated line sections), using permanent thermocouples located at each of the separate components.

(B) Have a wall temperature of 191 deg.C plus or minus (+/-) 11 deg.C over its entire length. The temperature of the system shall be demonstrated by profiling the thermal characteristics of the system at initial installation and after any major maintenance performed on the system. The temperature profile of the HC sampling system shall be demonstrated by inserting thermocouple wires (typically Teflon™ coated for ease of insertion) into the sampling system assembled in-situ where possible, using good engineering judgment. The wire

should be inserted up to the HFID inlet. Stabilize the sampling system heaters at normal operating temperatures. Withdraw the wires in increments of 5 cm to 10 cm (2 inches to 4 inches) including all fittings. Record the stabilized temperature at each position. The system temperature will be monitored during testing at the locations and temperature described in Sec. 86.1310-90(b)(3)(v)(A).

~~—Note: It is understood that profiling of the sample line can be done under flowing conditions also as required with the probe. This test may be cumbersome if test facilities utilize long transfer lines and many fittings; therefore it is recommended that transfer lines be kept as short as possible and the use of fittings should be kept minimal.~~

~~(C) Maintain a gas temperature of 191 deg.C plus or minus (+/-) 11 deg.C immediately before the heated filter and HFID. These gas temperatures will be determined by a temperature sensor located immediately upstream of each component.~~

~~(vi) The continuous hydrocarbon sampling probe shall:~~

~~(A) Be defined as the first 25.4 cm (10 in) to 76.2 cm (30 in) of the continuous hydrocarbon sampling system;~~

~~(B) Have a 0.483 cm (0.19 in) minimum inside diameter;~~

~~(C) Be installed in the primary dilution tunnel at a point where the dilution air and exhaust are well mixed (i.e., approximately 10 tunnel diameters downstream of the point where the exhaust enters the dilution tunnel);~~

~~(D) Be sufficiently distant (radially) from other probes and the tunnel wall so as to be free from the influence of any wakes or eddies; and~~

~~(E) Increase the gas stream temperature to 191 deg.C plus or minus (+/-) 11 deg.C by the exit of the probe. The ability of the probe to accomplish this shall be demonstrated at typical sample flow rates using the insertion thermocouple technique at initial installation and after any major maintenance. Compliance with the temperature specification shall be demonstrated by monitoring during each test the temperature of either the gas stream or the wall of the sample probe at its terminus.~~

~~(vii) The response time of the continuous measurement system shall be no greater than:~~

~~(A) 1.5 seconds from an instantaneous step change at the port entrance to the analyzer to within 90 percent of the step change;~~

~~(B) 10 seconds from an instantaneous step change at the entrance to the sample probe or overflow span gas port to within 90 percent of the step change. Analysis system response time shall be coordinated with CVS flow fluctuations and sampling time/test cycle offsets if necessary; and~~

~~(C) For the purpose of verification of response times, the step change shall be at least 60 percent of full-scale chart deflection.~~

~~(4) Primary dilution tunnel. (i) The primary dilution tunnel shall be:~~

~~(A) Small enough in diameter to cause turbulent flow (Reynolds Number greater than 4000) and of sufficient length to cause complete mixing of the exhaust and dilution air. Good engineering judgment shall dictate the use of mixing plates and mixing orifices to ensure a well-mixed sample. To verify mixing, ARB recommends flowing a tracer gas (i.e. propane or CO<sub>2</sub>) from the raw exhaust inlet of the dilution tunnel and measuring its concentration at several points along the axial plane at the sample probe. Tracer gas concentrations should remain nearly constant (i.e. within 2%) between all of these points.~~

~~\* \* \* \* \*~~

~~(v) Additional dilution air must be provided so as to maintain a sample temperature of 47 deg. C plus or minus (+/-) 5 deg. C upstream of the sample filter. Temperature shall be measured with a thermocouple with a 3/16" shank, having thermocouple wires with a gage diameter 24 AWG or smaller, a bare-wire butt-welded junction; or other suitable temperature measurement with an equivalent or faster time constant and an accuracy and precision of plus or minus (+/-) 1.9 deg. C.~~

~~(vi) The filter holder assembly shall be located within 12.0 in (30.5 cm) of the exit of the secondary dilution tunnel.~~

~~(vii) The face velocity through the sample filter shall not exceed 100 cm/s (face velocity is defined as the standard volumetric sample flow rate (i.e., scm<sup>3</sup>/sec) divided by the sample filter stain area (i.e., cm<sup>2</sup>)).~~

~~(7) Particulate sampling. (i) Filter specifications. (A) Polytetrafluoroethylene (PTFE or Teflon™) coated borosilicate glass fiber high-efficiency filters or polytetrafluoroethylene (PTFE or Teflon™) high-efficiency membrane filters with an integral support ring of polymethylpentene (PMP) or equivalent inert material are required. Filters shall have a~~

minimum clean filter efficiency of 99% as measured by the ASTM D2986-95a DOP test (incorporated by reference at Sec. 86.1).

\* \* \* \* \*

86.1311-94 Exhaust gas analytical system, CVS bag sample. October 21, 1997.

86.1312-88 Weighing chamber and microgram balance specifications. ~~March 15, 1985~~  
September 5, 1997.

86.1312-2007 Filter stabilization and microbalance workstation environmental conditions, microbalance specifications, and particulate matter filter handling and weighing procedures. January 18, 2001.

~~(a) Ambient conditions for filter stabilization and weighing. (1) Temperature and humidity.~~

~~(i) The filter stabilization environment shall be maintained at 22 deg.C plus or minus (+/-) 3 deg.C and a dewpoint of 9.5 deg.C plus or minus (+/-) 1 deg.C. Dewpoint shall be measured with an instrument that exhibits an accuracy of at least 0.25 deg.C NIST traceable as stated by the instrument manufacturer. Temperature shall be measured with an instrument that exhibits an accuracy of at least 0.2 deg.C or better.~~

~~(ii) The immediate microbalance workstation environment shall be maintained at 22 deg.C plus or minus (+/-) 1 deg.C and a dewpoint of 9.5 deg.C plus or minus (+/-) 1 deg.C. If the microbalance workstation environment freely circulates with the filter stabilization environment, and this entire environment meets 22 deg.C plus or minus (+/-) 1 deg.C and a dewpoint of 9.5 deg.C plus or minus (+/-) 1 deg.C, then there is no requirement to measure temperature and dewpoint at the microbalance separate from the filter stabilization location. Otherwise, temperature at the microbalance workstation shall be measured with an instrument that exhibits an accuracy of at least 0.2 deg.C or better, and dewpoint shall be measured with an instrument that exhibits an accuracy of at least 0.25 deg.C NIST traceable as stated by the instrument manufacturer.~~

\* \* \* \* \*

86.1313-94 Fuel specifications. September 5, 1997.

Amend as follows:

1. Subparagraph (a) Gasoline fuel [n/a]
2. Subparagraph (b) Petroleum diesel test fuel. [For guidance see §86.1313-98.]
3. Subparagraph (c) Methanol fuel. Amend 86.1313-94(c) as follows: Delete subparagraphs (c)(1) and (c)(2); replace with:
  - 3.1 (1) **Exhaust 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:

<b>Specification</b>	<b>Limit</b>
<b>M-100 Fuel Methanol</b>	
Methanol	98.0 ± 0.5 vol. percent
<b>Ethanol</b>	1.0 vol. Percent (max.)
Petroleum fuel meeting the specifications of <u>40 CFR 86.1313-98</u>	1.0 ± 0.1 vol. percent
<b>E-100 Fuel Ethanol</b>	
Ethanol	98.0 ± 0.5 vol. percent
<b>Methanol</b>	1.0 vol. Percent (max.)
Petroleum fuel meeting the specifications of <u>40 CFR 86.1313-98</u>	1.0 ± 0.1 vol. percent

3.2 (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).

3.3 (3) [No change.]

3.4 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. Subparagraph (d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles. Amend 86.1313-94(d) as follows: Delete subparagraphs (d)(1) and (d)(2); replace with:

- 4.1 (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
<b>M-85 Fuel Methanol</b>	
Petroleum fuel meeting the specifications of <u>40 CFR §86.1313-98</u>	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.
<b>E-85 Fuel Ethanol</b>	
Petroleum fuel meeting the specifications of <u>40 CFR §86.1313-98</u>	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

- 4.2 (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 86.1313-98(a) or (b), as modified by these test procedures, 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.

- 4.3 (3) [No change.]
  - 4.4 **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 86.1313-94 (a)(1), as modified by these test procedures, such that the final blend is composed of either 35 volume percent methanol (71.0 volume percent of total blend) for methanol-fueled vehicles or 10 volume percent ethanol (71.0 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.
  - 4.5 **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.
5. Subparagraph (e) Natural gas fuel. Amend 86.1313-94(e) as follows:  
Delete subparagraphs (e)(1), (e)(2) and (e)(3); Replace with:
- 5.1 (1) **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
<b>Compressed Natural Gas Certification Test Fuel</b>	
Methane	90.0 ± 1.0 mole percent
Ethane	4.0 ± 0.5 mole percent
C <sub>3</sub> and higher hydrocarbon content	2.0 ± 0.3 mole percent
Oxygen	0.5 mole percent maximum

Inert gases (CO <sub>2</sub> + N <sub>2</sub> )	3.5 ± 0.5 vol. percent
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5.2 (2) **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).

5.3 (3) Delete.

5.4 (4) [No change.]

6. Amend 86.1313-94(f) as follows: Delete subparagraphs (f)(1) and (f)(2); Replace with:

6.1 (1) **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
<b>Liquefied Petroleum Gas Certification Test Fuel</b>	
Propane	93.5 ± 1.0 volume percent
Propene	3.8 ± 0.5 volume percent
Butane and heavier components	1.9 ± 0.3 volume percent

6.2 (2) **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).

6.3 (3) [No change.]

7. §86.1313-94(g) [No change.]

8. Add the following California only requirement: 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 the new clean fuel are not specifically set forth in paragraph 86.1313-98 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 NMHC, NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in the "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 that 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.

86.1313-98 Fuel specifications. ~~April 11, 1989~~ February 18, 2000.

1. Subparagraph (a) [n/a]
2. Amend subparagraph (b) Diesel test fuel as follows:
  - 2.1 Subparagraph (b)(1) [No change.]
  - 2.2 Add the following language to subparagraph (b)(2): ~~Except as noted below, petroleum fuel for diesel engines ... shall be used. For 1993 and subsequent model-year diesel-fueled engines, the petroleum fuel used in exhaust emissions testing may meet the specifications in Table N98-2 of 40 Code of Federal Regulations section 86.1313-98(b)(2); as adopted September 5, 1997, or substantially equivalent~~

specifications approved by the Executive Officer as an option to the specifications in Table N90-2. For 1995 through 2003 model-year medium-duty diesel fueled engines, and for 1996 and 1997 model-year urban bus engines only, the petroleum fuel used in exhaust emissions testing may meet the specifications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in Table N90-2. Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications in Table N98-2, or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer. The manufacturer shall submit evidence to the Executive Officer demonstrating to the Executive Officer's satisfaction that the test fuel will be the predominant in-use fuel. Such evidence could include such things as copies of signed contracts from customers indicating the intent to purchase and use the test fuel as the primary fuel for use in the engines or other evidence acceptable to the Executive Officer.

<u>Fuel Property</u>	<u>Limit</u>	<u>Test Method<sup>a</sup></u>
Natural Cetane Number	47-55	D613-86
Distillation Range, °F		Title 13 CCR, §2282(g)(3)
IBP	340-420	
10% point	400-490	
50% point	470-560	
90% point	550-610	
EP	580-660	
API Gravity, degrees	33-39	D287-82
Total Sulfur, wt. %	0.01-0.05	Title 13 CCR, §2282(g)(3)
Nitrogen Content, ppmw	100-500	Title 13 CCR, §2282(g)(3)
Total Aromatic Hydrocarbons, vol.%	8-12	Title 13 CCR, §2282(g)(3)
Polycyclic Aromatic Hydrocarbons, wt. % (max.)	1.4	Title 13 CCR, §2282(g)(3)
Flashpoint, °F (max)	130	D 93-80
Viscosity @ 40°F, centistokes	2.0-4.1	D 445-83

<sup>a</sup> ASTM specifications unless otherwise noted. A reference to a subsection of Title 13, CCR, §2282 means the test method identified in that subsection for the particular property. 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 of the specified method.

2.3 (3) Add the following language to subparagraph (b)(3): ~~Except as noted below, petroleum fuel for diesel engines meeting the specifications in Table N90-3, or substantially equivalent specifications approved by the Executive Officer, shall be used in service accumulation. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel fuel, shall be used. For 1993 and subsequent model-year diesel-fueled engines, excluding the 1995 through 2005 model-year medium-duty diesel-fueled engines referenced below, the petroleum fuel used in service accumulation may meet the specifications in Table N94-3 of 40 Code of Federal Regulations section 86.1313-94(b)(3), as adopted August 21, 1990, or substantially equivalent specifications approved by the Executive Officer as an option to the specifications in Table N90-3. For 1995 through 2004 and 2005 model-year medium-duty diesel-fueled engines, and for 1996 and 1997 model-year urban bus engines only, diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation. The manufacturer shall submit evidence to the Executive Officer demonstrating to the Executive Officer's satisfaction that the test fuel will be the predominant in-use fuel. Such evidence could include such things as copies of signed contracts from customers indicating the intent to purchase and use the test fuel as the primary fuel for use in the engines or other evidence acceptable to the Executive Officer.~~

3. Subparagraphs (c), (d) and (e). [For guidance see §86.1313-94, above.]

86.1313-04 Fuel specifications. January 18, 2001. [n/a]

86.1313-2007 Fuel specifications. January 18, 2001. [No change.]

~~Section 86.1313-2007 includes text that specifies requirements that differ from Sec. 86.1313-90 4. Where a paragraph in Sec. 86.1313-90 4 is identical and applicable to Sec. 86.1313-2007, this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see Sec. 86.1313-90 4." or "[Reserved].~~

~~(a) [Reserved].~~

~~(b) heading and (b)(1) [Reserved]. For guidance see Sec. 86.1313-90 4.~~

~~(b)(2) Petroleum fuel for diesel engines meeting the specifications in Table N07-2, or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emissions testing. The grade of petroleum fuel used shall be commercially designated as "Type 2-D" grade diesel fuel~~

except that fuel commercially designated as "Type 1-D" grade diesel fuel may be substituted provided that the manufacturer has submitted evidence to the Administrator demonstrating to the Executive Officer's satisfaction that this fuel will be the predominant in-use fuel. Such evidence could include such things as copies of signed contracts from customers indicating the intent to purchase and use "Type 1-D" grade diesel fuel as the primary fuel for use in the engines or other evidence acceptable to the Executive Officer. Table N07-2 follows:

Table N07-2

Item	ASTM test method No.	Type 1-D	Type 2-D
(i) Cetane Number.....	D613.....	40-54.....	40-50
(ii) Cetane Index.....	D976.....	40-54.....	40-50
(iii) Distillation range:			
(A) IBP..... deg.F.....	D86.....	330-390.....	340-400
	( deg.C).....	(165.6-198.9).....	(171.1-204.4)
(B) 10 pct. point... deg.F.....	D86.....	370-430.....	400-460
	( deg.C).....	(187.8-221.1).....	(204.4-237.8)
(C) 50 pct. point... deg.F.....	D86.....	410-480.....	470-540
	( deg.C).....	(210.0-248.9).....	(243.3-282.2)
(D) 90 pct. point... deg.F.....	D86.....	460-520.....	560-630
	( deg.C).....	(237.8-271.1).....	(293.3-332.2)
(E) EP..... deg.F.....	D86.....	500-560.....	610-690
	( deg.C).....	(260.0-293.3).....	(321.1-365.6)
(iv) Gravity..... deg.API.....	D287.....	40-44.....	32-37
(v) Total sulfur..... ppm.....	D2622.....	7-15.....	7-15
(vi) Hydrocarbon composition:-			
(A) Aromatics, minimum pct.....	D5186.....	8.....	27
	(Remainder shall be paraffins, naphthenes, and olefins).		
(vii) Flashpoint, min..... deg.F.....	D93.....	120.....	130
	( deg.C).....	(48.9).....	(54.4)
(viii) Viscosity..... centistokes.....	D445.....	1.6-2.0.....	2.0-3.2

\* \* \* \* \*

- 86.1314-94 Analytical gases. June 30, 1995.
- 86.1316-94 Calibration; frequency and overview. September 5, 1997.
- 86.1318-84 Engine dynamometer system calibrations. December 10, 1984.
- 86.1319-90 CVS calibration. January 18, 2001.
- 86.1320-90 Gas meter or flow instrumentation calibration; particulate, methanol, and formaldehyde measurement. 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.
- 86.1323-2007 Oxides of nitrogen analyzer calibration. January 18, 2001

~~This section describes the initial and periodic calibration of the chemiluminescent oxides of nitrogen analyzer.~~

~~(a) Prior to introduction into service and at least monthly thereafter, the chemiluminescent oxides of nitrogen analyzer must be checked for NO<sub>2</sub> to NO converter efficiency. The Executive Officer may approve less frequent checks of the converter efficiency. Figure N84-9 is a reference for paragraphs (a) (1) through (11) of this section.~~

~~\*\*\*\*\*~~

~~(A) Calculate the volume fraction of water vapor in the wetted span gas, as  $H_2O_{vol} = (\exp(3.69 - (81.28/T_{sat})) + 1.61)/P_{sat}$ . This calculation approximates some of the thermodynamic properties of water based on the "1995 Formulation for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use", issued by The International Association for the Properties of Water and Steam (IAPWS). However, this approximation should only be used as prescribed in this section because it is an exponential fit that is accurate for data at 25 deg.C plus or minus (+/-) 10 deg.C. Then, assuming a diesel fuel atomic hydrogen to carbon ratio of 1.8, and an intake and dilution air humidity of 75 grains (10.71 g<sub>water</sub>/kg<sub>dry-air</sub> or 54.13 percent RH at 25 deg.C and 101.3 kPa),~~

~~\*\*\*\*\*~~

- 86.1324-84 Carbon dioxide analyzer calibration. ~~November 16, 1983~~ September 5, 1997.
- 86.1325-94 Methane analyzer calibration. September 5, 1997.
- 86.1326-90 Calibration of other equipment. April 11, 1989.
- 86.1327-98 Engine dynamometer test procedures; overview. September 5, 1997.
- 86.1330-90 Test sequence, general requirements. January 18, 2001.
- 86.1332-90 Engine mapping procedures. ~~April 11, 1989~~ September 21, 1994.
- 86.1333-90 Transient test cycle generation. ~~April 11, 1989~~ May 4, 1998.
- 86.1334-84 Pre-test engine and dynamometer preparation. January 18, 2001.
- 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.
- 86.1337-90 Engine dynamometer test run. April 11, 1989.
- 86.1337-2007 Engine dynamometer test run. January 18, 2001.
- 86.1338-84 Emission measurement accuracy. ~~November 16, 1983~~ September 5, 1997.
- 86.1338-2007 Emission measurement accuracy. January 18, 2001.
- 86.1339-90 Particulate filter handling and weighing. January 18, 2001.
- 86.1340-94 Exhaust sample analysis. June 30, 1995.
- 86.1341-98 Test cycle validation criteria. September 5, 1997.
- 86.1342-94 Calculations; exhaust emissions. September 5, 1997.

\* \* \* \* \*

Amend subparagraph (d) Meaning of symbols as follows:

\* \* \* \* \*

Delete subparagraph (d)(1)(ii)(D) and replace with: If gaseous fuels are being used, 18.64 g/ft<sup>3</sup> for natural gas and 17.28 g/ft<sup>3</sup> 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.~~

Amend subparagraph (d)(3)(v)(B) as follows:  $CO_e = [1 - (0.01 + 0.005HCR)CO_{2e} - 0.00323R]CO_{em}$  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.~~

Amend subparagraph (d)(8)(iii) as follows: For petroleum-fueled, gaseous-fueled, and methanol-fueled diesel engines:  $K_H = 1/[1-0.0026(H-75)]$  (or for SI units,  $= 1/[1-0.0182 (H-10.71)]$ ).

86.1343-88 Calculations; particulate exhaust emissions (including diesel gaseous-fuel, dual-fuel and multi-fuel engines). ~~April 11, 1989~~ September 5, 1997.

86.1344-94 Required information. October 21, 1997.

86.1360-2007 Supplemental steady-state test; test cycle and procedures.  
 October 6, 2000–January 18, 2001.

**A. Federal provisions**

1. Introductory paragraph. [No change.]
2. Amend subparagraph (a) as follows: Applicability. This section applies to 2005 and subsequent model year heavy duty diesel engines.
3. Amend subparagraph (b) as follows:
  - 3.1 Subparagraph (b)(1)
    - 3.1.1 (b)(1)(i). Test cycle. [No change.]

~~(1)(i) The following 13-mode cycle must be followed in dynamometer operation on the test engine:~~

Mode Number	Engine Speed	Percent Load	Weighting Factor	Mode Length (minutes)
1	Idle	--	0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

3.1.2. Add subparagraph (b)(1)(ii) as follows: For 2007 and subsequent model years, upon Executive Officer approval, the manufacturer may use mode lengths other than those listed in subparagraph (b)(1)(i) of this section.

3.2. Subparagraph (b)(2): [No change.] ~~In addition to the 13 test points identified in paragraph (b)(1) of this section, for engines not certified to a NOx emission standard or FEL less than 1.5 g/bhp-hr, ARB may~~



select, and require the manufacturer to conduct the test using, up to 3 additional test points within the control area (as defined in paragraph (d) of this section). ARB will notify the manufacturer of these supplemental test points in writing in a timely manner before the test. Emissions sampling for the additional test modes must include all regulated gaseous pollutants. Particulate matter does not need to be measured.

4. Subparagraph (c): [No change.] Determining engine speeds. (1) The engine speeds A, B, and C, referenced in the table in paragraph (b)(1) of this section, and speeds D and E, referenced in § 86.1370-2007 must be determined as follows:

$$\text{Speed A} = n_{le} + 0.25 \times (n_{hi} - n_{le})$$

$$\text{Speed B} = n_{le} + 0.50 \times (n_{hi} - n_{le})$$

$$\text{Speed C} = n_{le} + 0.75 \times (n_{hi} - n_{le})$$

$$\text{Speed D} = n_{hi}$$

$$\text{Speed E} = n_{le} + 0.15 \times (n_{hi} - n_{le})$$

Where:

$n_{hi}$  — = High speed as determined by calculating 70% of the maximum power. The highest engine speed where this power value occurs on the power curve is defined as  $n_{hi}$ .

$n_{le}$  — = Low speed as determined by calculating 50% of the maximum power. The lowest engine speed where this power value occurs on the power curve is defined as  $n_{le}$ .

Maximum Power — = the maximum observed power calculated according to the engine mapping procedures defined in § 86.1332-90.

5. Subparagraph (d) Determining the control area. [No change.] The control area extends from the engine speed A to C, as defined in paragraph (c) of this section, and extends from 25 to 100 percent load.

6. Subparagraph (e) Test requirements. [No change.] (1) Engine warm-up. Prior to beginning the test sequence, the engine must be warmed up according to the procedures in § 86.1332-90(d)(3)(i) through (iv).

(2) Test sequence. The test must be performed in the order of the mode numbers in paragraph (b)(1) of this section. Where applicable, the ARB-selected test points identified under paragraph (b)(2) of this section must be performed immediately upon completion of mode 13. The engine must be operated for the prescribed time in each mode, completing engine speed and load changes in the first 20 seconds of

each mode. The specified speed must be held to within plus or minus (+/-) 50 rpm and the specified torque must be held to within plus or minus two percent of the maximum torque at the test speed.

(3) Particulate sampling. One pair of filters (primary and back-up) shall be used for sampling PM over the 13-mode test procedure. The modal weighting factors specified in paragraph (b)(1) of this section shall be taken into account by taking a sample proportional to the exhaust mass flow during each individual mode of the cycle. This can be achieved by adjusting sample flow rate, sampling time, and/or dilution ratio, accordingly, so that the criterion for the effective weighting factors is met. The sampling time per mode must be at least 4 seconds per 0.01 weighting factor. Sampling must be conducted as late as possible within each mode. Particulate sampling shall be completed no earlier than 5 seconds before the end of each mode.

(4) The test must be conducted with all emission-related engine control variables in the highest brake-specific NOx emissions state which could be encountered for a 30 second or longer averaging period at the given test point and for the conditions under which the engine is being tested.

(5) Exhaust emissions measurements and calculations. Manufacturers must follow the exhaust emissions sample analysis procedures under § 86.1340-90, and the calculation formulas and procedures under § 86.1342-94, for the 13-mode cycle and the 3 ARB-selected test points as applicable for steady-state testing, including the NOx correction factor for humidity.

(6): Calculating the weighted average emissions. (i) For each regulated gaseous pollutant, the weighted average emissions must be calculated as follows:

$$A_{WA} = \frac{\sum_{i=1}^N [A_{M_i} \times WF_i]}{\sum_{i=2}^3 [A_{P_i} \times WF_i]}$$

Where:

$A_{WA}$  —= Weighted average emissions for each regulated gaseous pollutant, in grams per brake horsepower hour.

$A_M$  —= Modal average mass emissions level, in grams per hour. Mass emissions must be calculated as described in §86.1342-94.

$A_P$  —= Modal average power, in brake horse power. Any power measured

~~during the idle mode (mode 1) is not included in this calculation.~~

~~$W_i$  = Weighting factor corresponding to each mode of the steady-state test cycle, as defined in paragraph (b)(1) of this section.~~

~~$i$  = The modes of the steady-state test cycle, as defined in paragraph (b)(1) of this section.~~

~~$n$  = 13, corresponding to the 13 modes of the steady-state test cycle, as defined in paragraph (b)(1) of this section.~~

~~(ii) For PM measurements, a single filter must be used to measure PM over the 13 modes. The brake-specific PM emission level for the test must be calculated as described for a transient hot start test in §86.1343-88. Only the power measured during the sampling period shall be used in the calculation.~~

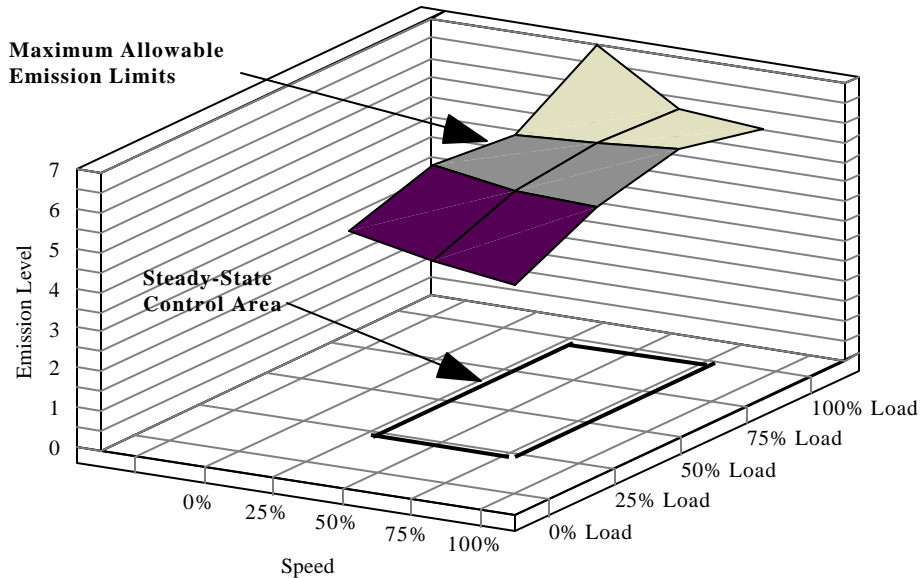
7. Amend subparagraph (f) as follows: Maximum allowable emission limits.

(1) For gaseous emissions, the 12 non-idle test point results and the four-point linear interpolation procedure specified in paragraph (g) of this section for intermediate conditions, shall define Maximum Allowable Emission Limits for purposes of paragraph B.1.(j) of this section except as modified under paragraph (f)(3) of this section. [No change to remainder of paragraph.] Each engine shall have its own Maximum Allowable Emission Limits generated from the 12 non-idle supplemental steady state test points from that engine. The control area extends from the 25% to the 75% engine speeds, at engine loads of 25% to 100%, as defined in paragraph (d) of this section. Figure 1 of this paragraph (f)(1) depicts a sample Maximum Allowable Emission Limit curve, for illustration purposes only, as follows:

**Figure 1**

## Maximum Allowable Emission Limits

Sample - For Illustration Only



(2) If the weighted average emissions, calculated according to paragraph (e)(6) of this section, for any gaseous pollutant is equal to or lower than required by paragraph B.1 (j) of this section, each of the 13 test values for that pollutant shall first be multiplied by the ratio of the applicable emission standard (under paragraph B.1 (j) of this section) to the weighted average emissions value, and then by 1.10 for interpolation allowance, before determining the Maximum Allowable Emission Limits under paragraph (g)(2) of this section.

(3) [No change.] If the Maximum Allowable Emission Limit for any point, as calculated under paragraphs (f)(1) and (2) of this section, is greater than the applicable Not-to-Exceed limit (if within the Not-to-Exceed control area defined in § 86.1370-2007(b)), then the Maximum Allowable Emission Limit for that point shall be defined as the applicable Not-to-Exceed limit.

8. Subparagraph (g) Calculating intermediate test points. [No change.] Calculating intermediate test points. (1) For the three test points selected by ARB under paragraph (b)(2) of this section, the emissions must be measured and calculated as described in paragraph (e)(6)(i) of this section (except that  $n = 1$  and  $WF = 1$ ). The measured values then must be compared to the interpolated values according to paragraph (g)(3) of this

section. The interpolated values are determined from the modes of the test cycle closest to the respective test point according to paragraph (g)(2) of this section.

(2) Interpolating emission values from the test cycle. The gaseous emissions for each regulated pollutant for each of the control points (Z) must be interpolated from the four closest modes of the test cycle that envelop the selected control point Z as shown in Figure 2 of this paragraph (g)(2).

(i) For these modes (R, S, T, U), the following definitions apply:

Speed (R) = Speed(T) =  $n_{RT}$

Speed (S) = Speed(U) =  $n_{SU}$

Percent load (R) = Percent load (S)

Percent load (T) = Percent load (U)

(ii) The interpolated value of the brake specific gaseous emissions of the selected control point Z (EZ) must be calculated as follows:

$$E_Z = E_{RS} + (E_{TU} - E_{RS}) * (M_Z - M_{RS}) / (M_{TU} - M_{RS})$$

$$E_{TU} = E_T + (E_U - E_T) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$$

$$E_{RS} = E_R + (E_S - E_R) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$$

$$M_{TU} = M_T + (M_U - M_T) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$$

$$M_{RS} = M_R + (M_S - M_R) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$$

Where:

$E_R, E_S, E_T, E_U$  — = for each regulated pollutant, brake specific gaseous emissions of the enveloping modes adjusted according to the factors in (f)(2).

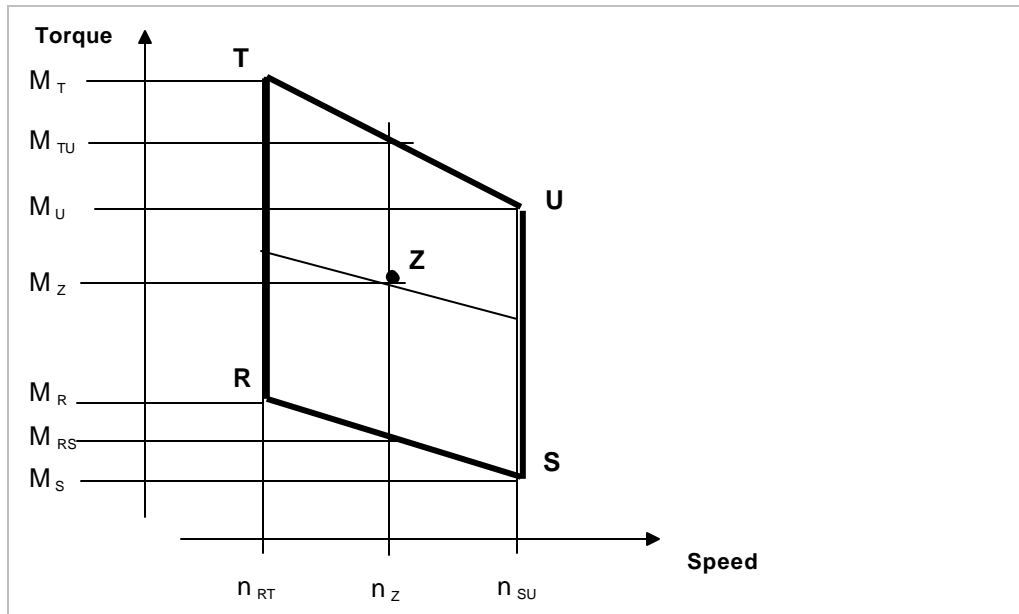
$M_R, M_S, M_T, M_U$  — = engine torque of the enveloping modes.

$M_Z$  — = engine torque of the selected control point Z.

$n_Z$  — = engine speed of the selected control point Z.

(iii) Figure 2 follows:

**Figure 2  
Four-Point Linear Interpolation**



~~(3) Comparing calculated and interpolated emission values. The measured brake specific gaseous emissions of the control point Z ( $X_z$ ) must be less than or equal to the interpolated value ( $E_z$ ).~~

9. Subparagraph (h): Test fuel specifications. [No change.]~~The test fuel used for supplemental steady-state testing under this section must meet the requirements of § 86.1313-90.~~
10. Subparagraph (i) General requirements: [No change.]~~General requirements. Ambient conditions, charge cooling specifications, and intake and exhaust restrictions for supplemental steady-state testing and maximum allowable emission limit testing under this section must meet the requirements of § 86.1330-90.~~

**B. California provisions**

1. ~~(j)~~ **Emission testing caps for the 2005 and subsequent model years.**

- 1.1 ~~(4)~~ The weighted average exhaust emissions, as determined under paragraph (e)(5) and (6) of this section pertaining to the supplemental steady-state test cycle, for each regulated pollutant shall not exceed 1.0 times the applicable emission standards specified in California

Code of Regulations, title 13, §1956.8 (a)(2) or §1956.8(h)(2), Part I.11 of these test procedures or FELs specified in §86.007-11(a)(1).

- 1.2 ~~(2)~~ For engines not having a NOx FEL less than 1.5 g/bhp-hr, gaseous exhaust emissions shall not exceed the steady-state interpolated values determined by the Maximum Allowable Emission Limits (for the corresponding speed and load), as determined under ~~subdivision~~ subparagraph (g) of this section, when the engine is operated in the steady-state control area defined under ~~subdivision~~ subparagraph (d) of this section, during steady-state engine operation.
  - 1.3 ~~(3)~~ For engines with a NOx FEL less than 1.5 g/bhp-hr, the Maximum Allowable Emission Limit requirements, as determined under Sec. 86.1360-2007(f), do not apply.
  - 1.4 ~~(4)~~ The emission caps specified in this section shall be rounded to the same number of significant figures as the applicable standards in ~~California Code of Regulations Title 13, §1956.8(a)(2) or §1956.8(h)(2)~~ Part I.11 of these test procedures using ASTM E29-93a.
2. ~~(k)~~ **In-Use Compliance** for 2005 and subsequent model year engines. The procedures for in-use voluntary and influenced recall for heavy-duty diesel engines under this section are described in ~~California Code of Regulations, title 13, CCR sections §§2111 through 2140~~, except as modified by this paragraph for 2005 and 2006 model year engines. In evaluating the scope of the affected population for the purposes of this section, there shall be a rebuttable presumption that the affected population is the engine family to which the tested engines belong. No engine may be used to establish the existence of an emissions exceedance if the engine or vehicle in which it was installed was subject to abuse or improper maintenance or operation, or if the engine was improperly installed, and such acts or omissions caused the exceedance.
- 2.1 ~~(4)~~ For the purposes of this section, an exceedance of the emission testing caps occurs when the average emissions of the test vehicles or engines, pursuant to ~~California Code of Regulations, title 13, Section CCR §2139~~, for any pollutant exceed the emission threshold. For the purposes of this section, emission threshold is defined as:

(i) for a test using vehicle test equipment (e.g., an over-the-road mobile monitoring device such as "ROVER", or a chassis dynamometer), the applicable maximum NOx emissions limit plus the greater of 0.5 g/bhp-hr or one standard deviation of the data set established pursuant to paragraph ~~(k)(2)~~ B.2.2 of this section; or

(ii) for a test using an engine dynamometer, the applicable maximum NOx emissions limit plus 0.5 g/bhp-hr.

2.2 ~~(2)~~ Where an engine dynamometer or vehicle test shows an apparent exceedance of the emissions threshold, the party conducting the original test shall repeat such test under the same conditions at least nine times. The mean of the tests shall be used for the averaging of the test vehicle emissions in determining compliance.

2.3 ~~(3)~~ If the average emissions of the test vehicles exceed the emissions threshold, the Executive Officer shall notify the manufacturer in writing of the test results. The manufacturer has the option to submit an influenced recall plan in accordance with ~~California Code of Regulations~~, title 13, ~~CCR §§ sections~~ 2113 through 2121 within 45 days or to proceed with performing the engineering analysis and/or conducting further testing in accordance with paragraphs ~~(k)(4)~~ B.2.4 and/or ~~(k)(5)~~ B.2.5 of this section. Upon the completion of testing conducted in paragraph(s) B.2.4 ~~(k)(4)~~ and/or ~~(k)(5)~~, B.2.5 if the test results indicate that the average emissions of the test vehicles exceeds the emissions threshold, the Executive Officer shall notify the manufacturer in writing of the test results and upon receipt of the notification, the manufacturer shall have 45 days to submit an influenced recall plan in accordance with ~~California Code of Regulations~~, title 13, ~~CCR §§ sections~~ 2113 through 2121.

2.4 ~~(4)~~ If the testing conducted under paragraph B.2.1 ~~(k)(1)~~ and ~~California Code of Regulations~~, title 13, ~~CCR § section~~ 2139 was performed using vehicle test equipment, then the engine manufacturer may elect to conduct additional tests of that engine using an engine dynamometer, provided that all environmental and engine operating conditions present during vehicle testing under paragraph B.2.1 ~~(k)(1)~~ and ~~California Code of Regulations~~ title 13, ~~CCR § section~~ 2139 can be reproduced or corrected consistent with paragraph B.2.6 ~~(k)(6)~~ of this section. If the engine manufacturer elects to conduct such additional engine dynamometer tests, it shall provide ARB with at



least three business days notice prior to commencement of such testing. If based on such additional tests the engine exceeds the emission threshold, the engine manufacturer may conduct further testing in accordance with paragraph B.2.5 ~~(k)(5)~~ of this section and/or perform an engineering analysis to determine the percentage of the affected population that exceeds the emissions threshold and the emission levels of the exceeding engines. However, the manufacturer may not determine the percentage of the affected population or the emission levels solely on the basis of an engineering analysis unless it demonstrates to the Executive Officer's satisfaction that such analysis alone is sufficient under the circumstances.

2.5 ~~(5)~~ Within 60 days of receiving notice of an exceedance under paragraph B.2.3 ~~(k)(3)~~ of this section, the manufacturer may commence testing of not less than ten additional in-service engines. The manufacturer may conduct these tests using vehicle testing equipment, or using an engine dynamometer, at the manufacturer's option.

2.6 ~~(6)~~ The testing of additional engines under paragraphs B.2.4 ~~(k)(4)~~ and B.2.5 ~~(k)(5)~~ of this section shall be conducted under conditions that are no less stringent than the initial test in terms of those parameters that may affect the result, and, at the manufacturer's option, may be limited to those emission limits and conditions for which apparent exceedances have been identified. Such parameters typically, but not necessarily, include relevant ambient conditions, operating conditions, service history, and age of the vehicle. Prior to conducting any testing, the manufacturer shall submit a test plan to ARB for its review and approval. Within 30 days following ARB's proposed modifications, the manufacturer shall incorporate the proposed modifications and implement the test plan as approved. Special conditioning of test engines shall not be permitted. Where the manufacturer elects to conduct the additional testing utilizing an engine dynamometer, it shall reproduce relevant engine operating and environmental conditions associated with the initial exceedance, provided, however, that correction factors may be used to reproduce temperature, humidity or altitude conditions that cannot be simulated in the laboratory. Regardless of the testing equipment utilized, the test results shall be adjusted to reflect documented test systems error and/or variability in accordance with good engineering practices.

### 3. ~~(f)~~ Exemptions.

- 3.1 (1) The requirements set forth in this section do not apply to “ultra-small volume manufacturers” for model years 2005 and 2006. For the purposes of this section, an “ultra-small volume manufacturer” means any manufacturer with California sales less than or equal to 300 new passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, and heavy-duty engines per model year based on the average number of vehicles and engines sold by the manufacturer in the previous three consecutive model years.
- 3.2 (2) The requirements set forth in this section do not apply to “urban buses”, as defined in title 13, ~~California Code of Regulations~~, CCR Section §1956.2, for model years 2005 and 2006.

**A. Federal provisions.**

1. Amend subparagraph (a) as follows: General. The purpose of this test procedure is to measure in-use emissions of 2005 and subsequent model year heavy-duty diesel engines while operating within a broad range of speed and load points (the Not-To-Exceed Control Area) and under conditions which can reasonably be expected to be encountered in normal vehicle operation and use. Emission results from this test procedure are to be compared to the Not-To-Exceed Limits specified in paragraph (d)(1) of this section. The Not-To-Exceed Limits specified in paragraph (d)(1) of this section do not apply for engine starting conditions specified in ~~subdivision (k)~~ subparagraph A.1.7 of this section.

2. Amend subparagraph (b) as follows:

2.1 Introductory paragraph, subparagraphs (b)(1) through (b)(4): [No change.]: ~~Not-to-exceed control area for heavy-duty diesel engines. The Not-To-Exceed Control Area for heavy-duty diesel engines consists of the following engine speed and load points:~~

~~(1) All operating speeds greater than the speed calculated using the following formula, where  $n_{hi}$  and  $n_{lo}$  are determined according to the provisions in § 86.1360-2007(c):~~

$$n_{lo} + 0.15 \times (n_{hi} - n_{lo})$$

~~(2) All engine load points greater than or equal to 30% or more of the maximum torque value produced by the engine.~~

~~(3) Notwithstanding the provisions of paragraphs (b)(1) and (b)(2) of this section, all operating speed and load points with brake specific fuel consumption (BSFC) values within 5% of the minimum BSFC value of the engine. For the purposes of this requirement, BSFC must be calculated under the general test cell conditions specified in § 86.1330-90. The manufacturer may petition the Executive Officer at certification to exclude such points if the manufacturer can demonstrate that the engine is not expected to operate at such points in normal vehicle operation and use. Engines equipped with drivelines with multi-speed manual transmissions or automatic transmissions with a finite number of gears are not subject to the requirements of this paragraph (b)(3).~~

~~(4) Notwithstanding the provisions of paragraphs (b)(1) through (b)(3) of this section, speed and load points below 30% of the maximum power value produced by the~~

engine shall be excluded from the Not-To-Exceed Control Area for all emissions.

2.2 Amend subparagraph (b)(5) as follows: For particulate matter only from 2005 and 2006 model year engines, speed and load points determined by one of the following methods, whichever is applicable, shall be excluded from the Not-To-Exceed Control Area. B and C engine speeds shall be determined according to the provisions of § 86.1360-2007(c): [No change to remainder of paragraph.] ~~(i) If the C speed is below 2400 rpm, the speed and load points to the right of or below the line formed by connecting the following two points:~~

~~(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;~~

~~(B) 70% of maximum power at 100% speed ( $n_{hi}$ );~~

~~(ii) If the C speed is above 2400 rpm, the speed and load points to the right of the line formed by connecting the two points in item (b)(5)(ii)(A) and (B) of this section and below the line formed by connecting the two points in item (b)(5)(ii)(B) and (C) of this section:~~

~~(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;~~

~~(B) 50% of maximum power at 2400 rpm;~~

~~(C) 70% of maximum power at 100% speed ( $n_{hi}$ ).~~

2.3 Amend subparagraphs (b)(6) and (b)(7) as follows: [No change except that these requirements apply for 2007 and subsequent model year engines.]

~~(6)(i) For 2007 and subsequent model year petroleum-fueled diesel cycle engines, a manufacturer may identify particular engine-vehicle combinations and may petition the Executive Officer at certification to exclude operating points from the Not-to-Exceed Control Area defined in Sec. 86.1370-2007(b)(1) through (4) if the manufacturer can demonstrate that the engine is not capable of operating at such points when used in the specified engine-vehicle combination(s).~~

~~(ii) For 2007 and subsequent model year diesel cycle engines that are not petroleum-fueled, a manufacturer may petition the Executive Officer at certification to exclude operating points from the Not-to-Exceed Control Area~~

defined in Sec. 86.1370-2007(b)(1) through (4) if the manufacturer can demonstrate that the engine is not expected to operate at such points in normal vehicle operation and use.

~~(7) For 2007 and subsequent model year petroleum-fueled diesel cycle engines, a manufacturer may petition the Executive Officer to limit NTE testing in a single defined region of speeds and loads. Such a defined region must generally be of elliptical or rectangular shape, and must share some portion of its boundary with the outside limits of the NTE zone. Under this provision testing would not be allowed with sampling periods in which operation within that region constitutes more than 5.0 percent of the time-weighted operation within the sampling period. Approval of this limit by the Executive Officer is contingent on the manufacturer satisfactorily demonstrating that operation at the speeds and loads within that region accounts for less than 5.0 percent of all in-use operation (weighted by vehicle-miles-traveled or other ARB-approved weightings) for the in-use engines of that configuration (or sufficiently similar engines). At a minimum, this demonstration must include operational data from representative in-use vehicles.~~

3. Subparagraph (c) [No change Reserved]

4. Amend subparagraph (d) as follows: Not-to-exceed control area caps.

4.1 Amend subparagraph (d)(1) as follows: (i) The emission caps specified in this section shall be rounded to the same number of significant figures as the applicable standards in ~~California Code of Regulations, Title 13, §1956.8 (a)~~ Part I.11 of these test procedures using ASTM E29-93a.

(ii) For 2005 and 2006 model year engines, when operated within the Not-To-Exceed Control Area defined in ~~paragraph subdivision (b) of this section~~, diesel engine brake-specific exhaust emissions in grams/bhp-hr (as determined under ~~paragraphs subdivisions (b) and (c) of this section~~), for each regulated pollutant, shall not exceed 1.25 times the applicable emission standards specified in ~~California Code of Regulations, Title 13, §1956.8 (a)(12) and (h)(2)~~ Part I.11 of these test procedures during engine and vehicle operation specified in ~~paragraph (e)(1) of this section~~, except as noted in ~~paragraph (e)(2) of this section~~, when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by ~~paragraph (d)(2) of this section~~.

(iii) For 2007 and subsequent model year engines having a NO<sub>x</sub> FEL less than 1.50 g/bhp-hr, the brake-specific exhaust NMHC or NO<sub>x</sub> emissions in g/bhp-hr, as determined under Sec. 86.1370-2007

pertaining to the NTE test procedures, shall not exceed 1.5 times the applicable NMHC or NOx emission standards or FELs specified in Part I.11 of these test procedures California Code of Regulations, title 13, CCR §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in subdivisions (b), (e), (f), and ~~(g)~~ B.1 of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

(iv) For 2007 and subsequent model year engines not having a NOx FEL less than 1.50 g/bhp-hr, the brake-specific NOx and NMHC exhaust emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.25 times the applicable emission standards or FELs specified in Part I.11 of these test procedures California Code of Regulations, title 13, CCR §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in paragraphs (b), (e), (f), and (g) of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

(v) For 2007 and subsequent model year engines, the brake-specific exhaust PM emissions in g/bhp-hr, as determined under Sec. 86.1370-2007 pertaining to the not-to-exceed test procedures, shall not exceed 1.5 times the applicable PM emission standards or FEL (for FELs above the standard only) specified in Part I.11 of these test procedures California Code of Regulations, title 13, CCR §1956.8 (a)(2) and (h)(2), during engine and vehicle operation specified in paragraphs (b), (e), (f), and ~~(g)~~ B.1 of this section when averaged over any period of time greater than or equal to 30 seconds, except where a longer averaging period is required by paragraph (d)(2) of this section.

- 4.2 Subparagraph (d)(2) [No change.] ~~For engines equipped with emission controls that include discrete regeneration events, if a regeneration event occurs during the NTE test, then the averaging period must be at least as long as the time between the events multiplied by the number of full regeneration events within the sampling period. The requirement in this paragraph (d)(2) only applies for engines that send an electronic signal indicating the start of the regeneration event~~

- 4.3 Add the following subparagraph (d)(3): For 2005 and subsequent model year heavy-duty engines, operation within the Not-to-Exceed control area (defined in paragraph (b) of this section) must also comply with the following:
- (i) A filter smoke number of 1.0 under steady-state operation, or the following alternate opacity limits:
    - (A) A 30 second transient test average opacity limit of 4% for a 5 inch path; and
    - (B) A 10 second steady state test average opacity limit of 4% for a 5 inch path.
  - (ii) The limits set forth in paragraph (d)(3)(i) of this section refer to exhaust smoke emissions generated under the conditions set forth in paragraphs (b) and (e) of this section and calculated in accordance with the procedures set forth in §86.1372-2007.
5. Amend subparagraph (e) as follows: Ambient corrections.
- 5.1 Introductory paragraph: [No change.] ~~The measured data shall be corrected based on the ambient conditions under which it was taken, as specified in this section.~~
- 5.2 Subparagraph (e)(1) For engines operating within the ambient conditions specified in paragraph B.1.1 ~~(g)(1)~~ of this section. [No change to remainder of paragraph.]
- ~~(i) NO<sub>x</sub> emissions shall be corrected for ambient air humidity to a standard humidity level of 50 grains (7.14 g/kg) if the humidity of the intake air was below 50 grains, or to 75 grains (10.71 g/kg) if above 75 grains.~~
  - ~~(ii) NO<sub>x</sub> and PM emissions shall be corrected for ambient air temperature to a temperature of 55 degrees F (12.8 degrees C) for ambient air temperatures below 55 degrees F or to 95 degrees F (35.0 degrees C) if the ambient air temperature is above 95 degrees F.~~
  - ~~(iii) No ambient air temperature or humidity correction factors shall be used within the ranges of 50-75 grains or 55-95 degrees F.~~
  - ~~(iv) Where test conditions require such correction factors, the manufacturer must use good engineering judgement and generally accepted engineering practice to determine the appropriate correction factors, subject to ARB review.~~
- 5.3 Amend subparagraph (e)(2) as follows: For engines operating within

the ambient conditions specified in paragraph B.1.2 (g)(2) of this section; [No change to remainder of section.]

~~(i) NOx emissions shall be corrected for ambient air humidity to a standard humidity level of 50 grains (7.14 g/kg) if the humidity of the intake air was below 50 grains, or to 75 grains (10.71 g/kg) if above 75 grains.~~

~~(ii) NOx and PM emissions shall be corrected for ambient air temperature to a temperature of 55 degrees F (12.8 degrees C) for ambient air temperatures below 55 degrees F.~~

~~(iii) No ambient air temperature or humidity correction factors shall be used within the ranges of 50-75 grains or for temperatures greater than or equal to 55 degrees F.~~

~~(iv) Where test conditions require such correction factors, the manufacturer must use good engineering judgement and generally accepted engineering practice to determine the appropriate correction factors, subject to ARB review.~~

6. Amend subparagraph (f) as follows: NTE cold temperature operating exclusion. 2007 and subsequent model year engines equipped with exhaust gas recirculation (EGR) whose operation within the NTE control area specified in §86.1370(b) when operating during cold temperature conditions as specified in paragraph (f)(1) of this section are not subject to the NTE emission limits during the specified cold temperature operation conditions. [No change to remainder of section.]

~~(1) Cold temperature operation is defined as engine operating conditions meeting either of the following two criteria:~~

~~(i) Intake manifold temperature (IMT) less than or equal to the temperature defined by the following relationship between IMT and absolute intake manifold pressure (IMP) for the corresponding IMP.~~

$$P = 0.0875 \times \text{IMT} - 7.75 \text{ Equation (1)}$$

Where;

P = absolute intake manifold pressure in bars

IMT = intake manifold temperature in degrees Fahrenheit

~~(ii) Engine coolant temperature (ECT) less than or equal to the temperature defined by the following relationship between ECT and absolute intake manifold pressure (IMP) for the corresponding IMP.~~



$$P = 0.0778 \times ECT - 9.8889 \text{ Equation (2)}$$

Where;

P = absolute intake manifold pressure in bars

ECT = engine coolant temperature in degrees Fahrenheit

~~(2)~~ [Reserved]

7. Subparagraph (g). NOx and NMHC aftertreatment warm-up. [No change.]

**B. California provisions.**

1. ~~(g)~~ Ambient operating regions. For each engine family, the not-to-exceed emission limits must apply during one of the following two ambient operating regions;
  - 1.1 ~~(1)~~ The not-to-exceed emission limits apply for all altitudes less than or equal to 5,500 feet above sea-level, during all ambient conditions (temperature and humidity). Temperature and humidity ranges for which correction factors are allowed are specified in paragraph (e) of this section; or
  - 1.2 ~~(2)~~ The not-to-exceed emission limits apply at all altitudes less than or equal to 5,500 feet above sea-level, for temperatures less than or equal to the temperature determined by the following equation at the specified altitude;

$$T = -0.00254 \times A + 100$$

Where:

T = ambient air temperature in degrees Fahrenheit

A = altitude in feet above sea-level (A is negative for altitudes below sea-level)

Temperature and humidity ranges for which correction factors are allowed are specified in section (e).

2. ~~(h)~~ In-Use Compliance. The procedures for in-use voluntary and influenced recall for heavy-duty diesel engines under this section are described in ~~California Code of Regulations, title 13, CCR §§ sections 2111 through 2140~~, except as modified by this paragraph for 2005 and 2006 model year engines. In evaluating the scope of the affected population for the purposes of this section, there shall be a rebuttable presumption that the affected population is the engine family to which the tested engines belong. No engine may be used to establish the existence of an emissions exceedance if the engine or vehicle in which it was installed was subject to abuse or

improper maintenance or operation, or if the engine was improperly installed, and such acts or omissions caused the exceedance.

- 2.1 ~~(4)~~ For the purposes of this section, an exceedance of the emission testing caps occurs when the average emissions of the test vehicles or engines, pursuant to ~~California Code of Regulations~~, title 13, ~~CCR § section~~ 2139, for any pollutant exceed the emission threshold. For the purposes of this section, emission threshold is defined as:
- (i) for a test using vehicle test equipment (e.g., an over-the-road mobile monitoring device such as “ROVER”, or a chassis dynamometer), the applicable maximum NOx emissions limit plus the greater of 0.5 g/bhp-hr or one standard deviation of the data set established pursuant to paragraph ~~B.2(h)(2)~~ of this section; or
  - (ii) for a test using an engine dynamometer, the applicable maximum NOx emissions limit plus 0.5 g/bph-hr.
- 2.2 ~~(2)~~ Where an engine dynamometer or vehicle test shows an apparent exceedance of the emissions threshold, the party conducting the original test shall repeat such test under the same conditions at least nine times. The mean of the tests shall be used for the averaging of the test vehicle emissions in determining compliance.
- 2.3 ~~(3)~~ If the average emissions of the test vehicles exceed the emissions threshold, the Executive Officer shall notify the manufacturer in writing of the test results. The manufacturer has the option to submit an influenced recall plan in accordance with ~~California Code of Regulations~~, title 13, ~~CCR §§ sections~~ 2113 through 2121 within 45 days or to proceed with performing the engineering analysis and/or conducting further testing in accordance with paragraphs ~~B.2.4(h)(4)~~ and/or ~~B.2.5(h)(5)~~ of this section. Upon the completion of testing conducted in paragraph(s) ~~B.2.2(h)(4)~~ and/or ~~B.2.5(h)(5)~~, if the test results indicate that the average emissions of the test vehicles exceeds the emissions threshold, the Executive Officer shall notify the manufacturer in writing of the test results and upon receipt of the notification, the manufacturer shall have 45 days to submit an influenced recall plan in accordance with ~~California Code of Regulations~~, title 13, ~~CCR §§ sections~~ 2113 through 2121.
- 2.4 ~~(4)~~ If the testing conducted under paragraph ~~B.2.1(h)(1)~~ and ~~California Code of Regulations~~, title 13, ~~CCR § section~~ 2139 was performed using vehicle test equipment, then the engine manufacturer may elect to conduct additional tests of that engine using an engine dynamometer, provided that all environmental and engine operating conditions present during vehicle testing under paragraph ~~B.2.1(h)(1)~~ and ~~California Code of Regulations~~, title 13, ~~CCR § section~~ 2139 can

be reproduced or corrected consistent with paragraph ~~B.2.6(h)(6)~~ of this section. If the engine manufacturer elects to conduct such additional engine dynamometer tests, it shall provide ARB with at least three business days notice prior to commencement of such testing. If based on such additional tests the engine exceeds the emission threshold, the engine manufacturer may conduct further testing in accordance with paragraph ~~B.2.2(h)(5)~~ of this section and/or perform an engineering analysis to determine the percentage of the affected population that exceeds the emissions threshold and the emission levels of the exceeding engines. However, the manufacturer may not determine the percentage of the affected population or the emission levels solely on the basis of an engineering analysis unless it demonstrates to the Executive Officer's satisfaction that such analysis alone is sufficient under the circumstances.

2.5 ~~(5)~~ Within 60 days of receiving notice of an exceedance under paragraph ~~B.2.3(h)(2)~~ of this section, the manufacturer may commence testing of not less than ten additional in-service engines. The manufacturer may conduct these tests using vehicle testing equipment, or using an engine dynamometer, at the manufacturer's option.

2.6 ~~(6)~~ The testing of additional engines under paragraphs ~~B.2.4(h)(4)~~ and ~~B.2.5(h)(5)~~ of this section shall be conducted under conditions that are no less stringent than the initial test in terms of those parameters that may affect the result, and, at the manufacturer's option, may be limited to those emission limits and conditions for which apparent exceedances have been identified. Such parameters typically, but not necessarily, include relevant ambient conditions, operating conditions, service history, and age of the vehicle. Prior to conducting any testing, the manufacturer shall submit a test plan to ARB for its review and approval. Within 30 days following ARB's proposed modifications, if any, the manufacturer shall incorporate the proposed modifications and implement the test plan as approved. Special conditioning of test engines shall not be permitted. Where the manufacturer elects to conduct the additional testing utilizing an engine dynamometer, it shall reproduce relevant engine operating and environmental conditions associated with the initial exceedance, provided, however, that correction factors may be used to reproduce temperature, humidity or altitude conditions that cannot be simulated in the laboratory. Regardless of the testing equipment utilized, the test results shall be adjusted to reflect documented test systems error and/or variability in accordance with good engineering practices.

### 3. ~~(f)~~ Deficiencies for NTE requirements.

- 3.1 ~~(4)~~For model years 2005 through 2009, upon application by the manufacturer, the Executive Officer may accept a HDDE as compliant with the NTE requirements even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: technical feasibility of the given hardware and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Deficiencies will be approved on a engine model and/or horsepower rating basis within an engine family, and each approval is applicable for a single model year. A manufacturer's application must include a description of the auxiliary emission control device(s) which will be used to maintain emissions to the lowest practical level, considering the deficiency being requested, if applicable. An application for a deficiency must be made during the certification process; no deficiency will be granted to retroactively cover engines already certified.
- 3.2 ~~(2)~~Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Executive Officer. The NTE deficiency should only be seen as an allowance for minor deviations from the NTE requirements. The NTE deficiency provisions allow a manufacturer to apply for relief from the NTE emission requirements under limited conditions. ARB expects that manufacturers should have the necessary functioning emission control hardware in place to comply with the NTE.
- 3.3 ~~(3)~~For model years 2010 through 2013, the Executive Officer may allow up to three deficiencies per engine family. The provisions of §86.007-11 (a)(4)(iv)(A) and §86.007-11 (B) apply for deficiencies allowed by §86.007-11 (a)(4)(iv)(C). In determining whether to allow the additional deficiencies, the Executive Officer may consider any relevant factors, including the factors identified in §86.007-11 (a)(4)(iv)(A). If additional deficiencies are approved, the Executive Officer may set any additional conditions that he/she determines to be appropriate.
4. ~~(j)~~Exemptions.
- 4.1 ~~(4)~~The requirements set forth in this section do not apply to "ultra-small volume manufacturers" for model years 2005 and 2006. For the

purposes of this section, an “ultra-small volume manufacturer” means any manufacturer with California sales less than or equal to 300 new passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, and heavy-duty engines per model year based on the average number of vehicles and engines sold by the manufacturer in the previous three consecutive model years.

- 4.2 (2) The requirements set forth in this section do not apply to “urban buses”, as defined in title 13, CCR, §Section 1956.2, for model years 2005 and 2006.

~~(k) NO<sub>x</sub> and NMHC aftertreatment warm-up. For 2007 and subsequent engines equipped with one or more aftertreatment devices that reduce NO<sub>x</sub> or NMHC emissions, the NTE NO<sub>x</sub> and NMHC emission caps do not apply when the exhaust gas temperature is measured within 12 inches of the outlet of the aftertreatment device and is less than 250 deg.C. For multi-bed systems, it is the temperature at the outlet of the device with the maximum flow rate that determines whether the NTE caps apply.~~

This section contains the measurement techniques to be used for determining compliance with the filter smoke limit or opacity limits in §86.1370-2007 (d)(3)(i).

[No change to remainder of section.]

~~(a) For steady-state or transient smoke testing using full-flow opacimeters, equipment meeting the requirements of subpart I of this part or ISO/DIS-11614 "Reciprocating internal combustion compression ignition engines—Apparatus for measurement of the opacity and for determination of the light absorption coefficient of exhaust gas" is required. This document is incorporated by reference.~~

~~(1) All full-flow opacimeter measurements shall be reported as the equivalent percent opacity for a five inch effective optical path length using the Beer-Lambert relationship.~~

~~(2) Zero and full-scale (100 percent opacity) span shall be adjusted prior to testing.~~

~~(3) Post test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than two percent of full-scale.~~

~~(4) Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.~~

~~(b) For steady-state testing using a filter-type smokemeter, equipment meeting the requirements of ISO/FDIS-10054 "Internal combustion compression ignition engines—Measurement apparatus for smoke from engines operating under steady-state conditions—Filter-type smokemeter" is recommended. Other equipment may be used provided it is approved in advance by the Executive Officer.~~

~~(1) All filter-type smokemeter results shall be reported as a filter smoke number (FSN) that is similar to the Bosch smoke number (BSN) scale.~~

~~(2) Filter-type smokemeters shall be calibrated every 90 days using manufacturer's recommended practices or good engineering practice.~~

~~(c) For steady-state testing using a partial-flow opacimeter, equipment meeting the requirements of ISO-8178-3 and ISO/DIS-11614 is recommended. Other equipment may be used provided it is approved in advance by the Executive Officer.~~

~~(1) All partial-flow opacimeter measurements shall be reported as the equivalent~~

percent opacity for a five inch effective optical path length using the Beer-Lambert relationship.

~~(2) Zero and full scale (100 percent opacity) span shall be adjusted prior to testing.~~

~~(3) Post-test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than two percent of full scale.~~

~~(4) Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.~~

~~(d) Replicate smoke tests may be run to improve confidence in a single test or stabilization. If replicate tests are run, three additional tests which conform to this section shall be run, and the final reported test results must be the average of all the valid tests.~~

~~(e) A minimum of thirty seconds sampling time shall be used for average transient smoke measurements. The opacity values used for this averaging must be collected at a minimum rate of 1 data point per second, and all data points used in the averaging must be equally spaced in time.~~

86.1380-2004 Load response test. October 6, 2000. Amend as follows: [Delete all subparagraphs except subparagraphs (c)(i) through (c)(iv).]

## **Appendix I - Urban Dynamometer Schedules.**

(f)(2)EPA Engine Dynamometer Schedule for Heavy-Duty Diesel Engines.  
December 10, 1984.