State of California
AIR RESOURCES BOARD

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

Adopted: December 12, 2002
Amended: September 1, 2006

NOTE: The proposed amendments are indicated by underline for additions and ~~strikeout~~ for deletions compared to the adopted test procedures. Only those portions of the existing language containing the proposed modifications are included. All other portions remain unchanged and are indicated by the symbol "* * * * *" for reference. A complete set of the adopted test procedures (without the proposed amendments) is available at http://www.arb.ca.gov/regact/levhdg02/levhdg02.htm .

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]

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11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

A. Federal provisions.

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B. California provisions.

1. **Urban Bus Standards**.

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6. **Heavy-Duty Diesel Engine Idling Requirements.**

6.1 **Engine Shutdown System**. The requirements in this subsection apply to engine manufacturers and original equipment manufacturers, as applicable, that are responsible for the design and control of engine and/or vehicle idle controls.

6.1.1 **Requirements**. Except as provided in subsections 11.B.6.2 and 3, all new 2008 and subsequent model-year heavy-duty diesel

engines shall be equipped with an engine shutdown system that automatically shuts down the engine after 300 seconds of continuous idling operation once the vehicle is stopped, the transmission is set to "neutral" or "park", and the parking brake is engaged. If the parking brake is not engaged, then the engine shutdown system shall shut down the engine after 900 seconds of continuous idling operation once the vehicle is stopped and the transmission is set to "neutral" or "park." The engine shutdown system must be tamper-resistant and non-programmable. A warning signal, such as a light or sound indicator inside the vehicle cabin, may be used to alert the driver 30 seconds prior to engine shutdown. The engine shutdown system must be capable of allowing the driver to reset the engine shutdown system timer by momentarily changing the position of the accelerator, brake, or clutch pedal, or other mechanism within 30 seconds prior to engine shutdown. Once reset, the engine shutdown system shall restart the engine shutdown sequence described in this paragraph above, and shall continue to do so until the engine shuts down or the vehicle is driven.

6.1.2 **Engine Shutdown System Override**. The engine shutdown system may be overridden, to allow the engine to run continuously at idle, only under the following conditions:

(1) If the engine is operating in power take-off (PTO) mode. The PTO system shall have a switch or a setting that can be switched "on" to override the engine shutdown system and will reset to the "off" position when the vehicle's engine is turned off or when the PTO equipment is turned off. Subject to advance Executive Officer approval, other methods for detecting or activating PTO operation may be allowed; or,

(2) if the vehicle's engine coolant temperature is below 60°F. The engine shutdown system shall automatically be activated once the coolant temperature reaches 60°F or above. The engine coolant temperature shall be measured with the engine's existing engine coolant temperature sensor used for engine protection, if so equipped. Other methods of measuring engine coolant temperature may be allowed, subject to advance Executive Officer approval.

(3) if an exhaust emission control device is regenerating, and keeping the engine running is necessary to prevent aftertreatment or engine damage, the engine shutdown system may be overridden for the duration necessary to complete the regeneration process up to a maximum of 30 minutes. Determination of what constitutes the need for regeneration will be based on data provided by the manufacturer at time of certification. Regeneration events that may require longer than 30 minutes of engine idling to complete shall require advance Executive Officer approval. At the end of the regeneration process, the engine

shutdown system shall automatically be enabled to restart the engine shutdown sequence described in subparagraph 11.B.6.1.1. above. A vehicle that uses a regeneration strategy under engine idling operating conditions shall be equipped with a dashboard indicator light that, when illuminated, indicates that the exhaust emission control device is regenerating. Other methods of indicating that the exhaust emission control device is regenerating may be used with advance Executive Officer approval.

(4) if servicing or maintenance of the engine requires extended idling operation. The engine's electronic control module may be set to temporarily deactivate the engine shutdown system for up to a maximum of 60 minutes. The deactivation of the engine shutdown system shall only be performed with the use of a diagnostic scan tool. At the end of the set deactivation period, the engine's electronic control module shall reset to restart the engine shutdown system sequence described in subparagraph 11.B.6.1.1 above.

6.2 **Exempt Vehicles**. Heavy-duty diesel engines to be used in buses as defined in California Vehicle Code §§ 233, 612 and 642, school buses as defined in California Vehicle Code § 545, recreational vehicles as defined in Health and Safety Code 18010, medium duty vehicles as defined in § 1900(b)(13) of title 13, California Code of Regulations (CCR), military tactical vehicles as defined in §1905 of title 13, CCR, and authorized emergency vehicles as defined in California Vehicle Code § 165 are exempted from these requirements.

6.3 **Optional NOx Idling Emission Standard**. In lieu of the engine shutdown system requirements specified in subsection 11.B.6.1 above, an engine manufacturer may elect to certify its new 2008 and subsequent model-year heavy-duty diesel engines to an optional NOx idling emission standard of 30 grams per hour. Compliance with this optional standard will be determined based on testing conducted pursuant to the supplemental NOx idling test cycle and procedures specified in section 86.1360-2007.B.4 below. The manufacturer may request an alternative test procedure if the technology used cannot be demonstrated using the procedures in section 86.1360-2007.B.4, subject to advance approval of the Executive Officer. Manufacturers certifying to the optional NOx idling standard must not increase emissions of CO, PM, or NMHC, determined by comparing results from the supplemental NOx idling test cycle and procedures specified in section 86.1360-2007.B.4 below, to emission results from the idle mode of the supplemental steady state test cycle or emission results from idle portions of the transient test cycle for heavy duty diesel engines, respectively specified in sections 86-1360-2007 and 86.1327-98, below. With advance Executive Officer approval, a manufacturer may use other methods of ensuring that

emissions of CO, PM, and NMHC are not adversely affected in meeting the optional NOx requirement. Also, manufacturers shall state in their application for certification that meeting the optional NOx idling requirement will not adversely affect the associated emissions of CO, PM and NMHC.

An engine manufacturer certifying its engine to the optional NOx idling emission standard must also produce a vehicle label, as defined in subsection 35.B.4, below.

(D) Optional Alternatives to Main Engine Idling. All new 2008 and subsequent model year heavy duty diesel engines may also be equipped with idling emission reduction devices that comply with the compliance requirements specified in title 13, CCR section 2485(c)(3).

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12. Alternative certification procedures. [§86.080-12] April 17, 1980. [No change.]

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21. Application for certification. [§86.xxx-21]

A. Federal provisions.

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B. 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.

2. **Heavy-Duty Diesel Engine Idling Requirements**.

2.1 For 2008 and subsequent model-year heavy-duty diesel engines, the manufacturer must provide a statement in the application for certification that the heavy-duty diesel engine for which certification is being requested will comply with the automatic engine shutdown requirements to control idle emissions as specified in subsection 11.B.6.1. If the heavy-duty diesel engine for which certification is being requested is explicitly designed for exempt vehicles, per the provisions in 11.B.6.2, then the manufacturer must also provide a statement in its application for certification so stating.

2.2 A manufacturer that elects to certify engines to the optional NOx idling emission standard, specified in subsection 11.B.6.3, must provide in the application for certification information pertaining to the NOx idling emission certification test conducted under 86.1360-2007.B.4, below, including emissions data for total particulate matter, non-methane hydrocarbons or total hydrocarbons, oxides of nitrogen, carbon monoxide, and carbon dioxide in grams per hour, the test load in brake-horsepower, and engine test speeds in revolutions per minute for both mode 1 and mode 2 testing. With advance

Executive Officer approval, a manufacturer may use an alternative procedure to show compliance with the optional NOx idling emission standard. Regardless of the procedure used, the manufacturer shall also provide the appropriate labels to be affixed to the vehicle on which the engine is going to be installed as required in subsection 35.B.4, below. The manufacturer must maintain records at the manufacturer's facility that contain all test data, engineering analyses, and other information which provide the basis for the compliance statement, where such information exists. The manufacturer must provide such information to the Executive Officer within 30 days upon request.

2.3 If the heavy-duty diesel engine for which certification is being requested incorporates any of the alternative idle emission control strategies contained in title 13, CCR, section 2485(c)(3), then the manufacturer must provide in its application for certification a description of the alternative strategy or technology including the type, brand name, model identification number, and where applicable emissions data and power rating. In addition, the manufacturer must also provide the appropriate labels to be affixed to the outside of the vehicle as required in subsections 35.B.4. If the alternative technology is a fuel-fired heater, then the manufacturer must provide with the application for certification the information required under subsection H.4.4, Part I of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," as incorporated by reference in title 13, CCR, section 1961(d).

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.]

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35. 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 Amend ~~Add the following language to~~ subparagraph (a)(3)(iii)(H) as follows: ~~:~~

1.3.1 An unconditional statement of compliance with the appropriate model year California regulations; for example, "This engine conforms to

California regulations applicable to XXXX model year new heavy-duty diesel engines." It may also state that the engine conforms to any applicable federal or Canadian emission standards for new heavy-duty diesel engines.

1.3.2~~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 XXXX 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)."

1.3.3~~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 XXXX 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)(I) 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.

4. **Vehicle Labels for Heavy-Duty Diesel Engine Idling Requirements.** For each 2008 and subsequent model year heavy-duty diesel engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3 or equipped with a certified/verified auxiliary power system (APS) pursuant to title 13, CCR, section 2485(c)(3)(A), a single label shall be produced and affixed, as applicable, on each vehicle equipped with such heavy-duty diesel engine.

4.1 The labeling requirements for engine manufacturers, aftermarket APS manufacturers and installers, and original equipment manufacturers are as follows:

4.1.1 Engine manufacturers. The engine manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each new engine or APS pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the original equipment manufacturer.

4.1.2 Aftermarket APS manufacturers and installers. An aftermarket APS manufacturer that has certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each APS system pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the party that is responsible for installing the APS on the vehicle.

4.1.3 Original equipment manufacturer. An original equipment manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce and affix the appropriate label on the outside of the vehicle pursuant to paragraphs 35.B.4.2 or 35.B.4.3, whichever is applicable.

4.2 **Label Format.** Figure 1 shows a facsimile of the label format for an engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3. Figure 2 shows a facsimile of the label format for an engine in a certified/verified APS pursuant to title 13, CCR, section 2485(c)(3)(A). The engine manufacturer, APS manufacturer or original equipment manufacturer, whichever is applicable, that produces and affixes the label on the vehicle must ensure that the label has the following

characteristics:

Figure 1

Figure 2

4.2.1 Oval shape.

4.2.2 Dimensions of no less than 6 inches wide by 4 inches high.

4.2.3 The color of the outer and inner ellipses shall be dark blue and the stars in red. The background of the label shall be light blue in color. The size of the stars shall be equal to the size of the characters as specified in paragraph 35.B.4.2.4 below.

4.2.4 A vehicle equipped with an engine that is certified pursuant to paragraph 11.B.6.3 shall have a label with the word "CERTIFIED," and below it the phrase "CLEAN IDLE," as shown in Figure 1. A vehicle equipped with an APS certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall have a label with the word "VERIFIED," and below it the phrase "CLEAN APS," as shown in Figure 2. The label information shall be written in the English language with sans serif font, black in color, and in upper case letters. The size of the font shall be at least 7/16 inch (or 32 points) and the spacing of the fonts must be such that the longest phrase (for example, "CLEAN IDLE") extends from the left edge to the right edge of the inner edge of the inner ellipse, without touching the edges. The label information shall be centrally aligned, both vertically and horizontally.

4.2.5 A hologram as shown in Figure 3 shall be embedded within the proposed label. The hologram must cover the entire label. The hologram shall have the phrase "Clean Skies" repeatedly written from edge to edge of the label boundaries and each phrase shall be separated by a circular bullet. The position of the circular bullet in each line shall be exactly above the space between the words "Clean" and "Skies" of the line below. The color of the font shall be orange. The font size" shall be less

than or equal to a quarter of the font size of the phrase “CLEAN IDLE” or “CLEAN APS” as specified in subsection 35.B.4.2.4, above. The hologram shall have the map of the State of California, in orange color, overlaid over the text and positioned in the center of the label as shown in Figure 3, below.

Figure 3

4.3 Label Location and Attachment Requirements

4.3.1 The appropriate label shall be permanently affixed to the exterior on the driver’s side of the hood, in an area within one foot by one foot from the top and front edges of the hood. If such an attachment is not feasible, the label may be attached at a different location subject to advance approval by the Executive Officer.

4.3.2 Each label must be affixed in such a manner that it can not be removed without destroying or defacing the label. The label must not be affixed to any vehicle component that can easily be detached from the vehicle.

4.3.3 The label and any adhesives used must be designed to withstand, for a period of 10 years, typical environmental conditions. Typical environmental conditions include, but are not limited to, exposure to extreme heat or cold, moisture, engine fuels, lubricants and coolants.

4.4 The party that certifies/verifies the engine pursuant to paragraph 11.B.6.3 or the APS pursuant to title 13, CCR, section 2485(c)(3)(A) shall be the ultimate party responsible for ensuring that the labels are correctly produced. Samples of labels produced pursuant to this subsection must be submitted to the Executive Officer with the applicable certification or verification application.

4.5 Labels on vehicles may also be applied by original equipment manufacturers, distributors, or dealers. However, the party that certified the engine or the APS and produced the labels remains the ultimate party responsible for ensuring that the labels are correctly administered. If the

labels are administered by the original equipment manufacturer, dealer, or distributor, the producer of the label shall include its name and a serial number on the label. The location of the producer's name and serial number on the label shall be written in the lower part of the label, in the space vertically centered between the label wording and the inner ellipses, and the font must contrast the label background. The serial numbers of the labels administered must be recorded by the original equipment manufacturer, distributor, or dealer and reported to the party responsible for producing the labels. This information shall be maintained by the party responsible for producing the labels for a period of 10 years, and shall be made available to the Executive Officer upon request.

4.6 A heavy-duty diesel engine that has been certified pursuant to subsection 11.B.6.3 shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2220 through 2225.

4.7 An idling emission reduction device or system that has been certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2470 through 2476.

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

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PART II TEST PROCEDURES

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

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

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

A. Federal provisions

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B. California provisions

1. **Emission testing caps for the 2005 and subsequent model years**.

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4. **Determination of NOx Idling Emissions**. The requirements set forth in this subparagraph apply to 2008 and subsequent model year heavy-duty diesel engines certifying to the optional NOx idling emission standard specified in subsection 11.B.6.3, above. To determine whether an engine meets the optional NOx idling emission standard, emissions shall be measured by testing the engine on an engine dynamometer as described below.

4.1 **Test Cycle**. The following 2 mode duty cycle shall be performed on a dynamometer on the test engine:

Mode	Engine Speed (rpm)	Time in mode (seconds)	Engine Load
1	Manufacturer Recommended Curb idle	1800	See subparagraph 4.1.1 below
2	1100	1800	See subparagraph 4.1.2 below

4.1.1 For mode 1, the dynamometer load or torque applied shall be based on the vehicle power requirements during curb idle operation.

The engine manufacturer shall determine the curb idle speed and the appropriate test load for the test engine. The load shall include curb idle power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps and any other engine accessory operated during curb idle of the engine. The load for mode 1 may not include power requirements for operating the air conditioning compressor or for operating on-board accessories, such as a microwave, refrigerator, television, computer, etc., that the vehicle operator may use during rest periods.

4.1.2 For mode 2, the dynamometer load or torque applied shall be based on the vehicle power requirements during idle speed operations of 1100 revolutions per minute (rpm). The engine manufacturer shall determine the appropriate test load for the test engine. The load shall include high engine idle speed power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps, air conditioning compressor set at maximum capacity, and any other engine accessory operated during the idle operation of the engine. The total test load shall be equal to the test load so determined plus an additional load of 2 kilowatts to take into account the power needs for operating on-board accessories such as a television, refrigerator, microwave, computer, etc.

4.2 **Test Requirements.**

4.2.1 **Pre-conditioning**. Prior to measuring emissions, bring the engine to a warm condition as follows:

(a) If the idling test follows directly after testing over the Federal Test Procedure or the supplemental emission tests, consider the engine warm. Bring down the engine to the manufacturer recommended curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes.

(b) If the engine is cold, warm-up the engine by operating it at any speed above peak-torque speed and between 65 to 85% of maximum mapped power until the engine coolant's temperature is within 2% of its mean value for at least 2 minutes or until the engine thermostat controls engine temperature.

4.2.2 **Test Sequence**. Following engine warm-up as described in subparagraph 4.2.1, the test shall be performed first for mode 1. Bring down the engine to the curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes. Upon

completion of mode 1 testing, the engine speed shall be ramped up to 1100 rpm. Once the engine starts operating at 1100 rpm, apply the appropriate load as determined in subparagraph 4.1.2, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant temperature is within 2% of its mean value for at least 2 minutes. The engine shall be operated for the prescribed time in each mode. The specified test speed shall be held to within ±50 rpm and the specified torque shall be held to within ±2 percent of the maximum torque at the test speed.

4.2.3 **Calculations.** For each test mode, calculate the modal average mass emissions level for each regulated pollutant, in grams per hour, the modal average power, in brake horsepower and the modal average speed, in rpm. For compliance, the calculated average NOx emissions of each mode shall not exceed the optional NOx idling emission standard of 30 grams per hour specified in subsection 11.B.6.3 above.

86.1370-2007 Not-To-Exceed test procedures. January 18, 2001.

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