APPENDIX B

FINAL AMENDMENTS TO THE CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL-ENGINES AND VEHICLES

Adopted: April 8, 1985
Amended: July 29, 1986
Amended: January 22, 1990
Amended: May 15, 1990
Amended: December 26, 1990
Amended: July 12, 1991
Amended: October 23, 1992
Amended: October 22, 1993
Amended: March 24, 1994
Amended: September 22, 1994
Amended: June 29, 1995
Amended: June 4, 1997
Amended: February 26, 1999
Amended: November 22, 2000
Amended: December 8, 2000

NOTES: This document incorporates by reference various sections of the Code of Federal Regulations (CFR), some with modifications. Modifications to portions of paragraphs in the Federal language are indicated by underline for additions and ~~strikeout~~ for deletions. Larger portions of Federal language for a specific section which is not to be included in these procedures are denoted by the "DELETE" and larger portions of new California language are indicated by "REPLACE WITH" or "INSERT". The symbols "*****" and "….." mean that the reminder of the federal text for a specific section, which is not shown in these procedures, has been included by reference, with only the printed text changed. The symbol "#####' means that the remainder of the text of these procedures, which is not shown in this amendment document, has not been changed.

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 1985 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

The following provisions of Subparts A, I, and N, Title 40, Code of Federal Regulations, as adopted or amended by the U. S. Environmental Protection Agency on the date listed, 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 1985 and Subsequent Model Heavy-Duty Diesel-Engines and Vehicles, except as altered or replaced by the provisions set forth below.

The federal regulations contained in the Subparts identified above which pertain to oxides of nitrogen emission averaging shall not be applicable to these procedures except for diesel engines and vehicles produced in the 1998 and subsequent model years. The federal regulations contained in the Subparts identified above which pertain to particulate emission averaging shall not be applicable to these procedures for 1996 and subsequent model years. The smoke exhaust test procedures shall be applicable to California petroleum-fueled, liquefied-petroleum gas-fueled, and compressed-natural gas fueled heavy-duty diesel engines and vehicles for 1988 and later model years.

The federal regulations contained in the subparts identified above which pertain to nonconformance penalty shall not be applicable.

The federal regulations contained in the subparts identified above which pertain to evaporative emission shall not be applicable to these procedures. Applicable regulations pertaining to evaporative emissions are contained in “California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles,” as incorporated in Title 13, California Code of Regulations, Section 1976.

Starting with the 1990 model year, these regulations shall be applicable to all heavy-duty diesel natural-gas-fueled and liquefied-petroleum gas-fueled engines (and vehicles) including those engines derived from existing diesel engines. For any engine which 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.

The regulations concerning the certification of methanol-fueled urban bus engines are not applicable in California until 1991 and subsequent model years. The regulations concerning the certification of all other methanol-fueled diesel engines and vehicles are not applicable in California until 1993 and subsequent model years. Regulations concerning the certification of incomplete medium-duty diesel low-emission vehicles and engines and ultra-low-emission vehicles and engines operating on any fuel are applicable for the 1992 and subsequent model years.

All references to the “Administrator” in the federal regulations contained in the subparts identified above shall be replaced with the “Executive Officer”.

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-Fuel and Methanol Fueled Heavy-Duty Vehicles.

Amend § 86.004-21, Title 40, Code of Federal Regulations, to read:

§ 86.004-21 Application for certification. ~~October 21, 1997.~~ October 6, 2000.

* * * * *

(b)(2) DELETE
REPLACE WITH:

(b)(2) For 1992 and subsequent model-year low-emission and ultra-low-emission vehicles and engines not powered exclusively by diesel, projected California sales data and fuel economy estimates two years prior to certification, and projected California sales data for all vehicles and engines, regardless of operating fuel or vehicle emission category, sufficient to enable the Executive Officer to select a test fleet representative of the vehicles (or engines) for which certification is requested at the time of certification.

* * * * *

(m) DELETE ~~For model years 2004 through 2007, within 180 days after submission of the application for certification of a heavy-duty diesel engine, the manufacturer must provide emission test results from the Load Response Test conducted according to § 86.1380, including, at a minimum, test results conducted at each of the speeds identified in § 86.1380. Load Response Test data submissions are not necessary for carry-over engine families for which Load Response Test data has been previously submitted. In addition, upon approval of the Administrator, manufacturers may carry Load Response Test data across from one engine family to other engine families, provided that the carry-across engine families use similar emission control technology hardware which would be expected to result in the generation of similar emission data when run over the Load Response Test.~~

(n) Upon request from ARB ~~EPA~~, a manufacturer must provide to ARB ~~EPA~~ any hardware (including scan tools), passwords, and/or documentation necessary for ARB ~~EPA~~ to read, interpret, and store (in engineering units if applicable) any information broadcast by an engine's on-board computers and electronic control modules which relates in anyway to emission control devices and auxiliary emission control devices, provided that such hardware, passwords, or documentation exists and is not otherwise commercially available. Passwords include any information necessary to enable generic scan tools or personal computers access to proprietary emission related information broadcast by an engine's on-board computer, if such passwords exist. This requirement includes access by ARB ~~EPA~~ to any proprietary code information which may be broadcast by an engine's on-board computer and electronic control modules. Information which is confidential business information must be marked as such. Engineering units refers to the ability to read, interpret, and store information in commonly understood engineering units, for example, engine speed in revolutions per minute or per second, injection timing parameters such as start of injection in degree's before top-dead center, fueling rates in cubic centimeters per stroke, vehicle speed in

miles per hour or kilometers per hour. This paragraph (n) does not restrict ARB ~~EPA~~ authority to take any action authorized by Section 208 of the Clean Air Act.

Adopt and amend § 86.007-21, Title 40, Code of Federal Regulations, to read:

§ 86.007-21 Application for certification. October 6, 2000.

Section 86.007-21 includes text that specifies requirements that differ from § 86.004-21. Where a paragraph in § 86.004-21 is identical and applicable to § 86.007-21, this may be indicated by specifying the corresponding paragraph and the statement "[Reserved]. For guidance see § 86.004-21.".

(a) through (n) [Reserved]. For guidance see § 86.004-21.

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

(1) 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) 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;

(7) 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 §86.1360-2007(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.

(p)(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 §86.1370-2007(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) For engines equipped with exhaust gas recirculation, the manufacturer must provide a detailed description of the control system the engine will use to comply with the requirements of § 86.007-11(a)(4)(iii) and § 86.1370 (f) for NTE cold temperature operating exclusion, including but not limited to the method the manufacturer will use to access this exclusion during normal vehicle operation.~~

~~(3)~~ (2) For each engine model and/or horsepower rating within an engine family for which a manufacturer is applying for a~~n~~ NTE deficiency(ies) under the provisions of §86.1370-2007(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.

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

Amend §86.1313-90, Title 40, Code of Federal Regulations, to read:

§86.1313-90 Fuel Specifications. April 11, 1989.

* * * * *

(b) Diesel test fuel. (1) The petroleum fuels for testing diesel engines … pour depressant, dye, dispersant, and biocide. Fuels specified for emissions testing are intended to be representative of commercially available in-use fuels.

(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 ~~N94-2~~ of 40 Code of Federal Regulations section 86.1313-98(b)(2) ~~86.1313-94(b)(2)~~, as adopted September 5, 1997 ~~August 21, 1990~~, 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 ~~N94-2~~, 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.

Fuel Property	Limit	Test Method [a]
Natural Cetane Number	47-55	D613-86
Distillation Range, ^{o}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, ^{o}F (max)	130	D 93-80
Viscosity @ 40^{o}F, centistokes	2.0-4.1	D 445-83

[a] 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.

(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 ~~Administrator~~, 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 2003 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 2003 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.

# # # # #

Adopt §86.1342-94, Title 40, Code of Federal Regulations, to read:

§86.1342-94 Calculations; exhaust emissions. September 5, 1997.

# # # # #

Adopt and amend § 86.1360-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1360-2007 Supplemental steady-state test; test cycle and procedures.
October 6, 2000.

(a) Applicability. This section applies to 2005 ~~2007~~ and subsequent model year ~~later diesel~~ heavy duty diesel engines.

(b) Test cycle.

(1) 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

(2) In addition to the 13 test points identified in paragraph (b)(1) of this section, ARB ~~EPA~~ 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 ~~EPA~~ 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.

(c) 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 ~~86.1380~~, must be determined as follows:

Speed A = n_{lo} + 0.25 x (n_{hi}-n_{lo})
Speed B = n_{lo}+ 0.50 x (n_{hi}-n_{lo})
Speed C = n_{lo} + 0.75 x (n_{hi}-n_{lo})
Speed D = n_{hi}
Speed E = n_{lo} + 0.15 x (n_{hi}-n_{lo})

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_{lo} = 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_{lo}.

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

(d) Determining the control area. 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.

(e) Test requirements. (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. The ARB ~~EPA~~-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-minus>~~ 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 ~~EPA~~-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:

$$A_{WA} = \frac{\sum_{i=1}^{n} [A_{Mi} \times WF_i]}{\sum_{i=2}^{n} [A_{Pi} \times WF_i]}$$

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_F = 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.

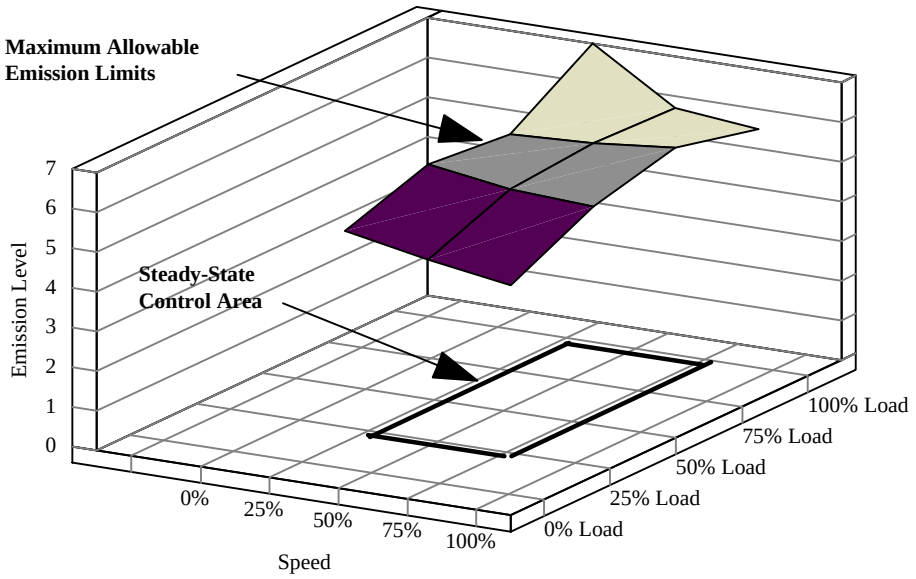
(ii) For PM measurements, a single pair of filters must be used to measure PM over the 13 modes. The brake-specific PM emission level for the test must be calculated as described for a transient hot start test in § 86.1343-88. Only the power measured during the sampling period shall be used in the calculation.

(f) 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 (j) of this section ~~§ 86.007-11(a)(3)~~ except as modified under paragraph (f)(3) of this section. 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 (j) of this section ~~§ 86.007-11(a)(3)~~, each of the 13 test values for that pollutant shall first be multiplied by the ratio of the applicable emission standard (under paragraph (j) of this section ~~§ 86.00711(a)(3)~~) 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) 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.

(g) Calculating intermediate test points. (1) For the three test points selected by ARB ~~EPA~~ 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:

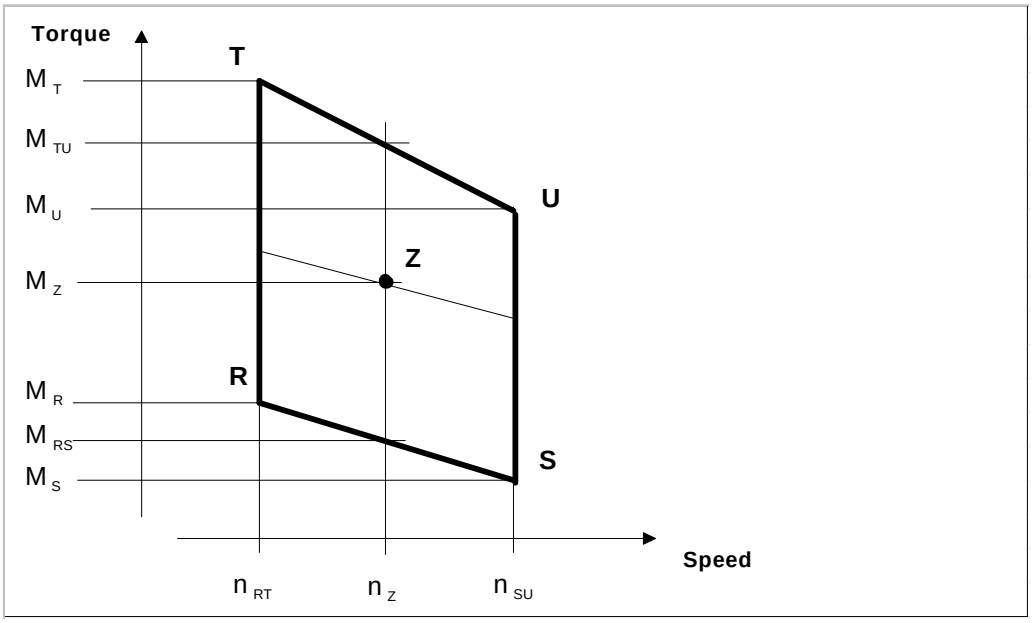
$E_Z = E_{RS} + (E_{TU} - E_{RS}) * (M_Z - M_{RS}) / (M_{TU} - M_{RS})$
$E_{TU} = E_T + (E_U - E_T) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$
$E_{RS} = E_R + (E_S - E_R) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$
$M_{TU} = M_T + (M_U - M_T) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$
$M_{RS} = M_R + (M_S - M_R) * (n_Z - n_{RT}) / (n_{SU} - n_{RT})$

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).

(h) Test fuel specifications. The test fuel used for supplemental steady-state testing under this section must meet the requirements of § 86.1313-90.

(i) 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.

INSERT

(j) Emission testing caps. (1) 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)(1).

(2) 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 paragraph (g) of this section, when the engine is operated in the steady-state control area defined under paragraph (d) of this section, during steady-state engine operation.

INSERT

(k) 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, 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.

(1) 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 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) 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) 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.

(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, 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) and/or (k)(5) of this section. Upon the completion of testing conducted in paragraph(s) (k)(4) and/or (k)(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, sections 2113 through 2121.

(4) If the testing conducted under paragraph (k)(1) and California Code of Regulations, title 13, 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 (k)(1) and California Code of Regulations, title 13, section 2139 can be reproduced or corrected consistent with paragraph (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 (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.

(5) Within 60 days of receiving notice of an exceedance under paragraph (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.

(6) The testing of additional engines under paragraphs (k)(4) and (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.

INSERT

(l) Exemptions.

(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.

(2) The requirements set forth in this section do not apply to “urban buses”, as defined in Title 13, California Code of Regulations, Section 1956.2, for model years 2005 and 2006.

Adopt and amend § 86.1370-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1370-2007 Not-To-Exceed (NTE) test procedures. October 6, 2000.

(a) 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 ~~§ 86.007-11(a)(4)~~.

(b) Not-to-exceed control area for ~~diesel~~ heavy-duty diesel engines. The Not-To-Exceed Control Area for ~~diesel~~ 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, BFSC must be calculated under the general test cell conditions specified in § 86.1330-90. The manufacturer may petition the Executive Officer ~~Administrator~~ 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.

(5) For particulate matter only, 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):

(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 paragraphs (b)(5)(ii)(A) and (B) of this section and below the line formed by connecting the two points in paragraphs (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}).

~~(6) For natural gas and other non-diesel fueled diesel cycle engines, the manufacturer may petition the Administrator at certification to exclude operating points from the Not-to-Exceed Control Area defined in § 86.1370 (b)(1) through (5) if the manufacturer can demonstrate that the engine is not expected to operate at such points in normal vehicle operation and use.~~

(c) [Reserved]

(d) Not-to-exceed control area caps ~~limits~~. (1) When operated within the Not-To-Exceed Control Area defined in paragraph (b) of this section, diesel engine brake-specific exhaust emissions in grams/bhp-hr (as determined under paragraphs (b) and (c) of this section), for each regulated pollutant, shall not exceed 1.25 times the applicable emission standards ~~Not-To-Exceed Limits~~ specified in ~~§ 86.007-11(a)(4)~~ California Code of Regulations, Title 13, §1956.8 (a)(1) 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.

(2) [Reserved]

(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.

(e) Ambient corrections. The measured data shall be corrected based on the ambient conditions under which it was taken, as specified in this section.

(1) For engines operating within the ambient conditions specified in paragraph (g)(1) of this section ~~§86.007-11(a)(4)(ii)(a);~~

(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 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 ~~EPA~~ review.

(2) For engines operating within the ambient conditions specified in paragraph (g)(2) of this section ~~§86.007-11(a)(4)(ii)(b);~~

(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 ~~EPA~~ review.

(f) DELETE ~~NTE cold temperature operating exclusion. 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.~~

~~(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 × IMT - 7.75 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 × ECT - 9.8889 Equation (2)~~

~~Where;~~

~~P = absolute intake manifold pressure in bars~~
~~ECT = engine coolant temperature in degrees Fahrenheit~~

~~(2) [Reserved]~~

INSERT

(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) 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

(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).

INSERT

(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, 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.

(1) 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 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 (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) 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.

(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, sections 2113 through 2121 within 45 days or to proceed with performing the engineering analysis and/or conducting further testing in accordance with paragraphs (h)(4) and/or (h)(5) of this section. Upon the completion of testing conducted in paragraph(s) (h)(4) and/or (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, sections 2113 through 2121.

(4) If the testing conducted under paragraph (h)(1) and California Code of Regulations, title 13, 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 (h)(1) and California Code of Regulations, title 13, section 2139 can be reproduced or corrected consistent with paragraph (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 (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.

(5) Within 60 days of receiving notice of an exceedance under paragraph (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.

(6) The testing of additional engines under paragraphs (h)(4) and (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.

INSERT

(i) Deficiencies for NTE requirements. (1) For model years 2005 through 2007, 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.

(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.

INSERT

(j) Exemptions.

(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.

(2) The requirements set forth in this section do not apply to “urban buses”, as defined in Title 13, California Code of Regulations, Section 1956.2, for model years 2005 and 2006.

Adopt and amend § 86.1372-2007, Title 40, Code of Federal Regulations, to read:

§ 86.1372-2007 Measuring smoke emissions within the NTE zone. October 6, 2000.

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) ~~§ 86.007-11(b)(1)(iv)~~.

(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 ~~(see § 86.1)~~.

(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 ~~Administrator~~.

(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 ~~Administrator~~.

(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.