ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 9 and 86

[FRL–5881–3]

Direct Final Rule Amending the Test Procedures for Heavy-Duty Engines, and Light-Duty Vehicles and Trucks and the Amending of Emission Standard Provisions for Gaseous Fueled Vehicles and Engines

AGENCY: Environmental Protection Agency (EPA).

ACTION: Direct final rule.

SUMMARY: This action promulgates amendments to several sections of the heavy-duty engine test procedure regulations in 40 CFR part 86. These changes are needed in order to accommodate the use of new testing equipment, to provide greater flexibility in the type of testing equipment used and to ensure uniform calibration and use of the testing equipment. The amendments will ensure the continued validity of testing results and ensure that heavy-duty engines are being exercised appropriately over the test procedures. This action also makes limited changes to the light-duty vehicle and truck test procedure regulations and the gaseous fuel emission standards in 40 CFR part 86. Because changes are limited to technical issues, all of which have been coordinated with industry, EPA expects no adverse comments.

DATES: This rule will be effective January 5, 1998 unless notice is received by October 6, 1997 that adverse or critical comments will be submitted on a specific element of this rule. If such comments are received, then EPA will publish a subsequent document in the **Federal Register** withdrawing any regulation for which adverse or critical comments were made.

The incorporation by reference of certain publications listed in the regulations is approved by the Director of the **Federal Register** as of January 5, 1998.

ADDRESSES: Interested parties may submit written comments in response to this notice (in duplicate, if possible) to Public Docket A–96–07 at Air Docket Section, U.S. Environmental Protection Agency, First Floor, Waterside Mall, Room M–1500, 401 M Street SW, Washington DC 20460. A copy of the comments should also be sent to the contact person listed below.

FOR FURTHER INFORMATION CONTACT: Mr. Jaime Pagán, U.S. Environmental Protection Agency, Engine Programs and Compliance Division, 2565 Plymouth Rd., Ann Arbor, MI 48105. Telephone: (313) 668–4574, fax: (313) 741–7816.

SUPPLEMENTARY INFORMATION:

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I. Introduction

EPA's Smoke Exhaust and Gaseous and Particulate Exhaust Test Procedures for certification and Selective Enforcement Audit (SEA) provide a consistent method for testing and obtaining emissions data from heavy-duty engines. This action promulgates amendments to the test procedures in order to accommodate the use of new testing equipment and clarify certain issues that have been identified since these procedures were first published.

Over the last few years, EPA and the Engine Manufacturers Association (EMA) have worked together to identify the issues that needed revision or clarification. During these interactions, suggestions were made involving specific changes to the test procedures. In general, the technical amendments included in this action fall into two categories. First, many of the amendments are simply clarifications that will help remove any potential ambiguities or inconsistencies. Second, another group of amendments take into account testing equipment and/or engine technology that was not as widely used when the rule was first written.

The changes to the Smoke Exhaust Test Procedure include clarifications regarding the operation of the dynamometer, accommodation of additional test equipment and more details on meter light sources to be used. The test procedures for SEA contain a new requirement that asks manufacturers to decide, before the initial cold cycle, whether they will measure background particulate matter (PM) or not. Promulgated amendments to the Gaseous and Particulate Test Procedures cover the calibration requirements of gas analyzers, the use of accessory loads, conditions for use of charge air cooling devices and the permitted point deletions from regression analysis.

Lastly, three minor changes to the Gaseous Fueled Vehicle Rule, established in a September 21, 1994 notice (59 FR 48472), are made. The regulatory text of that rule contained several minor errors and areas where the applicability of various standards to gaseous-fueled vehicles was not clear in the regulations, although all of the applicability issues were discussed in the preamble. The following section presents a more detailed overview of the specific amendments that EPA is promulgating in this action.

II. List of Changes to Test Procedures

1. Changes and clarifications regarding dynamometer control throughout the operation cycle for smoke emission tests (§ 86.884–7(a) and § 86.884–13(b)(6)). These changes respond to the need to better define the acceleration mode in the smoke test cycle. The amendments to the regulatory language make the speed and acceleration requirements more specific. In addition, it is clarified that during the last 10 seconds of the lugging mode the average engine speed and the average observed power shall be maintained within their specified values. Furthermore, the regulations are revised to state that within five seconds of the completion of the lugging mode, the dynamometer and engine controls shall be returned to idle position. These specifications are needed to ensure uniformity in how the procedures are followed.

2. Allow the use of newer in-line smokemeters and accommodate multistack engines to the smoke exhaust test procedure (§ 86.884–8(c) and § 86.884–14). In-line smokemeters, which were not available when the original rule was written, are now taken into account in the test procedure. The purpose of this addition is to provide engine manufacturers the flexibility of using this type of equipment. The use of in-line smokemeters is acceptable since it does not affect test results. Also, specifications for the distance between the smokemeter and the exhaust manifold, turbocharger outlet, aftertreatment device or crossover junction (whichever is farthest downstream), are now included in the regulations. Such distance specifications are needed to ensure a uniform procedure and repeatable test results.

3. Clarify the specifications for the type of light sources to be used during smoke testing (§ 86.884–9 (b)(2) and (c)). These clarifications specify the color temperature range and spectral peak for

smokemeter light sources. It is also specified that light detectors shall be a photocell or a photodiode. In addition, it is now specified that the distance from the optical centerline of the smokemeter to the exhaust pipe outlet is 1±0.25 inches. The new language adds specificity by providing specific ranges for these parameters and adds flexibility by allowing the use of more current smokemeter technology.

4. Semantic clarification for the smoke test: Curb Idle rpm versus Idle rpm (§ 86.884–7(a)(4) and § 86.884–10(a)(8)). The word ''Curb'' was eliminated from the term ''Curb Idle rpm'' in the smoke test procedure. When running a smoke test on an engine with Curb Idle Transmission Torque (CITT), it is very difficult to maintain the desired idle speed without having to adjust the controls. The change in the regulatory language simply allows to operate the engine at free idle speed and does not affect test results.

5. New calculations are provided to support the use of in-line smokemeters (§ 86.884–14(a)). EPA provides an equation to determine the standard half-second percent opacity, if the opacity is being measured using a smokemeter with a different optical path length than the one specified in § 86.884–8. This calculation will help support the use of current in-line smokemeters.

6. Selective Enforcement Auditing Test Procedures: Require that manufacturers decide, before the start of the cold cycle, whether they will measure background particulate matter (PM). The test shall be voided if the manufacturer fails to measure background PM after initially saying it would (§ 86.1008–90(a), § 86.1008–96(a), § 86.1008–2001(a) and § 86.1111–87(a)). The CFR (§ 86.1310(b)(1)(iv)(C)) states that the primary dilution air may be sampled to determine background PM levels. Since this measurement is not required, a valid test may be run without sampling for background particulate. Background particulate can make a significant contribution to the total particulate collected on the sample filter, especially at emission levels of 0.10 g/bhp-hr and below. As a result, most manufacturers choose to measure background particulate.

During Selective Enforcement Audit (SEA) testing, manufacturers will occasionally have problems measuring background particulate. Improper handling of the background filters is the usual cause of these problems. Manufacturers typically want to weigh the sample filters before deciding whether or not to void the test. If the engine passes based on the sample filter weights, the manufacturer will not void the test since including background emissions will only lower an already passing particulate value. However, if the engine fails based solely on the sample filter weights, the manufacturer will want to void the test since the engine may pass if background correction is included.

Although it is certain that an engine that passes without background correction will pass with background correction, it is uncertain if an unmeasured background correction will lower the particulate level of a failing engine enough to pass. An engine with failing sample filter weights may pass when retested solely as the result of test-to-test variability, lowering its emission level.

Therefore EPA will now require that manufacturers decide, before the start of the cold cycle, whether they will measure background PM. The test shall be voided if the manufacturer fails to measure background PM after initially saying it would.

7. Clarify the procedure for sampling background particulate (§ 86.1310–90(b)(1)(iv)(C)). The new language adds specificity to the exhaust gas sampling method by stipulating that the primary dilution air shall be sampled at the inlet to the primary dilution tunnel, if unfiltered, or downstream of any primary dilution air conditioning devices that are used.

8. Clarify the hydrocarbon (HC) probe location and line temperature requirements and introduce a new approach for demonstrating the temperature profile of heated lines (§ 86.1310–90(b)(3)). This clarification will provide more uniformity to the test procedures by requiring specific probe locations and line temperature requirements. The revisions to the regulations require that the temperature requirements of the hydrocarbon (HC) sample line shall be met over its entire length and not just at the measurement points. Since the gas temperature can not instantly be brought up to the required temperature, the length of the sample probe is defined as the length at which the gas temperature must meet specifications.

9. Require that all particulate matter (PM) filters (sample, reference and background) are to be handled in pairs during all weighing (§ 86.1310–90(b)(7), § 86.1312–88(a) (3) & (4), and § 86.1337). This measure will help reduce error and ensure the uniform use of all filter samples. More accurate measurements can be obtained by weighing the filters in pairs.

10. Recommend that PM filter loading be maximized consistent with other temperature requirements and the requirement to avoid moisture condensation (§ 86.1310–90(b)(7)(iv)). The new language will ensure that PM measurements are accurate by having a filter loading that is consistent with temperature and moisture requirements. Furthermore, EPA recommends that the filter pair loading be proportional to the engine's emission level. For example, a filter pair loading of 1 mg is typically proportional to a 0.1 g/bhp-hr PM emission level. This change eliminates the previous 5.3 milligram filter loading requirement which is too difficult to achieve with today's low PM emitting engines.

11. Apply the same proportional sampling requirement to the Critical Flow Venturi (CFV–CVS) and the Positive Displacement Pump-Constant Volume Sampler (PDP–CVS) systems (§ 86.1310–90(b)(6), § 86.1337–90(a)(10), § 86.1337–96(a)(10)). This new language consolidates the requirement for demonstrating, during diesel particulate testing, sample flow proportionality for both the single-dilution and double-dilution methods. Prior to the change, PDP–CVS systems were only required to demonstrate that flow through the particulate transfer tube was constant, plus or minus five percent. The CFV–CVS was required to demonstrate that the ratio of main tunnel flow to particulate sample flow did not change by more than plus or minus five percent. The requirements for the two CVS systems are the same assuming that flow through the PDP–CVS does not vary. Since this assumption is not always true, the proportionality requirements for the PDP–CVS and the CFV–CVS are not equivalent. To correct this, laboratories with a PDP–CVS sampling system are required to meet the same requirements as the CFV–CVS system, which is to demonstrate that the ratio of main tunnel flow to particulate sample flow did not change by more than plus or minus five percent.

12. Clarify the ambient condition requirements for the filter weighing room (§ 86.1312–88(a) (1) & (2)). This new language helps resolve some inconsistencies between the light-and heavy-duty test procedures. The new humidity requirement states that the room shall be maintained at a dew point temperature of 282.5K ±3K (9.4°C ±3°C) and a relative humidity of 45% ±8%. The ambient temperature requirement in the room is revised to 295K ±3K (22°C ±3°C) during all filter conditioning and weighing.

13. Allow a change in weight on the reference filters, between weighings, by an absolute number rather than a percentage of the nominal filter loading

(§ 86.1312–88(a)(4)). Sample and background filter pairs that are in the process of stabilization shall be discarded if the average weight of the reference filter pair changes by more than 40 micrograms. This change simplifies the old requirement where a ±5 percent change from the nominal filter loading was allowed. EPA considers that it is better practice to have a filter weight variation requirement that does not vary with the nominal filter loading since a specific loading is not required, but is only recommended.

14. Change in the conditioning room timing requirement (§ 86.1312–88(a)(5)). If any of the environmental conditions in the conditioning room, as specified in the test procedures, are not met, then it is required that the filters remain in the conditioning room for at least one hour after correct conditions are met prior to weighing. This amendment eliminates a previously unnecessary timing requirement and adds a new option for manufacturers that gives them greater flexibility in following the test procedures.

15. Specify a new ASTM procedure for measuring aromatic composition in diesel fuel (§ 86.1313–91, § 86.1313–94, § 86.1313–98). The amendment allows, for heavy-duty diesel engines of model years 1987 thru 1997, the use of ASTM procedure D5186–91 for measuring aromatic composition. For model years 1998 and later, ASTM D5186–91 will be the required procedure for measuring aromatic composition.

16. For diesel fuel testing only, change the requirement of calibrating the CO analyzer to bi-monthly or immediately after maintenance (§ 86.1316–90). This amendment loosens the monthly calibration requirement due to the typically low levels of CO, relative to the standard, produced by heavy-duty diesel engines.

17. Change a requirement to generate new calibration curves each month (§ 86.1316–90, § 86.1316–94). This amendment adds flexibility to the test procedure by allowing the manufacturer not to generate a new calibration curve for an analyzer if they have demonstrated that it has not significantly varied from its last calibration. This change does not affect the accuracy of the analyzers, but simplifies the calibration process.

18. Clarify the method for issuing speed and torque command setpoints throughout the test cycle (§ 86.1327–90(b), § 86.1327–94(b), § 86.1327–96(b)). The frequency for issuing the command setpoints for engine torque and speed were not specified in the original rule. It is now clarified that the torque and speed command setpoints shall be issued at 5 Hz or greater.

19. Clarify the exhaust system and insulation requirements for diesel engines equipped with catalysts (§ 86.1327–90(f), § 86.1327–94(f), § 86.1327–96(f)). These amendments respond to the need to account for exhaust aftertreatment technology, which is seeing a wider use in current heavy-duty engines. The language being added to the regulations specifies that the exhaust pipe diameter shall be the same as that found in-use. In addition, it is specified that for gasoline and diesel engines, the catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support. The reason for allowing such option to manufacturers is that the catalyst may be consumed by the high exhaust temperatures experienced during testing. Finally, it is also specified that the distance from the exhaust manifold flange or turbocharger outlet to any exhaust aftertreatment device shall be the same as the vehicle configuration or within the distance specifications that the engine manufacturers provide for the installation of such devices.

20. Clarify that loading from accessories is considered parasitic in nature and that their work shall not be included in the emission calculations (§ 86.1327–98, § 86.1341–98(b)(3)). The accessory loading is considered parasitic because it is not providing any ''useful work''. ''Useful work'' is the work that the application (that uses the engine in question) does when commanded by an operator. The amendment clarifies that accessories such as oil coolers, alternators, air compressors, etc., if used, shall be applied to all engine testing operations. Their work, however, shall not be included in the integrated work used in emission calculations. This clarification adds consistency between emission test results from different engines, which do not necessarily operate with the same accessories.

21. Require the following of SAE Recommended Practice J1937 for simulating the use of a charge air cooling device while running the FTP in a dynamometer test cell (§ 86.1330–84(b)(5), § 86.1330–90(b)(5)). The following of this procedure will help ensure the uniform use of such devices, which were not of common use when the original rule was written.

22. Define new intake and exhaust restriction setting requirements for diesel fueled heavy-duty engines (§ 86.1330–84(f) and § 86.1330–90(f)). This new language replaces earlier language that required the manufacturers to demonstrate some average restrictions that their engines would typically experience in-use. The old requirements were very difficult to meet. The new requirement for the air inlet specifies a restriction setting which is midway between a clean filter and the maximum restriction specified by the manufacturer. In addition, the new requirement for exhaust restriction is 80 percent of the manufacturer's recommended maximum specified exhaust restriction. Furthermore, EPA still holds the manufacturer accountable for the entire range of restrictions that the engine might experience in-use.

23. Correct the temperature requirement of the CVS dilution air (§ 86.1330–84(b), § 86.1330–90(b)). The language added makes the dilution air temperature requirement consistent with § 86.1310–90, which is 68°F (20°C) for Otto cycle engines and between 68°F and 86°F (20°C and 30°C) for diesel cycle engines.

24. Change the required torque command set-points in the FTP that utilize the provisions related to Curb Idle Torque (CITT) (§ 86.1333–90). The manufacturer is allowed to modify all torque command set-points to CITT when the speed command set-point is equal to or less than zero percent and the ''initial'' torque command set-point is less than CITT. This language corrects a problem where, in certain cases, a low torque command resulted in a real torque command less than CITT, which is an operating condition that these engines do not typically encounter in-use.

25. Clarify the idle torque requirements for cycle validation (§ 86.1333–90). The existing language for idle torque requirements is clarified to make it more understandable.

26. Apply a single set of requirements to both forced and natural cool downs which precede the cold start exhaust emissions test (§ 86.1334–84 and § 86.1335–90). This change defines a cold engine as one with oil and water temperatures between 68 and 86°F. This is a change from the existing natural cool down requirements which call for only oil temperature to be stabilized between 68 and 86 °F. The temperature requirements for forced cool down are now the same as for natural cool down, thus providing one definition for a cold engine regardless of the cool down procedure.

27. Correct an oversight regarding the first FTP idle definition (§ 86.1337–90 and § 86.1337–96). This amendment adds language to § 86.1337–90 and § 86.1337–96 that was inadvertently lost

from § 86.1337–88. It also corrects a paragraph reference in the same sections and eliminates specifications for particulate testing without the use of flow compensation because these specifications are no longer needed since the same particulate sampling requirements now apply for systems with and without flow compensation.

28. Clarify the procedure for calibrating gaseous emission analyzers (§ 86.1321–90, § 86.1321–94, § 86.1322–84, § 86.1323–84, § 86.1324–84 and § 86.1325–94, § 86.1338–84). The data points requirements for calibrating analyzers below 15 percent of full scale are specified in order to ensure an accurate curve. The previous calibration procedure was defined by the type of gas divider used for the calibration. Not all gas dividers were covered by the previous procedure and no procedure was provided for a laboratory which uses gas bottles. Changes to the procedure now allow the generation of calibration data with six points that are approximately equally spaced. Finally, analyzer response over 100% of full scale may be used if it can be shown that readings in this range are accurate. These changes give more flexibility without affecting the accuracy of the calibrations.

29. Require that particulate sample filters be placed in unsealed petri dishes during conditioning after the emissions test (§ 86.1339–90). This language will help ensure that particulate filters will be handled consistently in all laboratories and makes it consistent with the pre-conditioning requirements. The unsealed petri dish requirement is needed in order to have a uniform method for handling PM filters that also eliminates the possibility of filter contamination.

30. Eliminate the 80 hour maximum for pre-conditioning PM filters (§ 86.1339–90). This change simplifies the filter pre-conditioning procedure by eliminating the 80 hour maximum time requirement. It was found that only the minimum 1 hour requirement was of meaningful value for filter pre-conditioning.

31. Clarify the permitted point deletions from regression analysis for validation statistics (§ 86.1341–90, § 86.1341–98 and Appendix I, paragraph (f)(2)). A table that describes the permitted point deletions from regression analysis is simplified by removing some language and adding three sentences. The changes will make the table easier to understand and do not affect test results.

32. Correct an oversight regarding the calculation of cycle work (§ 1341–90). This clarification adds language to § 86.1341–90 that was inadvertently not included from § 86.1341–84.

33. Clarify that no useful work is generated from spurious non-zero/CITT torques that occur during idle (§ 86.1341–98(b) (3) & (4)). For manual transmissions, all spurious non-zero torques at reference idle portions of the cycle shall be set equal to zero and included in the horsepower-hour calculation used for emission determinations. For automatic transmissions, all spurious non-CITT torques at reference idle portions of the cycle shall be included in the horsepower-hour calculation used in the emission determination.

34. Clarify the calculations for converting emission measurements from as-measured dry concentrations to wet concentrations (§ 86.1342–90, § 86.1342–94). An equation used to convert as-measured dry concentrations to wet concentrations is amended in order to correct an error in its derivation.

35. Correct an error that occurred from § 86.1342–84 to § 86.1342–90 when some guidelines for converting dry measurements to wet concentrations became subordinate to a section describing the calculation of brake-specific fuel consumption (§ 86.1342–90, § 86.1342–94).

36. Clarify what calculations should be used for determining the emission of particulate matter depending on what type of CVS sampling system is used (§ 86.1343–88). The original language did not distinguish between critical flow venturi (CFV) CVS and positive displacement pump (PDP) CVS, which require different calculations for determining the mass of particulate matter. The new language now provides distinct calculations for both systems for emission calculation purposes.

37. Add provisions for testing heavy-duty engines and light-duty vehicles that require the manufacturer to verify that the venturi is achieving sonic flow when using a CFV–CVS sampling system (§ 86.119–90, § 86.1319–84 and § 86.1319–90). Having sonic flow during emission tests, when using a CFV–CVS sampling system, is of critical importance in order to achieve accurate and reliable emission results. Manufacturers have two options for verifying sonic flow. The first option involves calculating CFV pressure ratio, which must be less than or equal to the calibration pressure ratio limit derived from the CFV calibration data. Other sonic flow verification methods may be allowed with prior approval from the Administrator.

38. Revise Incorporation by Reference (§ 86.1). Section 86.1 contains a listing of all items in part 86 which are incorporated by reference, along with the section numbers where they are incorporated. The SAE Recommended Practice J1937 and the standard test method ASTM 5186–91 are added to such list. In addition, several minor corrections to section 86.1 are made. In the Gaseous Fuels Rule the changes to section 86.1 to incorporate the standards ASTM D2163–91 and ASTM D1945–91 were in some cases incorrect and did not properly list the part 86 sections in which these standards were incorporated.

39. Correct Certification Specifications for Diesel Fuel for Light-Duty Vehicles and Trucks (§ 86.113–94). In the Gaseous Fuels Rule (59 FR 48472) the section specifying certification fuel parameters for light-duty vehicles and trucks (§ 86.113–94) was modified to include natural gas and liquefied petroleum gas specifications. In addition to new gaseous fuels specifications, this section was restructured to make future additions of other fuels easier. Although these were the only intended changes, some changes were inadvertently made to the specifications for diesel fuel as well. Thus, in this notice such section is being revised to correct for these inadvertent changes to the diesel fuel specifications. Corrections involve the cetane number and cetane index in paragraph (b)(2), and the cetane index, 90 percent distillation point and gravity in paragraph (b)(3). These changes will bring the diesel fuel certification specifications back to their original state, prior to the publication of the Gaseous Fuels Rule.

40. Clarify Gaseous Fuel Standards Applicability (§ 86.094–8, § 86.094–9, § 86.094–11, § 86.096–8 and § 86.096–11). In the Gaseous Fuels Rule there were several instances where the regulatory text did not mirror the preamble discussion concerning the applicability of various standards to gaseous-fueled vehicles, especially as they relate to the options on the applicability of the standards prior to the 1997 model year. EPA is revising the regulatory text to clarify the provisions of the Gaseous Fuels Rule regulations. The clarifications are summarized briefly in the following sentences. In sections 86.094–8, 86.094–9, 86.096–8 and 86.096–11, the language concerning the crankcase emissions prohibition is being clarified to show that it is optional for the 1994 through 1996 model years and also optional for 1997 model year turbocharged gaseous fueled heavy-duty engines. In sections 86.094–9 and 86.096–11 the language concerning exhaust emission standards is being

clarified to show that those standards are optional for gaseous-fueled vehicles through the 1996 model year. In section 86.094–9 the language concerning idle carbon monoxide (CO) emission standards is being clarified to show that those standards are applicable to gaseous-fueled engines, but optional through the 1996 model year. Finally, the section 86.094–11 language concerning smoke standards is being clarified to show that those standards are applicable to gaseous-fueled vehicles, but optional through the 1996 model year.

41. Clarify Exhaust Emission Calculations § 86.144–94). In section 86.144–94, the density of nonmethane hydrocarbons in natural gas and liquefied petroleum gas is used for emission calculations. The description of this term incorrectly specifies that it be defined simply as the density of hydrocarbon components in the fuel. This definition does not exclude methane, as it should. The definition is being corrected here to refer to the density of only the nonmethane components.

42. Clarify Changes to the Flame Ionization Detector (FID) optimization (§ 86.1321–90 and § 86.1321–94). More language is incorporated to resolve some previous inconsistencies with the procedure. For instance, the FID response now can be optimized with respect to fuel flow or to fuel pressure. Furthermore, it is also clarified that the optimum fuel, air, and sample pressures or flow rates shall be recorded after their determination.

III. Environmental and Economic Impacts

EPA believes that these technical amendments will not have any significant economic or environmental impacts. The changes have the objective to clarify inconsistencies that might have been present in the original rule or to allow the use of new testing equipment that gives more flexibility, but does not affect test results.

IV. Public Participation

EPA believes that the provisions of this action are noncontroversial since all the changes to the test procedures have been previously discussed and resolved with the Engine Manufacturers Association (EMA) and its members. Nonetheless, if public comments are to be submitted, the Agency requests that wherever applicable, full supporting data and detailed analysis should be submitted to allow EPA to make maximum use of the comments. Commentators should provide specific suggestions for any changes to any aspect of the regulations that they believe need to be modified or improved. If EPA receives adverse or critical comments regarding any specific element of this rule, EPA will withdraw those regulations for which adverse or critical comments were received. All comments should be directed to EPA Air Docket, Docket No. A–96–07. The official comment period will last for 30 days following publication of this notice.

Commentators desiring to submit proprietary information for consideration should clearly distinguish such information from other comments to the greatest extent possible, and clearly label it ''Confidential Business Information''. Submissions containing such proprietary information should be sent directly to the contact person listed above, and not to the public docket, to ensure that proprietary information is not inadvertently placed in the docket.

Information covered by such a claim of confidentiality will be disclosed by EPA only to the extent allowed and by the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, it may be made available to the public without further notice to the commentator.

V. Statutory Authority

The statutory authority for this action is granted by Sections 202, 206, 207, 208 and 301(a) of the Clean Air Act.

VI. Administrative Designation and Regulatory Analysis

Under Executive Order 12866 (58 FR 51735 (October 4, 1993)), the Agency must determine whether this regulatory action is ''significant and therefore subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order. The Order defines ''significant'' regulatory action as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, EPA believes that this action is not a ''significant'' regulatory action within the meaning of the Executive Order.

VII. Compliance With Regulatory Flexibility Act

EPA has determined that it is not necessary to prepare a regulatory flexibility analysis in connection with this final rule. In support of its proposed rule entitled *Control of Emissions of Air Pollution from Highway Heavy-Duty Engines* (61 FR 33421, June 27, 1996), EPA characterized the heavy-duty engine manufacturing industry in Chapter 3 of its Regulatory Impact Analysis (RIA). Based on that characterization, EPA has determined that these technical amendments will not have a significant impact on a substantial number of small entities.

VIII. Unfunded Mandates

Under section 202 of the Unfunded Mandates Reform Act of 1995 (''Unfunded Mandates Act''), signed into law on March 22, 1995, EPA must prepare a written statement to accompany any rule where the estimated costs to State, local, or tribal governments, or to the private sector will be $100 million or more in any one year. Under section 205, EPA must select the most cost-effective and least burdensome alternative that achieves the objective of the rule and that is consistent with statutory requirements. Section 203 requires EPA to establish a plan for informing and advising any small governments that may be significantly and uniquely impacted by the rule. EPA estimates that the costs to State, local, or tribal governments, or the private sector, from this rule will be less than $100 million.

IX. Paperwork Reduction Act

The technical amendments promulgated by this action do not create or change the information collection burden under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et. seq. The Office of Management and Budget (OMB) has previously approved the information collection requirements already contained in all the Part 86 sections amended by this action and has assigned OMB control numbers 2060–0104 and 2060–0064.

X. Submission to Congress and the General Accounting Office

Under 5 U.S.C. 801(a)(1)(A) as added by the Small Business Regulatory Enforcement Fairness Act of 1996, EPA

submitted a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives and the Comptroller General of the General Accounting Office prior to publication of this rule in today's **Federal Register**. This rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

XI. Copies of Rulemaking Documents

The preamble and regulatory language are available in the public docket as described under **ADDRESSES** above and is also available electronically on the Technology Transfer Network (TTN), which is an electronic bulletin board system (BBS) operated by EPA's Office of Air Quality Planning and Standards and via the Internet. The service is free of charge, except for the cost of the phone call.

A. Technology Transfer Network (TTN)

Users are able to access and download TTN files on their first call using a personal computer and modem per the following information.

TTN BBS: 919–541–5742 (1200–14400 bps, no parity, 8 data bits, 1 stop bit)
Voice Helpline: 919–541–5384
Also accessible via Internet: TELNET ttnbbs.rtpnc.epa.gov
Off-line: Mondays from 8:00 AM to 12:00 Noon ET

A user who has not called TTN previously will first be required to answer some basic informational questions for registration purposes. After completing the registration process, proceed through the following menu choices from the Top Menu to access information on this rulemaking.

<T> GATEWAY TO TTN TECHNICAL AREAS (Bulletin Boards)
<M> OMS—Mobile Sources Information
<K> Rulemaking & Reporting
<5> Heavy-duty/Diesel
<1> File area #1 . . . Heavy-duty Truck and Bus Standards

At this point, the system will list all available files in the chosen category in reverse chronological order with brief descriptions. To download a file, select a transfer protocol that is supported by the terminal software on your own computer, then set your own software to receive the file using that same protocol.

If unfamiliar with handling compressed (i.e. ZIP'ed) files, go to the TTN top menu, System Utilities (Command: 1) for information and the necessary program to download in order to unZIP the files of interest after downloading to your computer. After getting the files you want onto your computer, you can quit the TTN BBS with the <G>oodbye command.

Please note that due to differences between the software used to develop the document and the software into which the document may be downloaded, changes in format, page length, etc. may occur.

B. Internet

Rulemaking documents may be found on the Internet as follows:

World Wide Web: http://www.epa.gov/omswww
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List of Subjects

40 CFR Part 9

Reporting and recordkeeping requirements.

40 CFR Part 86

Environmental protection, Administrative practice and procedures, Air pollution control, Confidential business information, Gasoline, Incorporation by reference, Labeling, Motor vehicles, Motor vehicle pollution, Reporting and recordkeeping requirements.

Dated: August 18, 1997.

Carol M Browner,

Administrator.

For the reasons set forth in the preamble, parts 9 and 86 of title 40 of chapter I of the Code of Federal Regulations are amended as follows:

PART 9—[AMENDED]

1. The authority citation for part 9 continues to read as follows:

Authority: 7 U.S.C. 135 *et seq.*, 136–136y; 15 U.S.C. 2001, 2003, 2005, 2006, 2601–2671; 21 U.S.C. 331j, 346a, 348; 31 U.S.C. 9701; 33 U.S.C. 1251 *et seq.*, 1311, 1313d, 1314, 1321, 1326, 1330, 1344, 1345 (d) and (e), 1361; E.O. 11735, 38 FR 21243, 3 CFR 1971–1975 Comp. p. 973; 42 U.S.C. 241, 242b, 243, 246, 300f, 300g, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-1, 300j-2, 300j-3, 300j-4, 300j-9, 1857 *et seq.*, 6901–6992k, 7401–7671q, 7542, 9601–9657, 11023, 11048.

1a. Section 9.1 is amended in the table by adding in numerical order new entries under the center heading ''Control of Air Pollution from New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines: Certification and Test Procedures,'' to read as follows:

§ 9.1 OMB approvals under the Paperwork Reduction Act.

* * * * *

40 CFR citation	OMB control no.
* * * * *	
Control of Air Pollution From New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines: Certification and Test Procedures	
* * * * *	
86.1313–98	2060–0104
* * * * *	
86.1327–98	2060–0104
* * * * *	
86.1341–98	2060–0104
* * * * *	

PART 86—CONTROL OF AIR POLLUTION FROM NEW AND IN-USE MOTOR VEHICLES AND NEW AND IN-USE MOTOR VEHICLE ENGINES: CERTIFICATION AND TEST PROCEDURES

1b. The authority citation for part 86 is revised to read as follows:

Authority: 42 U.S.C. 7401–7671q.

2. In § 86.1 the tables in paragraphs (b)(1) and (b)(2) are amended by adding an entry for ASTM D5186–91 after ASTM E29–90, and by revising the entries for ASTM D2163–91 and ASTM D1945–91 to read as follows:

§ 86.1 Reference materials.

* * * * *

(b) * * *

(1) * * *

Document number and name	40 CFR part 86 reference
* * * * *	
ASTM D5186–91, Standard Test Method for Determination of Aromatic Content of Diesel Fuels by Supercritical Fluid Chromatography.	86.1313–91, 86.1313–94, 86.1313–98.
ASTM D2163–91, Standard Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography.	86.113–94; 86.1213–94; 86.1313–94.

Document number and name	40 CFR part 86 reference
ASTM D1945–91, Standard Test Method for Analysis of Natural Gas By Gas Chromatography.	86.113–94; 86.513–94; 86.1213–94; 86.1313–94.
(2) * * *	

Document No. and name	40 CFR part 86 reference
* * * * *	
SAE Recommended Practice J1937, November 1989, Engine Testing with Low Temperature Charge Air Cooler Systems in a Dynamometer Test Cell.	86.1330–84; 86.1330–90.

* * * * *

3. Section 86.094–8 of subpart A is amended by revising paragraph (c) to read as follows:

§ 86.094–8 Emission standards for 1994 and later model year light-duty vehicles.

* * * * *

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any 1994 and later model year Otto-cycle, or methanol-or gaseous-fueled diesel light-duty vehicle. This requirement is optional for 1994 through 1996 model year gaseous-fueled light-duty vehicles.

* * * * *

4. Section 86.094–9 of subpart A is amended by revising paragraphs (a)(1)(i) introductory text, (a)(1)(ii) introductory text, (a)(1)(iii) and (c), to read as follows:

§ 86.094–9 Emission standards for 1994 and later model year light-duty trucks.

(a) * * *

(1) * * *

(i) *Light light-duty trucks.* Exhaust emission from 1994 and later model year light light-duty trucks shall meet all standards in Tables A94–8, A94–9, A94–11 and A94–12 in the rows designated with the applicable fuel type and loaded vehicle weight, according to the implementation schedule in Tables A94–7 and A94–10 as follows (optional for 1994 through 1996 model year gaseous-fueled light light-duty trucks):

* * * * *

(ii) *Heavy light-duty trucks.* Exhaust emissions from 1994 and later model year heavy light-duty trucks shall meet all standards in Tables A94–14 and A94–15 in the rows designated with the applicable fuel type and loaded vehicle weight or adjusted loaded vehicle weight, as applicable, according to the implementation schedule in Table A94–13, as follows (optional for 1994 through 1996 model year gaseous-fueled heavy light-duty trucks):

* * * * *

(iii) Exhaust emissions of carbon monoxide from 1994 and later model year light-duty trucks shall not exceed 0.50 percent of exhaust gas flow at curb idle at a useful life of 11 years or 120,000 miles, whichever first occurs (for Otto-cycle, and methanol-and gaseous-fueled diesel light-duty trucks only—optional for 1994 through 1996 model year gaseous-fueled light-duty trucks).

* * * * *

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any 1994 and later model year light-duty truck. This requirement is optional for 1994 through 1996 model year gaseous-fueled light-duty trucks.

* * * * *

5. Section 86.094–11 of subpart A is amended by revising paragraph (b)(1) introductory text to read as follows:

§ 86.094–11 Emission standards for 1994 and later model year diesel heavy-duty engines and vehicles.

* * * * *

(b)(1) The opacity of smoke from new 1994 and later model year diesel heavy-duty engines shall not exceed (optional for 1994 through 1996 model year gaseous-fueled diesel heavy-duty engines):

* * * * *

6. Section 86.096–8 of subpart A is amended by revising paragraph (c) to read as follows:

§ 86.096–8 Emission standards for 1996 and later model year light-duty vehicles.

* * * * *

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any 1996 and later model year Otto-cycle, or methanol-or gaseous-fueled diesel light-duty vehicle. This requirement is optional for 1996 model year gaseous-fueled light-duty vehicles.

* * * * *

7. Section 86.096–11 of subpart A is amended by revising paragraphs (a) introductory text and (c) to read as follows:

§ 86.096–11 Emission standards for 1996 and later model year diesel heavy-duty engines and vehicles.

(a) Exhaust emissions from new 1996 and later model year diesel heavy-duty engines shall not exceed the following (optional for 1996 model year gaseous-fueled diesel heavy-duty engines):

* * * * *

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any new 1996 or later model year methanol-or gaseous-fueled diesel, or any naturally aspirated diesel heavy-duty engine. For petroleum-fueled engines only, this provision does not apply to engines using turbochargers, pumps, blowers, or superchargers for air induction. This provision is optional for all 1996 model year gaseous-fueled diesel heavy-duty engines, and for 1997 model year gaseous-fueled diesel heavy-duty engines using turbochargers, pumps, blowers or superchargers for air induction.

* * * * *

8. Section 86.113–94 of subpart B is amended by revising the tables after paragraphs (b)(2) and (b)(3) to read as follows:

§ 86.113–94 Fuel specifications.

* * * * *

(b) * * *

(2) * * *

Item		ASTM test method No.	Type 2–D
Cetane Number		D613	40–48
Cetane Index		D976	40–48
Distillation range:			
IBP	°F	D86	340–400
	(°C)		(171.1–204.4)
10 pct. point	°F	D86	400–460
	(°C)		(204.4–237.8)
50 pct. point	°F	D86	470–540
	(°C)		(243.3–282.2)

Item		ASTM test method No.	Type 2–D
90 pct. point	°F	D86	560–630
	(°C)		(293.3–332.2)
EP	°F	D86	610–690
	(°C)		(321.1–365.6)
Gravity	°API	D287	32–37
Total sulfur	pct.	D2622	0.03–0.05
Hydrocarbon composition:			
Aromatics, min.	pct.	D1319	27
Paraffins, Naphthenes, Olefins		D1319	(1)
Flashpoint, min.	°F	D93	130
	(°C)		(54.4)
Viscosity, centistokes		D445	2.0–3.2

[1] Remainder.

(3) * * *

Item		ASTM test method No.	Type 2–D
Cetane Number		D613	38–58
Cetane Index		D976	min. 40
Distillation range:			
90 pct. point	°F	D86	540–630
	(°C)		(282.2–343.3)
Gravity	°API	D287	30–39
Total sulfur	pct.	D2622	0.03–0.05
Flashpoint, min.	°F	D93	130
	(°C)		(54.4)
Viscosity	centistokes	D445	1.5–4.5

* * * * *

9. Section 86.119–90 of subpart B is amended by revising paragraph (b)(3) and adding paragraph (b)(8) to read as follows:

§ 86.119–90 CVS calibration.

* * * * *

(b) * * *

(3) Measurements necessary for flow calibration are as follows:

CALIBRATION DATA MEASUREMENTS

Parameter	Symbol	Units	Tolerances
Barometric pressure (corrected)	P_b	Inches Hg (kPa)	±.01 in Hg (±.034 kP_a).
Air temperature, flowmeter	ETI	°F (°C)	±.25°F (±.14°C).
Pressure depression upstream of LFE	EPI	Inches H_2O (kPa)	±.05 in H_2O (±.012 kPa).
Pressure drop across LFE matrix	EDP	Inches H_2O (kPa)	±.005 in H_2O (±.001 kPa).
Air flow	Qs	Ft^3/min. (m^3/min,)	±.5 pct.
CFV inlet depression	PPI	Inches fluid (kPa)	±.13 in fluid (±.055 kPa).
CFV outlet pressure	PPO	Inches Hg (kPa)	±0.05 in. Hg (±0.17 kPa)
Temperature at venturi inlet	T_v	°F (°C)	±0.5°F (±0.28°C).
Specific gravity of manometer fluid (1.75 oil)	Sp. Gr		

* * * * *

(8) Calculation of a parameter for monitoring sonic flow in the CFV during exhaust emissions tests:

(i) *Option 1.* (A) CFV pressure ratio. Based upon the calibration data selected to meet the criteria for paragraphs (d)(7)(iv) and (v), in which K_v is constant, select the data values associated with the calibration point with the lowest absolute venturi inlet pressure. With this set of calibration data, calculated the following CFV pressure ratio limit, $Pr_{ratio\text{-}lim}$:

$$Pr_{ratio\text{-}lim} = \frac{P_{out\text{-}cal}}{P_{in\text{-}cal}}$$

Where:

$P_{in\text{-}cal}$=Venturi inlet pressure (PPI in absolute pressure units), and

$P_{out\text{-}cal}$=Venturi outlet pressure (PPO in absolute pressure units), measured at the exit of the venturi diffuser outlet.

(B) The venturi pressure ratio ($Pr_{ratio\text{-}i}$) during all emissions tests must be less than, or equal to, the calibration pressure ratio limit ($Pr_{ratio\text{-}lim}$) derived from the CFV calibration data, such that:

$$\frac{P_{out\text{-}i}}{P_{in\text{-}i}} = Pr_{ratio\text{-}i} \leq Pr_{ratio\text{-}lim}$$

Where:

$P_{in\text{-}i}$ and $P_{out\text{-}i}$ are the venturi inlet and outlet pressures, in absolute

pressure units, at each i-th interval during the emissions test.

(ii) *Option 2.* Other methods: With prior Administrator approval, any other method may be used that assure that the venturi operates at sonic conditions during emissions tests, provided the method is based upon sound engineering principles.

* * * * *

10. Section 86.144–94 of subpart B is amended by revising paragraph (c)(8)(ii)(B) to read as follows:

§ 86.144–94 Calculations; exhaust emissions.

* * * * *

(c) * * *

(8) * * *

(ii) * * *

(B) For natural gas and liquefied petroleum gas fuel; $Density_{NMHC}$=1.1771(12.011+H/C(1.008))g/ft^3-carbon atom (0.04157(12.011+H/C(1.008))kg/m^3-carbon atom), where H/C is the hydrogen to carbon ratio of the non-methane hydrocarbon components of the test fuel, at 68°F (20°C) and 760 mm Hg (101.3 kPa) pressure.

* * * * *

11. Section 86.884–7 of subpart I is amended by revising paragraphs (a)(2)(i), (a)(3) and (a)(4) to read as follows:

§ 86.884–7 Dynamometer operation cycle for smoke emission tests.

(a) * * *

(1) * * *

(2) *Acceleration mode.* (i) The engine speed shall be increased to 200 ±50 rpm above the measured free idle speed measured at the point where the throttle begins to move from part-throttle to the full throttle position. The speed anywhere during this mode should not exceed this checkpoint speed by more than 50 rpm. The duration of this first acceleration shall be three seconds or less measured from the point where the speed first begins to increase above idle to the point where the throttle reaches full open position.

* * * * *

(3) *Lugging mode.* (i) Immediately upon the completion of the preceding acceleration mode, the dynamometer controls shall be adjusted to permit the engine to develop maximum horsepower at rated speed. This transition period shall be 50 to 60 seconds in duration. During the last 10 seconds of this period, the average engine speed shall be maintained within 50 rpm of the rated speed, and the average observed power (corrected, if necessary, to rating conditions) shall be no less than 95 percent of the maximum horsepower developed during the preconditioning prior to the smoke cycle.

(ii) With the throttle remaining in the fully open position, the dynamometer controls shall be adjusted gradually so that the engine speed is reduced to the intermediate speed. This lugging operation shall be performed smoothly over a period of 35±5 seconds. The rate of slowing of the engine shall be linear, within 100 rpm, as specified in § 86.884–13(c).

(4) *Engine unloading.* Within five seconds of completing the preceding lugging mode, the dynamometer and engine controls shall be returned to the idle position described in paragraph (a)(1) of this section. The engine must be at free idle condition within one minute after completion of the lugging mode.

* * * * *

12. Section 86.884–8 of subpart I is amended by revising paragraph (c) to read as follows:

§ 86.884–8 Dynamometer and engine equipment.

* * * * *

(c) An exhaust system with an appropriate type of smokemeter placed 10 to 32 feet from the exhaust manifold(s), turbocharger outlet(s), exhaust aftertreatment device(s), or crossover junction (on Vee engines), whichever is farthest downstream. The smoke exhaust system can share the same hardware required in part 86, subpart N, § 86.1327–84(f)(2), insofar as that hardware also meets the following smoke test requirements. The smoke exhaust system shall present an exhaust backpressure within +0.2 inch Hg of the upper limit at maximum rated horsepower, as established by the engine manufacturer in his sales and service literature for vehicle application. The following options may also be used:

(1) For engines with multiple exhaust outlets, join the exhaust outlets together into a single exhaust system and install the smokemeter 10 to 32 feet downstream from the junction of the individual exhaust outlets, or exhaust aftertreatment device(s), whichever is farthest downstream.

(2) For engines with multiple exhaust outlets, install a smokemeter in each of the exhaust pipes 10 to 32 feet downstream from each exhaust manifold, turbocharger outlet, or exhaust aftertreatment device, whichever is farthest downstream.

(3) For engines with multiple exhaust outlets, install a smokemeter on the exhaust pipe which produces the highest smoke levels 10 to 32 feet downstream from the exhaust manifold, turbocharger outlet, or exhaust aftertreatment device, whichever is farthest downstream. It may be required to make smoke measurements from other exhaust outlets if deemed appropriate by the Administrator.

(4) When utilizing an end-of-line smokemeter, the terminal two feet of the exhaust pipe used for smoke measurement shall be of a circular cross section and be free of elbows and bends. The end of the pipe shall be cut off squarely. The terminal two feet of the exhaust pipe shall have a nominal inside diameter in accordance with the engine being tested, as specified below:

Maximum Rated Horsepower	Standard Exhaust Pipe Diameter, inches (meters)
Less than 101 ..	2 (0.051)
101 to 200	3 (0.076)
201 to 300	4 (0.102)
301 to 500	5 (0.127)
501 or more	5 (0.127)[1] or 6 (0.152)[2]

[1] Applicable for on-highway engines.
[2] Applicable for nonroad engines.

(5) When utilizing an in-line smokemeter, there shall be no change in the exhaust pipe diameter within 3 exhaust pipe diameters before or after the centerline of the smokemeter optics. Within 6 exhaust pipe diameters upstream of the centerline of the smokemeter optics, no change in exhaust pipe diameter may exceed a 12 degree half-angle.

* * * * *

13. Section 86.884–9 of subpart I is amended by revising paragraphs (b)(2)(i), (b)(2)(ii), (b)(2)(iii), (b)(2)(iv), and (c)(1) to read as follows:

§ 86.884–9 Smoke measurement system.

* * * * *

(b) * * *

(2) * * *

(i) It is positioned so that a built-in light beam traverses the exhaust smoke plume at right angles to the axis of the exhaust stream.

(ii) The smokemeter light source shall be an incandescent lamp with a color temperature range of 2800K to 3250K, or a light source with a spectral peak between 550 to 570 nanometers.

(iii) The light output is collimated to a beam with a maximum diameter of 1.125 inches and an included angle of divergence within a 6° included angle.

(iv) The light detector shall be a photocell or photodiode. If the light source is an incandescent lamp, the detector shall have a spectral response similar to the photopic curve of the human eye (a maximum response in the range of 550 to 570 nanometers, to less than 4 percent of that maximum

response below 430 nanometers and above 680 nanometers).

* * * * *

(c) *Assembling equipment.* (1) The optical unit of the smokemeter shall be mounted radially to the exhaust pipe so that the measurement will be made at right angles to the axis of the exhaust plume. For an end-of-line smokemeter the distance from the optical centerline to the exhaust pipe outlet shall be 1 ±0.25 inch. The full flow of the exhaust stream shall be centered between the source and the detector apertures (or windows and lenses) and on the axis of the light beam.

* * * * *

14. Section 86.884–10 of subpart I is amended by revising paragraph (a)(8) to read as follows:

§ 86.884–10 Information.

* * * * *

(a) * * *

(8) Idle rpm.

* * * * *

15. Section 86.884–13 of subpart I is amended by revising paragraphs (b)(6)(ii) and (b)(6)(iii) to read as follows:

§ 86.884–13 Data analysis.

* * * * *

(b) * * *

(6) * * *

(ii) Average speed during the last 10 seconds shall be within ±50 rpm of rated speed.

(iii) Average observed power during the last 10 seconds shall be at least 95 percent of the horsepower developed during the preconditioning mode.

* * * * *

16. Section 86.884–14 of subpart I is revised to read as follows:

§ 86.884–14 Calculations.

(a) If the measured half-second opacity values were obtained with a smokemeter with an optical path length different than shown in the table in § 86.884–8(c), then convert the measured half-second values or the original instantaneous values to the appropriate equivalent optical path length values specified in the table. Convert the opacity values according to the following equations:

$N_s = 100 \times (1 - (1 - N_m/100)^{L_s/L_m})$

L_m and L_s must use consistent units in the above equation

Where:

N_m=Measured half-second value for conversion, percent opacity

L_m=Measuring smokemeter optical path length, meters

L_s=Standard optical path length corresponding with engine power, n

N_s=Standard half-second value, percent opacity

(b) Average the 45 readings in § 86.884–13(d)(3) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as ''A''. This is the value for the engine acceleration mode.

(c) Average the 15 readings in § 86.884–13(d)(4) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as ''B''. This is the value for the engine lugging mode.

(d) Average the 9 readings in § 86.884–13(d)(5) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as ''C''. This is the value for the peaks in either mode.

(e)(1) If multiple smokemeters were used, the half-second values for each mode from each smokemeter shall be combined and the calculated average based upon the total number of combined values.

(2) For example, if two smokemeters were used for acceleration mode data, 45 half-second values in each data set from both smokemeters would be combined to form a data set of 90 values, which would then be averaged.

17. Section 86.1008–90 of subpart K is amended by adding paragraph (a)(1)(iii) to read as follows:

§ 86.1008–90 Test procedures.

(a)(1)(i) * * *

(iii) During the testing of heavy-duty diesel engines, the manufacturer shall decide for each engine, prior to the start of the initial cold cycle, whether the measurement of background particulate is required for the cold and hot cycles to be valid. The manufacturer may choose to have different requirements for the cold and hot cycles. If a manufacturer chooses to require the measurement of background particulate, failure to measure background particulate shall void the test cycle regardless of the test results. If a test cycle is void, the manufacturer shall retest using the same validity requirements of the initial test.

* * * * *

18. Section 86.1008–96 of subpart K is amended by revising paragraph (a)(1) to read as follows:

§ 86.1008–96 Test procedures

* * * * *

(a)(1)(i) For heavy-duty engines, the prescribed test procedure is the Federal Test Procedure, as described in subparts N, I, and P of this part.

(ii) During the testing of heavy-duty diesel engines, the manufacturer shall decide for each engine, prior to the start of the initial cold cycle, whether the measurement of background particulate is required for the cold and hot cycles to be valid. The manufacturer may choose to have different requirements for the cold and hot cycles. If a manufacturer chooses to require the measurement of background particulate, failure to measure background particulate shall void the test cycle regardless of the test results. If a test cycle is void, the manufacturer shall retest using the same validity requirements of the initial test.

* * * * *

19. Section 86.1008–2001 of subpart K is amended by adding paragraph (a)(1)(iii) to read as follows:

§ 86.1008–2001 Test procedures.

(a)(1)(i) * * *

(iii) During the testing of heavy-duty diesel engines, the manufacturer shall decide for each engine, prior to the start of the initial cold cycle, whether the measurement of background particulate is required for the cold and hot cycles to be valid. The manufacturer may choose to have different requirements for the cold and hot cycles. If a manufacturer chooses to require the measurement of background particulate, failure to measure background particulate shall void the test cycle regardless of the test results. If a test cycle is void, the manufacturer shall retest using the same validity requirements of the initial test.

* * * * *

20. Section 86.1111–87 is amended by redesignating paragraph (a)(4) as paragraph (a)(5) and adding a new paragraph (a)(4) to read as follows:

§ 86.1111–87 Test procedures for PCA testing.

* * * * *

(a) * * *

(4) During the testing of heavy-duty diesel engines, the manufacturer shall decide for each engine, prior to the start of the initial cold cycle, whether the measurement of background particulate is required for the cold and hot cycles to be valid. The manufacturer may choose to have different requirements for the cold and hot cycles. If a manufacturer chooses to require the measurement of background particulate, failure to measure background particulate shall void the test cycle regardless of the test results. If a test cycle is void, the manufacturer shall retest using the same validity requirements of the initial test.

* * * * *

21. Section 86.1310–90 of subpart N is amended by revising paragraphs (b)(1)(iv)(C), (b)(3)(v), (b)(3)(vi), (b)(6)

introductory text, and (b)(7)(iv) to read as follows:

§ 86.1310–90 Exhaust gas sampling and analytical system; diesel engines.

* * * * *

(b) * * *

(1) * * *

(iv) * * *

(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. The primary dilution air shall be sampled at the inlet to the primary dilution tunnel, if unfiltered, or downstream of any primary dilution air conditioning devices, if used.

* * * * *

(3) * * *

(v) The continuous HC sampling system shall consist of a probe (which must raise the sample to the specified temperature) and, where used, a sample transfer system (which must maintain the specified temperature). The continuous hydrocarbon sampling system (exclusive of the probe) shall:

(A) Maintain a wall temperature of 464K ± 11K (191°C ± 11°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 464K ± 11K (191°C ± 11°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 judgement. 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 § 86.1310–90(b)(v)(A). Comment: It is understood that profiling of the sample line can be done under flowing conditions also as required with the probe.

(C) Maintain a gas temperature of 464K ±11K (191°C ±11°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.

(E) Increase the gas stream temperature to 464K ±11K (191°C ±11°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.

* * * * *

(6) *Particulate sampling system*. The particulate collection system must be configured in either of two ways. The single-dilution method collects a proportional sample from the primary tunnel, and then passes this sample through the collection filter. The double-dilution method collects a proportional sample from the primary tunnel, and then transfers this sample to a secondary dilution tunnel where the sample is further diluted; the double-diluted sample is then passed through the collection filter. Proportionality (i.e., mass flow ratio) between the primary tunnel flow rate and the sample flow rate must be maintained within ±5 percent. The requirements for these two systems are:

* * * * *

(7) * * *

(iv) It is recommended that the filter loading should be maximized consistent with other temperature requirements and the requirement to avoid moisture condensation. A filter pair loading of 1 mg is typically proportional to a 0.1 g/bhp-hr emission level. All particulate filters, reference filters, and background filters shall be handled in pairs during all weighing operations for emissions testing.

* * * * *

22. Section 86.1312–88 of subpart N is amended by revising paragraph (a) to read as follows:

§ 86.1312–88 Weighing chamber and microgram balance specifications.

(a) *Ambient conditions.* (1) *Temperature.* The ambient temperature of the chamber (or room) in which the particulate filters are conditioned and weighed shall be maintained at 295 K ± 3 K (22 °C ± 3 °C) during all filter conditioning and weighing.

(2) *Humidity.* The humidity of the chamber (or room) in which the particulate filters are conditioned and weighed shall be maintained at a dew point temperature of 282.5 K ± 3 K (9.4 °C ± 3 °C) and a relative humidity of 45% ±8%. Either the dew point temperature or the relative humidity or both may be averaged over the preceding 10 minute period on a moving average basis.

(3) The chamber (or room) environment shall be free of any ambient contaminates (such as dust) that would settle on the particulate filters during their stabilization. It is required that at least two unused reference filter pairs remain in the weighing room at all times in covered (to reduce dust contamination) but unsealed (to permit humidity exchange) petri dishes. These reference filter pairs shall be placed in the same general area as the sample filters. These reference filter pairs shall be weighed within 4 hours of, but preferably at the same time as, the sample filter pair weighings.

(4) If the average weight of the reference filter pairs changes between sample filter weighings by more than 40 micrograms, then all sample filters and background filters in the process of stabilization shall be discarded and the emissions tests repeated.

(5) If the room (or chamber) environmental conditions are not met, then the filters shall remain in the conditioning room for at least one hour after correct conditions are met prior to weighing.

(6) The reference filter pairs shall be changed at least once a month, but never between clean and used weighings of a given sample filter pairs. More than one set of reference filter pair may be used. The reference filters shall be the same size and material as the sample filters.

* * * * *

23. Section 86.1313–91 of subpart N is amended by revising paragraph (b)(2) including Table N91–2 to read as follows:

§ 86.1313–91 Fuel specifications.

* * * * *

(b) * * *

(2) Petroleum fuel for diesel engines meeting the specifications in Table N91–2, or substantially equivalent specifications approved by the Administrator, 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 Administrator'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 Administrator.

TABLE N91–2

Item	ASTM	Type 1–D	Type 2–D
Cetane Number	D613	48–54	42–50
Cetane Index	D86	40–54	40–48
Distillation range:			
IBP °F	D86	330–390	340–400
(°C)		(165.6–198.9)	(171.1–204.4)
10 percent point, °F	D86	370–430	400–460
(°C)		(187.8–221.1)	(204.4–237.8)
50 percent point, °F	D86	410–480	470–540
(°C)		(210–248.9)	(243.3–282.2)
90 percent point, °F	D86	460–520	560–630
(°C)		(237.8–271.1)	(293.3–332.2)
EP, °F	D86	500–560	610–690
(°C)		(260.0–293.3)	(321.1–365.6)
Gravity, °API	D287	40–44	32–37
Total Sulfur, percent	D2622	0.08–0.12	0.08–0.12
Hydrocarbon composition:			
Aromatics, pct	D1319 or D5186	[1] 8	[1] 27
Paraffins, Naphthenes, Olefins	D1319	([2])	([2])
Flashpoint, °F	D93	120	130
(°C)		(48.9)	(54.4)
(minimum)		.....	.....
Viscosity, Centistokes	D445	1.6–2.0	2.0–3.2

[1] Minimum.
[2] Remainder.

* * * * *

24. Section 86.1313–94 of subpart N is amended by revising paragraph (b)(2) including Table N94–2 to read as follows:

§ 86.1313–94 Fuel specifications.

* * * * *

(b) * * *

(2) Petroleum fuel for diesel engines meeting the specifications in Table N94–2, or substantially equivalent specifications approved by the Administrator, 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 at ''Type 1–D'' grade diesel fuel may be substituted provided that the manufacturer has submitted evidence to the Administrator demonstrating to the Administrator'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 Administrator.

TABLE N94–2

Item	ASTM	Type 1–D	Type 2–D
Cetane Number	D613	40–54	40–48
Cetane Index	D976	40–54	40–48
Distillation range:			
IBP °F	D86	330–390	340–400
(°C)		(165.6–198.9)	(171.1–204.4)
10 percent point, °F	D86	370–430	400–460
(°C)	(187.8–221.1)	(204.4–237.8)	
50 percent point, °F	D86	410–480	470–540
(°C)		(210–248.9)	(243.3–282.2)
90 percent point, °F	D86	460–520	560–630
(°C)		(237.8–271.1)	(293.3–332.2)
EP, °F	D86	500–560	610–690
(°C)		(260.0–293.3)	(321.1–365.6)
Gravity, °API	D287	40–44	32–37
Total Sulfur, percent	D2622	0.03–0.05	0.03–0.05
Hydrocarbon composition:			
Aromatics, pct	D1319 or D5186	[1] 8	[1] 27
Paraffins, Naphthenes, Olefins	D1319	([2])	([2])

TABLE N94–2—Continued

Item	ASTM	Type 1–D	Type 2–D
Flashpoint, °F	D93	120	130
(°C)		(48.9)	(54.4)
(minimum)			
Viscosity, Centistokes	D445	1.6–2.0	2.0–3.2

[1] Minimum.
[2] Remainder.

* * * * *

25. Section 86.1313–98 is added to subpart N to read as follows:

§ 86.1313–98 Fuel specifications.

Section 86.1313–98 includes text that specifies requirements that differ from § 86.1313–94. Where a paragraph in § 86.1313–94 is identical and applicable to § 86.1313–98, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.1313–94''.

(a) through (b)(1) [Reserved]. For guidance see § 86.1313–94.

(b)(2) Petroleum fuel for diesel engines meeting the specifications in Table N98–2, or substantially equivalent specifications approved by the Administrator, 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 at ''Type 1–D'' grade diesel fuel may be substituted provided that the manufacturer has submitted evidence to the Administrator demonstrating to the Administrator'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 Administrator.

TABLE N98–2

Item	ASTM	Type 1–D	Type 2–D
Cetane Number	D613	40–54	40–48
Cetane Index	D976	40–54	40–48
Distillation range:			
IBP °F	D86	330–390	340–400
(°C)		(165.6–198.9)	(171.1–204.4)
10 percent point, °F	D86	370–430	400–460
(°C)		(187.8–221.1)	(204.4–237.8)
50 percent point, °F	D86	410–480	470–540
(°C)		(210–248.9)	(243.3–282.2)
90 percent point, °F	D86	460–520	560–630
(°C)		(237.8–271.1)	(293.3–332.2)
EP, °F	D86	500–560	610–690
(°C)		(260.0–293.3)	(321.1–365.6)
Gravity, °API	D287	40–44	32–37
Total Sulfur, percent	D2622	0.03–0.05	0.03–0.05
Hydrocarbon composition:			
Aromatics, pct	D5186	[1] 8	[1] 27
Paraffins, Naphthenes, Olefins	D1319	([2])	([2])
Flashpoint, °F	D93	120	130
(°C)		(48.9)	(54.4)
(minimum)			
Viscosity, Centistokes	D445	1.6–2.0	2.0–3.2

[1] Minimum.
[2] Remainder.

(b)(3) through (e) [Reserved]. For guidance see § 86.1313–94.

26. Section 86.1316–90 of subpart N is amended by revising paragraph (b)(1) and adding paragraph (f) to read as follows:

§ 86.1316–90 Calibrations; frequency and overview.

* * * * *

(b) * * *

(1) Calibrate the hydrocarbon analyzer, carbon dioxide analyzer, carbon monoxide analyzer, oxides of nitrogen analyzer, methanol analyzer and formaldehyde analyzer (certain analyzers may require more frequent calibration depending on the equipment and use). New calibration curves need not be generated each month if the existing curve meets the requirements of §§ 86.1321 through 86.1324.

* * * * *

(f) *For diesel fuel testing only.* The carbon monoxide analyzer shall be calibrated at least every two months or after any maintenance which could alter calibration.

27. Section 86.1316–94 of subpart N is amended by revising paragraph (b)(1) and adding paragraph (f) to read as follows:

§ 86.1316–94 Calibrations; frequency and overview.

* * * * *

(b) * * *

(1) Calibrate the hydrocarbon analyzer, carbon dioxide analyzer, carbon monoxide analyzer, and oxides of nitrogen analyzer (certain analyzers may require more frequent calibration depending on the equipment and use).

New calibration curves need not be generated each month if the existing curve meets the requirements of §§ 86.1321 through 86.1324.

* * * * *

(f) For diesel fuel testing only. The carbon monoxide analyzer shall be calibrated at least every two months or after any maintenance which could alter calibration.

28. Section 86.1319–84 of subpart N is amended by revising paragraph (d)(3) and adding paragraph (d)(8) to read as follows:

§ 86.1319–84 CVS calibration.

* * * * *

(d) * * *

(3) Measurements necessary for flow calibration are as follows:

CALIBRATION DATA MEASUREMENTS

Parameter	Symbol	Units	Tolerances
Barometric pressure (corrected)	P_b	Inches Hg (kPa)	±.01 in Hg (±.034 kPa).
Air temperature, flowmeter	ETI	°F (°C)	±.25 °F (±.14 °C).
Pressure depression upstream of LFE	EPI	Inches H2O (kPa)	±.05 in H2O (±.012 kPa).
Pressure drop across LFE matrix	EDP	Inches H2O (kPa)	±.005 in H2O (±.001 kPa).
Air flow	Q_s	Ft^3/min. (m^3/min,)	±.5 pct.
CFV inlet depression	PPI	Inches fluid (kPa)	±.13 in fluid (±.055 kPa).
CFV outlet pressure	PPO	Inches Hg (kPa)	±.05 in Hg (±0.17 kPa).
Temperature at venturi inlet	T_v	°F (°C)	±0.5 °F (±0.28 °C).
Specific gravity of manometer fluid (1.75 oil)	Sp. Gr		

* * * * *

(8) Calculation of a parameter for monitoring sonic flow in the CFV during exhaust emissions tests:

(i) *Option 1.* (A) CFV pressure ratio. Based upon the calibration data selected to meet the criteria for paragraphs (d)(7)(iv) and (v) of this section, in which K_v is constant, select the data values associated with the calibration point with the lowest absolute venturi inlet pressure. With this set of calibration data, calculated the following CFV pressure ratio limit, $Pr_{ratio\text{-}lim}$:

$$Pr_{ratio\text{-}lim} = \frac{P_{out\text{-}cal}}{P_{in\text{-}cal}}$$

where:

$P_{in\text{-}cal}$=Venturi inlet pressure (PPI in absolute pressure units), and

$P_{out\text{-}cal}$=Venturi outlet pressure (PPO in absolute pressure units), measured at the exit of the venturi diffuser outlet.

(B) The venturi pressure ratio ($Pr_{ratio\text{-}i}$) during all emissions tests must be less than, or equal to, the calibration pressure ratio limit ($Pr_{ratio\text{-}lim}$) derived from the CFV calibration data, such that:

$$\frac{P_{out\text{-}i}}{P_{in\text{-}i}} = Pr_{ratio\text{-}i} \leq Pr_{ratio\text{-}lim}$$

Where:

$P_{in\text{-}i}$ and $P_{out\text{-}i}$ are the venturi inlet and outlet pressures, in absolute pressure units, at each i-th interval during the emissions test.

(ii) *Option 2.* Other methods: With prior Administrator approval, any other method may be used that assure that the venturi operates at sonic conditions during emissions tests, provided the method is based upon sound engineering principles.

* * * * *

29. Section 86.1319–90 of subpart N is amended by revising paragraph (d)(3) and adding paragraph (d)(8) to read as follows:

§ 86.1319–90 CVS calibration.

* * * * *

(d) * * *

(3) Measurements necessary for flow calibration are as follows:

CALIBRATION DATA MEASUREMENTS

Parameter	Symbol	Units	Sensor-readout tolerances
Barometric pressure (corrected)	P_b	in Hg (kPa)	±.01 in Hg (±.034 kPa).
Air temperature, into flowmeter	ETI	°F(°C)	±0.5 °F (±0.28 °C).
Pressure drop between the inlet and throat of metering venturi	EDP	Inches H2O (kPa)	±0.05 in H_2O (±0.012 kPa).
Air flow	Q_s	Ft^3/min. (m^3/min,)	±.5% of NBS ''true'' value
CFV inlet depression	PPI	Inches fluid (kPa)	±.13 in fluid (±.055 kPa).
CFV outlet pressure	PPO	Inches Hg (kPa)	±.05 in Hg (±.17 kPa).
Temperature at venturi inlet	T_v	°F (°C)	±4.0 °F (±2.22 °C).
Specific gravity of manometer fluid (1.75 oil)	Sp. Gr		

* * * * *

(8) Calculation of a parameter for monitoring sonic flow in the CFV during exhaust emissions tests:

(i) *Option 1.* (A) CFV pressure ratio. Based upon the calibration data selected to meet the criteria for paragraphs (d)(7)(iv) and (v) of this section, in which K_v is constant, select the data values associated with the calibration point with the lowest absolute venturi inlet pressure. With this set of calibration data, calculated the following CFV pressure ratio limit, $Pr_{ratio\text{-}lim}$:

$$Pr_{ratio\text{-}lim} = \frac{P_{out\text{-}cal}}{P_{in\text{-}cal}}$$

Where:

$P_{in\text{-}cal}$=Venturi inlet pressure (PPI in absolute pressure units), and

$P_{out\text{-}cal}$=Venturi outlet pressure (PPO in absolute pressure units), measured at the exit of the venturi diffuser outlet.

(B) The venturi pressure ratio ($Pr_{ratio\text{-}i}$) during all emissions tests must be less than, or equal to, the calibration pressure ratio limit ($Pr_{ratio\text{-}lim}$) derived from the CFV calibration data, such that:

$$\frac{P_{out\text{-}i}}{P_{in\text{-}i}} = Pr_{ratio\text{-}i} \leq Pr_{ratio\text{-}lim}$$

Where:

P_{in-i} and P_{out-i} are the venturi inlet and outlet pressures, in absolute pressure units, at each i-th interval during the emissions test.

(ii) *Option 2.* Other methods: With prior Administrator approval, any other method may be used that assure that the venturi operates at sonic conditions during emissions tests, provided the method is based upon sound engineering principles.

* * * * *

30. Section 86.1321–90 of subpart N is amended by revising paragraphs (a) and (b)(3) to read as follows:

§ 86.1321–90 Hydrocarbon analyzer calibration.

* * * * *

(a) *Initial and periodic optimization of detector response.* Prior to introduction into service and at least annually thereafter, the FID hydrocarbon analyzer shall be adjusted for optimum hydrocarbon response.

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 86.1314) and zero-grade air.

(2) Optimize the FID's response on the most common operating range. The response is to be optimized with respect to fuel pressure or flow while meeting the analyzer response time given in § 86.1310(b)(3)(vii)(A) for continuous HC measurement. Efforts shall be made to minimize response variations to different hydrocarbon species that are expected to be in the exhaust. Good engineering judgement is to be used to trade off optimal FID response to propane-in-air against reductions in relative responses to other hydrocarbons. A good example of trading off response on propane for relative responses to other hydrocarbon species is given in Society of Automotive Engineers (SAE) Paper No. 770141, ''Optimization of Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts''; author Glenn D. Reschke. It is also required that the response be set to optimum condition with respect to air flow and sample flow. Heated Flame Ionization Detectors (HFIDs) must be at their specified operating temperature.

(3) One of the following procedures is to be used for FID or HFID optimization:

(i) Use the procedures outlined in Society of Automotive Engineers (SAE) paper No. 770141, ''Optimization of Flame Ionization Detector for Determination of Hydrocarbons in Diluted Automobile Exhaust''; author, Glenn D. Reschke, as an example.

(ii) The HFID optimization procedures outlined in 40 CFR part 86, subpart D, § 86.331–79(c).

(iii) Alternative procedures may be used if approved in advance by the Administrator.

(iv) The procedures specified by the manufacturer of the FID or HFID.

(4) After the optimum fuel, air, and sample pressures or flow rates have been determined, they shall be recorded for future reference.

(b) * * *

(3) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, propane-in-air calibration gases (e.g., 15, 30, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent of the value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated by using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit non-linear equation which represents the data within these limits shall be used to determine concentration values.

* * * * *

31. Section 86.1321–94 of subpart N is amended by revising paragraphs (a) and (b)(3) to read as follows:

§ 86.1321–94 Hydrocarbon analyzer calibration.

* * * * *

(a) Initial and periodic optimization of detector response. Prior to introduction into service and at least annually thereafter, the FID hydrocarbon analyzer shall be adjusted for optimum hydrocarbon response.

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 86.1314) and zero-grade air.

(2) Optimize the FID's response on the most common operating range. The response is to be optimized with respect to fuel pressure or flow while meeting the analyzer response time given in § 86.1310(b)(3)(vii)(A) for continuous HC measurement. Efforts shall be made to minimize response variations to different hydrocarbon species that are expected to be in the exhaust. Good engineering judgement is to be used to trade off optimal FID response to propane-in-air against reductions in relative responses to other hydrocarbons. A good example of trading off response on propane for relative responses to other hydrocarbon species is given in Society of Automotive Engineers (SAE) Paper No. 770141, ''Optimization of Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts''; author Glenn D. Reschke. It is also required that the response be set to optimum condition with respect to air flow and sample flow. Heated Flame Ionization Detectors (HFIDs) must be at their specified operating temperature.

(3) One of the following procedures is to be used for FID or HFID optimization:

(i) Use the procedures outlined in Society of Automotive Engineers (SAE) paper number 770141, ''Optimization of Flame Ionization Detector for Determination of Hydrocarbons in Diluted Automobile Exhaust''; author, Glenn D. Reschke, as an example. Available from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA 15096–0001.

(ii) The procedure listed in subpart D, § 86.331–79(c) of this part.

(iii) The procedures specified by the manufacturer of the FID or HFID.

(iv) Alternative procedures may be used if approved in advance by the Administrator.

(4) After the optimum fuel, air and sample pressures or flow rates have been determined, they shall be recorded for future reference.

(b) * * *

(3) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, propane-in-air calibration gases (e.g., 15, 30, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent of the value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated by using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit non-linear equation which represents the data within these limits shall be used to determine concentration values.

* * * * *

32. Section 86.1322–84 of subpart N is amended by revising paragraph (b)(3) to read as follows:

§ 86.1322–84 Carbon monoxide analyzer calibration.

* * * * *

(b) * * *

(3) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, carbon monoxide-in-N_2 calibration gases (e.g., 15, 30, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent of the

value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated by using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit not-linear equation which represents the data within these limits shall be used to determine concentration values.

* * * * *

33. Section 86.1323–84 of subpart N is amended by revising paragraph (b)(3) to read as follows:

§ 86.1323–84 Oxides of nitrogen analyzer calibration.

* * * * *

(b) * * *

(3) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, NO-in-N_2 calibration gases (e.g., 15, 30, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent of the value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit non-linear equation which represents the data within these limits shall be used to determine concentration values.

* * * * *

34. Section 86.1324–84 of subpart N is amended by revising paragraph (c) to read as follows:

§ 86.1324–84 Carbon dioxide analyzer calibration.

* * * * *

(c) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, carbon dioxide-in-N_2 calibration or span gases (e.g., 15, 30, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent or less of the value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated by using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit non-linear equation which represents the data within these limits shall be used to determine concentration values.

* * * * *

35. Section 86.1325–94 of subpart N is amended by revising paragraph (c) to read as follows:

§ 86.1325–94 Methane analyzer calibration.

* * * * *

(c) Calibrate on each used operating range with a minimum of 6, approximately equally spaced, CH4 in air calibration gases (e.g., 15, 40, 45, 60, 75, and 90 percent of that range). For each range calibrated, if the deviation from a least-squares best-fit straight line is within ±2 percent of the value at each non-zero data point and within ±0.3 percent of full scale on the zero data point, then concentration values may be calculated by using the linear calibration equation for that range. If the deviation exceeds these limits, then the best-fit non-linear equation which represents the data within these limits shall be used to determine concentration values.

36. Section 86.1327–90 of subpart N is amended by revising paragraphs (b), (f)(1), (f)(2) introductory text and (f)(2)(i) to read as follows:

§ 86.1327–90 Engine dynamometer test procedures; overview.

* * * * *

(b) Engine torque and rpm command set points shall be issued at 5 (10 Hz recommended) Hz or greater during both the cold and hot start tests. Feedback engine torque and rpm shall be recorded at least once every second during the test.

* * * * *

(f) * * *

(1) *Gasoline-fueled and methanol-fueled Otto-cycle engines.* A chassis-type exhaust system shall be used. For all catalyst systems, the distance from the exhaust manifold flange(s) to the catalyst shall be the same as in the vehicle configuration unless the manufacturer provides data showing equivalent performance at another location. The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(2) *Petroleum-fueled and methanol-fueled diesel engines.* Either a chassis-type or a facility-type exhaust system or both systems simultaneously may be used. If the engine is equipped with an exhaust aftertreatment device, the exhaust pipe must be the same diameter as found in-use for at least 4 pipe diameters upstream to the inlet of the beginning of the expansion section containing the aftertreatment device. The exhaust backpressure or restriction shall follow the same criteria as in § 86.1330–90(f) and may be set with a valve (muffler omitted). The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(i) The engine exhaust system shall meet the following requirements:

(A) The total length of the tubing from the exit of the engine exhaust manifold, turbocharger outlet or aftertreatment device to the primary dilution tunnel shall not exceed 32 feet (9.8 m).

(B) The initial portion of the exhaust system may consist of a typical in-use (i.e., length, diameter, material, etc.) chassis-type exhaust system.

(C) The distance from the exhaust manifold flange(s) or turbocharger outlet to any exhaust aftertreatment device shall be the same as in the vehicle configuration or within the distance specifications provided by the manufacturer.

(D) For engines which are not equipped with exhaust aftertreatment devices, all tubing in excess of 12 feet (3.7 m) from the exit of the turbocharger or exhaust manifold shall be insulated. For engines equipped with exhaust aftertreatment devices, all tubing after the aftertreatment device which is in excess of 12 feet (3.7 m) shall be insulated.

(E) If the tubing is required to be insulated, the radial thickness of the insulation must be at least 1.0 inch (25 mm). The thermal conductivity of the insulating material must have a value no greater than 0.75 BTU-in/hr/ft^2/°F (0.065 W/m-K) measured at 700 °F (371 °C).

(F) A smoke meter or other instrumentation may be inserted into the exhaust system tubing. If this option is exercised in the insulated portion of the tubing, then a minimal amount of tubing not to exceed 18 inches may be left uninsulated. However, no more than 12 feet (3.66 m) of tubing can be left uninsulated in total, including the length at the smoke meter.

* * * * *

37. Section 86.1327–94 of subpart N is amended by revising paragraphs (b), (f)(1), (f)(2) introductory text and (f)(2)(i) to read as follows:

§ 86.1327–94 Engine dynamometer test procedures; overview.

* * * * *

(b) Engine torque and rpm command set points shall be issued at 5 (10 Hz recommended) Hz or greater during both the cold and hot start tests. Feedback engine torque and rpm shall be recorded at least once every second during the test.

* * * * *

(f) * * *

(1) *Otto-cycle engines.* A chassis-type exhaust system shall be used. For all catalyst systems, the distance from the exhaust manifold flange(s) to the catalyst shall be the same as in the

vehicle configuration unless the manufacturer provides data showing equivalent performance at another location. The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(2) *Diesel engines.* Either a chassis-type or a facility-type exhaust system or both systems simultaneously may be used. If the engine is equipped with an exhaust aftertreatment device, the exhaust pipe must be the same diameter as found in-use for at least 4 pipe diameters upstream to the inlet of the beginning of the expansion section containing the aftertreatment device. The exhaust backpressure or restriction shall follow the same criteria as in § 86.1330–90 (f) and may be set with a valve (muffler omitted). The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(i) The engine exhaust system shall meet the following requirements:

(A) The total length of the tubing from the exit of the engine exhaust manifold, turbocharger outlet or aftertreatment device to the primary dilution tunnel shall not exceed 32 feet (9.8 m).

(B) The initial portion of the exhaust system may consist of a typical in-use (i.e., length, diameter, material, etc.) chassis-type exhaust system.

(C) The distance from the exhaust manifold flange(s) or turbocharger outlet to any exhaust aftertreatment device shall be the same as in the vehicle configuration or within the distance specifications provided by the manufacturer.

(D) For engines which are not equipped with exhaust aftertreatment devices, all tubing in excess of 12 feet (3.7 m) from the exit of the turbocharger or exhaust manifold shall be insulated. For engines equipped with exhaust aftertreatment devices, all tubing after the aftertreatment device which is in excess of 12 feet (3.7 m) shall be insulated.

(E) If the tubing is required to be insulated, the radial thickness of the insulation must be at least 1.0 inch (25 mm). The thermal conductivity of the insulating material must have a value no greater than 0.75 BTU-in/hr/ft^2/°F (0.065 W/m–K) measured at 700 °F (371 °C).

(F) A smoke meter or other instrumentation may be inserted into the exhaust system tubing. If this option is exercised in the insulated portion of the tubing, then a minimal amount of tubing not to exceed 18 inches may be left uninsulated. However, no more than 12 feet (3.66 m) of tubing can be left uninsulated in total, including the length at the smoke meter.

* * * * *

38. Section 86.1327–96 of Subpart N is amended by revising paragraphs (b), (f)(1), (f)(2) introductory text, and (f)(2)(i) to read as follows:

§ 86.1327–96 Engine dynamometer test procedures; overview.

* * * * *

(b) Engine torque and rpm command set points shall be issued at 5 (10 Hz recommended) Hz or greater during both the cold and hot start tests. Feedback engine torque and rpm shall be recorded at least once every second during the test.

* * * * *

(f) * * *

(1) *Gasoline-fueled and methanol-fueled Otto-cycle engines.* A chassis-type exhaust system shall be used. For all catalyst systems, the distance from the exhaust manifold flange(s) to the catalyst shall be the same as in the vehicle configuration unless the manufacturer provides data showing equivalent performance at another location. The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(2) Petroleum-fueled and methanol-fueled diesel engines. Either a chassis-type or a facility-type exhaust system or both systems simultaneously may be used. If the engine is equipped with an exhaust aftertreatment device, the exhaust pipe must be the same diameter as found in-use for at least 4 pipe diameters upstream to the inlet of the beginning of the expansion section containing the aftertreatment device. The exhaust backpressure or restriction shall follow the same criteria as in § 86.1330–90(f) and may be set with a valve (muffler omitted). The catalyst container may be removed during all test sequences prior to the practice cycle, and replaced with an equivalent container having an inactive catalyst support.

(i) The engine exhaust systems shall meet the following requirements:

(A) The total length of the tubing from the exit of the engine exhaust manifold, turbocharger outlet or aftertreatment device to the primary dilution tunnel shall not exceed 32 feet (9.8 m).

(B) The initial portion of the exhaust system may consist of a typical in-use (i.e., length, diameter, material, etc.) chassis-type exhaust system.

(C) The distance from the exhaust manifold flange(s) or turbocharger outlet to any exhaust aftertreatment device shall be the same as in the vehicle configuration or within the distance specifications provided by the manufacturer.

(D) For engines which are not equipped with exhaust aftertreatment devices, all tubing in excess of 12 feet (3.7 m) from the exit of the turbocharger or exhaust manifold shall be insulated. For engines equipped with exhaust aftertreatment devices, all tubing after the aftertreatment device which is in excess of 12 feet (3.7 m) shall be insulated.

(E) If the tubing is required to be insulated, the radial thickness of the insulation must be at least 1.0 inch (25 mm). The thermal conductivity of the insulating material must have a value no greater than 0.75 BTU-in/hr/ft^2/°F (0.065 W/m–K) measured at 700 °F (371 °C).

(F) A smoke meter or other instrumentation may be inserted into the exhaust system tubing. If this option is exercised in the insulated portion of the tubing, then a minimal amount of tubing not to exceed 18 inches may be left uninsulated. However, no more than 12 feet (3.66 m) of tubing can be left uninsulated in total, including the length at the smoke meter.

* * * * *

39. Section 86.1327–98 is added to subpart N to read as follows:

§ 86.1327–98 Engine dynamometer test procedures; overview.

Section 86.1327–98 includes text that specifies requirements that differ from § 86.1327–96. Where a paragraph in § 86.1327–96 is identical and applicable to § 86.1327–98, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.1327–96''.

(a) through (d)(3) [Reserved]. For guidance see § 86.1327–96.

(d)(4) Additional accessories (e.g., oil cooler, alternators, air compressors, etc.) may be installed or their loading simulated if typical of the in-use application. This loading shall be parasitic in nature and, if used, shall be applied during all engine testing operations, including mapping. The accessory work performed shall not be included in the integrated work used in emissions calculations.

(d)(5) through (f) [Reserved]. For guidance see § 86.1327–96.

40. Section 86.1330–84 of subpart N is amended by revising paragraphs (b)(1), (b)(2), and (f)(1)(i) and adding paragraph (b)(5) to read as follows:

§ 86.1330–84 Test sequence; general requirements.

* * * * *

(b) * * *

(1) The temperature of the CVS dilution air shall be maintained above 68 °F (20 °C) for Otto cycle engines and between 68 °F and 86 °F (20 °C and 30 °C) for diesel cycle engines throughout the test sequence, except as permitted by § 86.1335–84.

(2) For engines with auxiliary emission control devices which sense or detect ambient air temperature and operate at 68 °F or higher, the test cell ambient air temperature and the temperature of the engine intake air shall be maintained at 77 °F ±9 °F (25 °C ±5 °C) throughout the test sequence. For engines with auxiliary emission control devices which are temperature dependent and operate at 68 °F or higher, the temperature of the engine intake air shall be maintained at 77 °F ±9 °F (25 °C ±5 °C) throughout the test sequence.

* * * * *

(5) For engines equipped with an air-to-air intercooler (or any other low temperature charge air cooling device) between the turbocharger compressor and the intake manifold, the procedure for simulating the device in the transient dynamometer test facilities shall follow the SAE Recommended Practice J1937, ''Engine Testing with Low Temperature Charge Air Cooling System in a Dynamometer Test Cell.''

* * * * *

(f) *Diesel-Fueled Engines only.* (1)(i) Air inlet restriction shall be set to a value midway between a clean filter and the maximum restriction specified by the manufacturer. The exhaust restriction normally shall be set at 80 percent of the manufacturer's recommended maximum specified exhaust restriction. The manufacturer shall be liable for emission compliance from the minimum in-use restrictions to the maximum restrictions specified by the manufacturer for that particular engine.

* * * * *

41. Section 86.1330–90 of subpart N is amended by revising paragraphs (b)(1), (b)(2), and (f)(1)(i) and adding paragraph (b)(5) to read as follows:

§ 86.1330–90 Test sequence; general requirements.

* * * * *

(b) * * *

(1) The temperature of the CVS dilution air shall be maintained at greater than 68 °F (20 °C) for Otto cycle engines and between 68 °F and 86 °F (20 °C and 30 °C) for diesel cycle engines throughout the test sequence, except as permitted by § 86.1335–84.

(2) For engines with auxiliary emission control devices which sense or detect ambient air temperature and operate at 68 °F or higher, the test cell ambient air temperature and the temperature of the engine intake air shall be maintained at 77 °F ±9 °F (25 °C ±5 °C) throughout the test sequence. For engines with auxiliary emission control devices which are temperature dependent and operate at 68 °F or higher, the temperature of the engine intake air shall be maintained at 77 °F ±9 °F (25 °C ±5 °C) throughout the test sequence.

* * * * *

(5) For engines equipped with an air-to-air intercooler (or any other low temperature charge air cooling device) between the turbocharger compressor and the intake manifold, the procedure for simulating the device in the transient dynamometer test facilities shall follow the SAE Recommended Practice J1937, ''Engine Testing with Low Temperature Charge Air Cooling System in a Dynamometer Test Cell.''

* * * * *

(f) *Petroleum-fueled and methanol-fueled diesel engines.* (1)(i) Air inlet restriction shall be set to a value midway between a clean filter and the maximum restriction specified by the manufacturer. The exhaust restriction normally shall be set at 80 percent of the manufacturer's recommended maximum specified exhaust restriction. The manufacturer shall be liable for emission compliance from the minimum in-use restrictions to the maximum restrictions specified by the manufacturer for that particular engine.

* * * * *

42. Section 86.1333–90 of subpart N is amended by revising paragraphs (c), (d) introductory text, (d)(1), (d)(2), (e)(2) and removing paragraphs (d)(3) and (d)(4) to read as follows:

§ 86.1333–90 Transient test cycle generation.

* * * * *

(c) Engine speed and torque shall be recorded at least once every second during the cold start test and hot start test. The torque and rpm feedback signals may be filtered.

(d) *Idle Speed Enhancement Devices (e.g. cold idle, alternator idle, etc.).* The zero percent speed specified in the engine dynamometer schedules (appendix I (f)(1), (f)(2), or (f)(3) to this part) shall be superseded by proper operation of the engine's idle speed enhancement device.

(1) During idle speed enhancement device operation, a manual transmission engine shall be allowed to idle at whatever speed is required to target a feedback torque equal to zero (using, for example, clutch disengagement, speed to torque control switching, software overrides, etc.) at those points in appendix I (f)(1), (f)(2), or (f)(3) to this part where both reference speed and reference torque are zero percent values. For each idle segment that is seven seconds or longer, the average feedback torque must be within ±10 ft-lbs of zero. To allow for transition, up to the first four seconds may be deleted from each idle segment calculation.

(2) During idle speed enhancement device operation, an automatic transmission engine shall be allowed to idle at whatever speed is required to target a feedback torque equal to CITT (see (e)(2) of this section for definition of CITT) at those points in appendix I (f)(1), (f)(2), or (f)(3) to this part where both reference speed and reference torque are zero percent values. For each idle segment that is seven seconds or longer, the average feedback torque must be within ±10 ft-lbs of CITT. To allow for transition, up to the first four seconds may be deleted from each idle segment calculation.

(e) * * *

(2) All zero-percent speed, zero-percent torque points (idle points) shall be modified to zero percent speed, Curb Idle Transmission Torque (CITT), except as permitted in § 86.1337–90(a)(9). Also, all points with speed equal to or less than zero percent and torque less than CITT shall be modified to CITT. Motoring torque shall remain unchanged. In order to provide a smooth torque transition, all consecutive torque points that are between 0 and CITT shall be changed to CITT if the first of these is preceded or the last of these is succeeded by idle points. The manufacturer's specified CITT shall be based upon that value observed in typical applications at the mean of the manufacturers' specified idle speed range at stabilized temperature conditions.

* * * * *

43. Section 86.1334–84 of subpart N is amended by revising paragraph (a)(2) to read as follows:

§ 86.1334–84 Pre-test engine and dynamometer preparation.

(a) * * *

(2) Following any practice runs or calibration procedures, the engine shall be cooled per § 86.1335–90.

44. Section 86.1335–90 of subpart N is revised to read as follows:

§ 86.1335–90 Cool-down procedure.

(a) This cool-down procedure applies to Otto-cycle and diesel engines.

(b) Engines may be soaked at ambient conditions. No substances or fluids may

be applied to the engine's internal or external surfaces except for water and air as prescribed in paragraphs (c) and (d) of this section.

(c) For water-cooled engines, two types of cooling are permitted:

(1) Water may be circulated through the engine's water coolant system.

(i) The coolant may be flowed in either direction and at any desired flow rate. The thermostat may be removed or blocked open during the cool-down but must be restored before the exhaust emissions test begins.

(ii) The temperature of the circulated or injected water shall be at least 10 °C (50 °F). In addition, the temperature of the cooling water shall not exceed 30 °C (86 °F) during the last 30 minutes of the cool-down.

(iii) Only water, including the use of a building's standard water supply, or the coolant type that is already in the engine (per § 86.1327–90(e)) is permitted for cool-down purposes.

(2) Flows of air may be directed at the exterior of the engine.

(i) The air shall be directed essentially uniformly over the exterior surface of the engine at any desired flow rate.

(ii) The temperature of the cooling air shall not exceed 86 °F (30 °C) during the last 30 minutes of the cool-down, but may be less than 68 °F (20 °C) at any time.

(d) For air-cooled engines, only cooling as prescribed in paragraph (c)(2) of this section is permitted.

(e)(1) The cold cycle exhaust emission test may begin after a cool-down only when the engine oil and water temperatures are stabilized between 68 °F and 86 °F (20 °C and 30 °C) for a minimum of fifteen minutes.

(i) These temperature measurements are to be made by temperature measurement devices immersed in the sump oil and in the thermostat housing or cylinder head cooling circuit, the sensor parts of which are not in contact with any engine surface.

(ii) The flow of oil and water shall be shut off during this measurement. Air flow, except as necessary to keep the cell temperature between 68 °F and 86 °F (20 °C and 30 °C), shall be shut off. No engine oil change is permitted during the test sequence.

(2) Direct cooling of engine oil through the use of oil coolers or heat exchangers is permitted. The cold cycle emission test may begin only when the requirements in paragraph (e)(1)(ii) are met.

(3) Any other means for the direct cooling of the engine oil must be approved in advance by the Administrator.

(f)(1) The cold cycle exhaust emission test for engines equipped with exhaust aftertreatment devices may begin after a cool-down only when the aftertreatment device is 77 °F ±9 °F (25 °C ±5 °C), in addition to the temperature restrictions in paragraph (e) of this section. For catalysts, this temperature must be measured at the outlet of the catalyst bed.

(2) Exhaust aftertreatment device cool-down may be accomplished in whatever manner and using whatever coolant deemed appropriate by proper engineering judgment. The aftertreatment device, engine, and exhaust piping configurations shall not be separated, altered, or moved in any way during the cool-down.

(g) For engines with auxiliary emission control devices which are temperature dependent, the cold start shall not begin until the temperature readings of the auxiliary emission control devices are stable at 77 °F ±9 °F (25 °C ±5 °C).

(h) At the completion of the cool-down all of the general requirements specified in § 86.1330, the oil temperature specification set forth in paragraph (e) of this section, and the catalyst temperature specifications in paragraph (f) of this section must be met before the cold cycle exhaust emission test may begin.

45. Section 86.1337–90 of subpart N is amended by revising paragraphs (a)(9), (a)(10)(i), (a)(10)(ii), (a)(11), (a)(13), (a)(23), and (a)(26), and by removing paragraph (a)(10)(iii), to read as follows:

§ 86.1337–90 Engine dynamometer test run.

(a) * * *

(9) As soon as it is determined that the engine is started, start a ''free idle'' timer. Allow the engine to idle freely with no-load for 24 ±1 seconds. This idle period for automatic transmission engines may be interpreted as an idle speed in neutral or park. All other idle conditions shall be interpreted as an idle speed in gear. It is permissible to lug the engine down to curb idle speed during the last 8 seconds of the free idle period for the purpose of engaging dynamometer control loops.

(10) * * *

(i) During diesel particulate sampling it must be demonstrated that the ratio of main tunnel flow to particulate sample flow does not change by more than ±5.0 percent of its set point value (except for the first 10 seconds of sampling).

Note: For double dilution operation, sample flow is the net difference between the flow rate through the sample filters and the secondary dilution air flow rate.

(ii) Record the average temperature and pressure at the gas meter(s) or flow instrumentation inlet, where needed to calculate flow. If the set flow rate cannot be maintained because of high particulate loading on the filter, the test shall be terminated. The test shall be rerun using a lower flow rate and/or a larger diameter filter.

(11) Begin the transient engine cycles such that the first non-idle record of the cycle occurs at 25 ±1 seconds. The free idle time is included in the 25 ±1 seconds.

* * * * *

(13) Immediately after the engine is turned off, turn off the engine cooling fan(s) if used, and the CVS blower (or disconnect the exhaust system from the CVS). As soon as possible, transfer the ''cold start cycle'' exhaust and dilution air bag samples to the analytical system and process the samples according to § 86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analysis of the methanol and formaldehyde samples shall be obtained within 24 hours of the end of the sample collection period. For petroleum-fueled and methanol-fueled diesel engines, carefully remove the filter holder from the sample flow apparatus, and remove each particulate sample filter from its holder and invert the secondary filter and place it stain side to stain side on top of the primary filter. Place the filter pair in a petri dish and cover.

* * * * *

(23) Allow the engine to idle freely with no-load for 24 ±1 seconds. The provisions and interpretations of paragraph (a)(9) of this section apply.

* * * * *

(26) As soon as possible, transfer the ''hot start cycle'' exhaust and dilution air bag samples to the analytical system and process the samples according to § 86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analyze the methanol and formaldehyde samples within 24 hours. (If it is not possible to perform analysis within 24 hours, the samples should be stored in a cold (approximately 0°C) dark environment until analysis can be performed). For petroleum-fueled and methanol-fueled diesel engines, carefully remove the assembled filter holder from the sample flow lines and remove each particulate sample filter from its holder and invert the secondary filter and place it stain side to stain side on top of the primary filter. Place the filter pairs in a clean petri dish and

cover as soon as possible. Within 1 hour after the end of the hot start phase of the test, transfer the particulate filters to the weighing chamber for post-test conditioning.

* * * * *

46. Section 86.1337–96 of subpart N is amended by revising paragraphs (a)(9), (a)(10)(i), (a)(10)(ii), (a)(11), (a)(13), (a)(23), and (a)(26), and by removing paragraph (a)(10)(iii) to read as follows:

§ 86.1337–96 Engine dynamometer test run.

(a) * * *

(9) As soon as it is determined that the engine is started, start a ''free idle'' timer. Allow the engine to idle freely with no-load for 24±1 seconds. This idle period for automatic transmission engines may be interpreted as an idle speed in neutral or park. All other idle conditions shall be interpreted as an idle speed in gear. It is permissible to lug the engine down to curb idle speed during the last 8 seconds of the free idle period for the purpose of engaging dynamometer control loops.

(10) * * *

(i) During diesel particulate sampling it must be demonstrated that the ratio of main tunnel flow to particulate sample flow does not change by more than ±5.0 percent of its set point value (except for the first 10 seconds of sampling). For double dilution operation, sample flow is the net difference between the flow rate through the sample filters and the secondary dilution air flow rate.

(ii) Record the average temperature and pressure at the gas meter(s) or flow instrumentation inlet, where needed to calculate flow. If the set flow rate cannot be maintained because of high particulate loading on the filter, the test shall be terminated. The test shall be rerun using a lower flow rate and/or a larger diameter filter.

(11) Begin the transient engine cycles such that the first non-idle record of the cycle occurs at 25±1 seconds. The free idle time is included in the 25±1 seconds.

* * * * *

(13) Immediately after the engine is turned off, turn off the engine cooling fan(s) if used, and the CVS blower (or disconnect the exhaust system from the CVS). As soon as possible, transfer the ''cold start cycle'' exhaust and dilution air bag samples to the analytical system and process the samples according to § 86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analysis of the methanol and formaldehyde samples shall be obtained within 24 hours of the end of the sample collection period. For petroleum-fueled and methanol-fueled diesel engines, carefully remove the filter holder from the sample flow apparatus, remove each particulate sample filter from its holder and invert the secondary filter and place it stain side to stain side on top of the primary filter. Place the filter pair in a petri dish and cover.

* * * * *

(23) Allow the engine to idle freely with no-load for 24±1 seconds. The provisions and interpretations of paragraph (a)(9) of this section apply.

* * * * *

(26) As soon as possible, transfer the ''hot start cycle'' exhaust and dilution air bag samples to the analytical system and process the samples according to § 86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analyze the methanol and formaldehyde samples within 24 hours. (If it is not possible to perform analysis within 24 hours, the samples should be stored in a cold (approximately 0 °C) dark environment until analysis can be performed). For petroleum-fueled and methanol-fueled diesel engines, carefully remove the assembled filter holder from the sample flow lines and remove each particulate sample filter from its holder and invert the secondary filter and place it stain side to stain side on top of the primary filter. Place the filter pairs in a clean petri dish and cover as soon as possible. Within 1 hour after the end of the hot start phase of the test, transfer the particulate filters to the weighing chamber for post-test conditioning.

* * * * *

47. Section 86.1338–84 of subpart N is revised to read as follows:

§ 86.1338–84 Emission measurement accuracy.

(a) *Measurement accuracy—Bag sampling.* (1) Good engineering practice dictates that exhaust emission sample analyzer readings below 15 percent of full scale chart deflection should generally not be used.

(2) Some high resolution read-out systems such as computers, data loggers, etc., can provide sufficient accuracy and resolution below 15 percent of full scale. Such systems may be used provided that additional calibrations of at least 4 non-zero nominally equally spaced points, using good engineering judgement, below 15 percent of full scale are made to ensure the accuracy of the calibration curves.

(3) The following procedure shall be followed:

(i) Span the analyzer using a calibration gas that meets the accuracy requirements of § 86.1314–84(f)(2), is within the operating range of the analyzer and at least 90% of full scale.

(ii) Generate calibration data over the full concentration range at a minimum of 6, approximately equally spaced, points (e.g. 15, 30, 45, 60, 75 and 90 percent of the range of concentrations provided by the gas divider). If a gas divider or blender is being used to calibrate the analyzer and the requirements of paragraph (a)(2) of this section are met, verify that a second calibration gas with a concentration between 10 and 20 percent of full scale can be named within 2 percent of its certified concentration. If more calibration points are needed to meet the requirements of paragraph (a)(2) of this section, continue with paragraph (a)(3)(iii) of this section.

(iii) If a gas divider or blender is being used to calibrate the analyzer, input the value of a second calibration gas (a span gas may be used for calibrating a CO_2 analyzer) having a named concentration between 10 and 20 percent of full scale. This gas shall be included on the calibration curve. Continue adding calibration points by dividing this gas until the requirements of paragraph (a)(2) of this section are met.

(iv) Fit a calibration curve per §§ 86.1321 through 86.1324 for the full scale range of the analyzer using the calibration data obtained with both calibration gases.

(b) *Measurement accuracy—Continuous sampling.* (1) Analyzers used for continuous analysis must be operated such that the measured concentration falls between 15 and 100 percent of full scale chart deflection. Exceptions to these limits are:

(i) Analyzer response less than 15 percent or more than 100 percent of full scale may be used if automatic range change circuitry is used and the limits for range changes are between 15 and 100 percent of full scale chart deflection;

(ii) Analyzer response less than 15 percent of full scale may be used if one of the following is true:

(A) Alternative (a)(2) of this section is used to ensure that the accuracy of the calibration curve is maintained below 15 percent; or

(B) The full scale value of the range is 155 ppm (C) or less.

(iii) Analyzer response over 100% of full scale may be used if it can be shown that readings in this range are accurate.

(iv) The HC and CO readings are allowed to ''spike'' above full scale of the analyzer's maximum operating range for a maximum accumulation of 5

seconds. These analyzer readings shall default to the maximum readable value during this time.

(c) If a gas divider is used, the gas divider shall conform to the accuracy requirements specified in § 86.1314–84(g), and shall be used according to the procedures contained in (a) and (b) of this section.

48. Section 86.1339–90 of subpart N is revised to read as follows:

§ 86.1339–90 Particulate filter handling and weighing.

(a) At least 1 hour before the test, place a filter pair in a closed (to eliminate dust contamination) but unsealed (to permit humidity exchange) petri dish and place in a weighing chamber meeting the specifications of § 86.1312 for stabilization.

(b) At the end of the stabilization period, weigh each filter pair on a balance having a precision of 20 micrograms and a readability of 10 micrograms. This reading is the tare weight of the filter pair and must be recorded (see § 86.1344(e)(18)).

(c) The filter pair shall then be stored in a covered petri dish or a sealed filter holder, either of which shall remain in the weighing chamber until needed for testing.

(d) If the filter pair is not used within 1 hour of its removal from the weighing chamber, it must be re-weighed before use. This limit of 1 hour may be replaced by an 8-hour limit if either of the following three conditions are met:

(1) A stabilized filter pair is placed and kept in a sealed filter holder assembly with the ends plugged; or

(2) A stabilized filter pair is placed in a sealed filter holder assembly, which is then immediately placed in a sample line through which there is no flow; or

(3) A combination of the conditions specified in paragraphs (d) (1) and (2) of this section.

(e) After the emissions test, remove the filters from the filter holder and place them face to face in a covered but unsealed petri dish. They must then be conditioned in the weighing chamber for at least one hour. The filters are then weighed as a pair. This reading is the gross weight of the filters (Pf) and must be recorded (see § 86.1344–90(e)(19)).

(f) The net particulate weight (Pf) on each filter pair is the gross weight minus the tare weight. Should the sample on the filters (exhaust or background) contact the petri dish or any other surface, the test is void and must be rerun.

(g) Static neutralizers shall be used on petri dishes in accordance with good engineering judgement.

49. Section 86.1341–90 of subpart N is amended by revising paragraphs (b), (c) and (d) and removing paragraphs (e) through (h) to read as follows:

§ 86.1341–90 Test cycle validation criteria.

(a) * * *

(b) *Brake horsepower-hour calculation.* (1) Calculate the brake horsepower-hour for each pair of engine feedback speed and torque values recorded. Also calculate the reference brake horsepower-hour for each pair of engine speed and torque reference values. Calculations shall be to five significant digits.

(2) In integrating the reference and the feedback horsepower-hour, all negative torque values shall be set equal to zero and included. If integration is performed at a frequency of less than 5 Hz, and if during a given time segment, the torque value changes from positive to negative or negative to positive, then the negative portion must be computed by linear interpolation and set equal to zero and the positive portion included. The same methodology shall be used for integrating both reference and actual brake horsepower-hour.

(c) *Regression line analysis to calculate validation statistics.* (1) Linear regressions of feedback value on reference value shall be performed for speed, torque and brake horsepower on 1 Hz data after the feedback shift has occurred (see paragraph (a) of this section). The method of least squares shall be used, with the best fit equation having the form:

$y=mx+b$

Where:

y = The feedback (actual) value of speed (rpm), torque (ft-lbs), or brake horsepower.

m = Slope of the regression line.

x = The reference value (speed, torque, or brake horsepower).

b = The y-intercept of the regression line.

(2) The standard error of estimate (SE) of y on x and the coefficient of determination (r^2) shall be calculated for each regression line.

(3) For a test to be considered valid, the criteria in Figure N90–11 must be met for both cold and hot cycles individually. Point deletions from the regression analyses are permitted where noted in Figure N90–11.

FIGURE N90–11

	Speed	Torque	BHP
Regression Line Tolerances			
Petroleum-fueled and methanol-fueled diesel engines			
Standard error of estimate (SE) of Y on X.	100 rpm	13 pct. of power map maximum engine torque	8 pct. of power map maximum BHP.
Slope of the regression line, m	0.970 to 1.030	0.83–1.03 (hot), 0.77–1.03 (cold)	0.89–1.03 (hot), 0.87–1.03 (cold).
Coefficient of determination, r^2	[1] 0.9700	[1] 0.8800 (hot), [1] 0.8500 (cold)	[1] 0.9100.
Y intercept of the regression line, b	±50 rpm	±15 ft-lb	±5.0 BHP.
Gasoline-fueled and methanol-fueled Otto-cycle engines			
Standard error of estimate (SE) of Y on X.	100 rpm	10% (hot), 11% (cold) of power map max. engine torque.	5% (hot), 6% (cold) of power map maximum BHP.
Slope of the regression line, m	0.980 to 1.020	0.92–1.03 (hot), 0.88–1.03 (cold)	0.93–1.03 (hot), 0.89–1.03 (cold).
Coefficient of determination, r^2	[1] 0.9700	[1] 0.9300 (hot), [1] 0.9000 (cold)	[1] 0.9400 (hot), [1] 0.9300 (cold).
Y intercept of the regression line, b	±25 (hot), ±40 (cold)	±4% (hot), ±5 (cold) of power map max. engine torque.	±2.0% (hot), ±2.5% (cold) of power map BHP.

[1] Minimum.

PERMITTED POINT DELETIONS FROM REGRESSION ANALYSIS

Condition	Points to be deleted
1. Wide Open Throttle and Torque Feedback < Torque Reference	Torque, and/or BHP.
2. Closed Throttle, Not an Idle Point, Torque Feedback > Torque Reference	Torque, and/or BHP.
3. Closed Throttle, Idle Point, and Torque Feedback = CITT (±10 ft-lb)	Speed, and/or BHP.

For the purposes of this discussion:

An Idle Point is defined as a point having a Normalized Reference Torque of 0 and a Normalized Reference Speed of 0 and an engine tested as having a manual transmission has a CITT of 0. Point deletion may be applied either to the whole or to any part of the cycle.

(4)(i) For petroleum-fueled and methanol-fueled diesel engines, the integrated brake horsepower-hour for each cycle (cold and hot start) shall be between −15 percent and +5 percent of the integrated brake horsepower-hour for the reference cycle, or the test is void.

(ii) For gasoline-fueled and methanol-fueled Otto-cycle engines, the integrated brake horsepower-hour of the feedback cycle shall be within 5 percent of the integrated brake horsepower-hour of the reference cycle for the cold cycle, or the test is void. The tolerance for the hot cycle shall be 4 percent.

(5) If a dynamometer test run is determined to be statistically or experimentally void, corrective action shall be taken. The engine shall then be allowed to cool (naturally or forced) and the dynamometer test rerun per § 86.1337 or be restarted at § 86.1336–84(e).

(d) For petroleum-fueled and methanol-fueled diesel engines, all reference torque values specified (in paragraph (f)(2) of appendix I to this part) as ''closed throttle'' shall be deleted from the calculation of cycle torque and power validation statistics.

50. Section 86.1341–98 is added to subpart N and reads as follows:

§ 86.1341–98 Test cycle validation criteria.

Section 86.1341–98 includes text that specifies requirements that differ from § 86.1341–90. Where a paragraph in § 86.1341–90 is identical and applicable to § 86.1341–98, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.1341–90''

(a) Through (b)(2) [Reserved]. For guidance see § 86.1341–90.

(b)(3) All feedback torques due to accessory loads, either actual or simulated as defined in § 86.1327–90 (d)(4), shall be excluded from both cycle validation and the integrated work used for emissions calculations.

(4) For reference idle portions of the cycle where CITT is not applied, use measured torque values for cycle validation and the reference torque values for calculating the brake horsepower-hour value used in the emission calculations. For reference idle portions of the cycle where CITT is applied, use measured torque values for cycle validation and calculating the brake horsepower-hour value used in the emission calculations.

(c) Through (d) [Reserved]. For guidance see § 86.1341–90.

51. Section 86.1342–90 of subpart N is amended by removing paragraphs (h)(2)(i), (h)(2)(ii), (h)(2)(iii), (h)(2)(iv), (h)(2)(v), (h)(2)(vi), (h)(2)(vii) and adding paragraph (i) to read as follows:

§ 86.1342–90 Calculations; exhaust emissions.

* * * * *

(i) For dilute sampling systems which require conversion of as-measured dry concentrations to wet concentrations, the following equation shall be used for any combination of bagged, continuous, or fuel mass-approximated sample measurements (except for CO measurements made through conditioning columns, as explained in paragraph (d)(3) of this section):

Wet concentration = $K_w \times$ dry concentration.

Where:

(1)(i) For English units,

$K_w = 1 - (\alpha/200) \times CO_{2e}(') - ((1.608 \times H)/(7000 + 1.608 \times H))$

See paragraph (d)(1) of this section for α values.

(ii) For SI units,

$K_w = 1 - (\alpha/200) \times CO_{2e}(') - ((1.608 \times H)/(1000 + 1.608 \times H))$

See paragraph (d)(1) of this section for α values.

(2) $CO_{2e}(')$ = either CO_{2e} or CO_{2e}' as applicable.

(3)(i) H = Absolute humidity of the CVS dilution air, in grains (grams) of water per lb (kg) of dry air.

(ii) For English units,

$H' = [(43.478)R_i' \times P_d']/[P_B - (P_d' \times R_i'/100)]$

(iii) For SI units,

$H' = [(6.211)R_i' \times P_d']/[P_B - (P_d' \times R_i'/100)]$

(4) R_i = Relative humidity of the CVS dilution air, in percent.

(5) P_d = Saturated vapor pressure, in mm Hg (kPa) at the ambient dry bulb temperature of the CVS dilution air.

(6) P_B = Barometric pressure, mm Hg (kPa).

52. Section 86.1342–94 is amended by revising paragraphs (e) through (h) and adding paragraph (i) to read as follows:

§ 86.1342–94 Calculations; exhaust emissions.

* * * * *

(e) Through (i) [Reserved]. For guidance see § 86.1342–90.

53. Section 86.1343–88 is amended by revising the introductory text of paragraph (b), redesignating paragraphs (b)(2)(i) through (b)(2)(v) as paragraphs (b)(2)(ii) through (b)(2)(vi) respectively and by adding a new paragraph (b)(2)(i) to read as follows:

§ 86.1343–88 Calculations; particulate exhaust emissions.

* * * * *

(b) The mass of particulate for the cold-start test and the hot-start test is determined from the following equation:

* * * * *

(2)(i)(A) For a CFV–CVS: V_{mix} = Total dilute exhaust volume corrected to standard conditions (293 °K (20 °C) and 101.3 kPa (760 mm Hg)), cubic feet per test phase.

(B) For a PDP–CVS:

$$V_{mix} = V_o \times \frac{N(P_B - P_4)(528^\circ R)}{(760 mmHg)(T_p)},$$

in SI units,

$$V_{mix} = V_o \times \frac{N(P_B - P_4)(293^\circ K)}{(101.3 kPa)(T_p)},$$

Where:

* * * * *

[1] Closed throttle motoring.

[1]

53. Appendix I to part 86 is amended by revising the footnote to the table in paragraph (f)(2) to read as follows:

Appendix I to Part 86—Urban Dynamometer Schedules

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(f)(1) * * *
(2) * * *

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