DEPARTMENT OF THE TREASURY

Office of the Secretary

Advisory Committee to the National Center for State and Local Law Enforcement Training; Meeting

The Treasury Advisory Committee on State and Local Law Enforcement Training will hold its first meeting on Tuesday and Wednesday, December 6 and 7, 1983 in Building 262, room S-9, at the Federal Law Enforcement Training Center (FLETC), Glynco, Georgia.

The purpose of the meeting will be to acquaint the Advisory Committee members with current programs being offered to the state and local law enforcement community and to obtain advice and counsel in present and future course offerings.

The agenda for December 6 includes a briefing and a tour of the FLETC facility. Also, co-chairman of the Advisory Committee and members of the FLETC staff will be introduced. There will be a presentation describing the history of the National Center and current state and local law enforcement training programs. Presentations for December 7 include the role of the Advisory Committee, programs under development, and a discussion of other committee matters.

The meeting will be open to the public. Approximately 100 seats will be available for the public and the media on a first-come first-served basis.

Interested persons may address their inquiries to Mr. John Dooher, Treasury Advisory Committee on State and Local Law Enforcement Training, Room 4211 Federal Building, 1200 Pennsylvania Avenue, NW., Washington, D.C. 20226, (202) 566-2951.

Approved: November 9, 1983

John M. Walker, Jr.,

Assistant Secretary, Enforcement and Operations.

[FR Doc. 83-30641 Filed 11-15-83; 8:45 am]

BILLING CODE 2001-01-M

Fiscal Service

[Dept. Circ. 570, 1983 Rev., Supp. No. 9]

Surety Companies Acceptable on Federal Bonds; Cal-Farm Insurance Company

A certificate of authority as an acceptable surety on Federal bonds is hereby issued to the following company under Sections 9304 to 9308 Title 31 of the United States Code. An underwriting limitation of $3,197,000 has been established for the company.

Name of Company:

Cal-Farm Insurance Company

Business Address:

1601 Exposition Boulevard, Sacramento, California 95815

State of Incorporation:

California

Certificates of authority expire on June 30 each year, unless renewed prior to that date or sooner revoked. The certificates are subject to subsequent annual renewal so long as the companies remain qualified (31 CFR Part 223). A list of qualified companies is published annually as of July 1 in Department Circular 570, with details as to underwriting limitations, areas in which licensed to transact surety business and other information. Federal bond-approving officers should annotate their reference copies of the Treasury Circular 570, 1983 Revision, at page 30531 to reflect this addition. Copies of the circular, when issued, may be obtained from the Operations Staff, Banking and Cash Management, Department of the Treasury, Washington, DC 20226.

Dated: November 8, 1983.

D. H. McGrath, Jr.,

Acting Commissioner.

[FR Doc. 83-30872 Filed 11-15-83; 8:45 am]

BILLING CODE 4810-35-M

[Dept. Circ. 570, 1983 Rev., Supp. No. 10]

Surety Companies Acceptable on Federal Bonds; Erie Insurance Company

A certificate of authority as an acceptable surety on Federal bonds is hereby issued to the following company under Sections 9304 to 9308 Title 31 of the United States Code. An underwriting limitation of $473,000 has been established for the company.

Name of Company:

Erie Insurance Company

Business Address:

100 Erie Insurance Place, Erie, Pennsylvania 16530

State of Incorporation:

Pennsylvania

Certificates of authority expire on June 30, each year, unless renewed prior to that date or sooner revoked. The certificates are subject to subsequent annual renewal so long as the companies remain qualified (31 CFR Part 223). A list of qualified companies is published annually as of July 1 in Department Circular 570, with details as to underwriting limitations, areas in which licensed to transact surety business and other information. Federal bond-approving officers should annotate their reference copies of the Treasury Circular 570, 1983 Revision, at page 30532 to reflect this addition. Copies of the circular, when issued, may be obtained from the Operations Staff, Banking and Cash Management, Department of the Treasury, Washington, D.C. 20226.

Dated: November 8, 1983.

D. H. McGrath, Jr.,

Acting Commissioner.

[FR Doc. 83-30874 Filed 11-15-83; 8:45 am]

BILLING CODE 4810-35-M

[Dept. Circ. 570, 1983 Rev., Supp. No. 8]

Surety Companies Acceptable on Federal Bonds; Industrial Indemnity Company of the Northwest

A certificate of authority as an acceptable surety on Federal bonds is hereby issued to the following company under Sections 9304 to 9308 Title 31 of the United States Code. An underwriting limitation of $295,000 has been established for the company.

Name of Company:

Industrial Indemnity Company of the Northwest

Business Address:

2121 Fourth Avenue, Suite 1500, Seattle, Washington 98121

State of Incorporation:

Washington

Certificates of authority expire on June 30 each year, unless renewed prior to that date or sooner revoked. The certificates are subject to subsequent annual renewal so long as the companies remain qualified (31 CFR Part 223). A list or qualified companies is published annually as of July 1 in Department Circular 570, with details as to the underwriting limitations, areas in which licensed to transact surety business and other information. Federal bond-approving officers should annotate their reference copies of the Treasury Circular 570, 1983 Revision, at page 30535 to reflect this addition. Copies of the circular, when issued, may be obtained from the Operations Staff, Banking and Cash Management, Department of the Treasury, Washington, D.C. 20226.

Dated: November 8, 1983.

D. H. McGrath, Jr.,

Acting Commissioner.

[FR Doc. 83-30875 Filed 11-15-83; 8:45 am]

BILLING CODE 4810-35-M

[Dept. Circ. 570, 1983 Rev., Supp. No. 7]

Surety Companies Acceptable on Federal Bonds; St. Paul Mercury Insurance Company

A certificate of authority as an acceptable surety on Federal bonds is hereby issued to the following company under Sections 9304 to 9308 Title 31 of the United States Code. An underwriting limitation of $2,019,000 has been established for the company.

Name of Company:

St. Paul Mercury Insurance Company

Business Address:

385 Washington Street, St. Paul, Minnesota 55102

State of Incorporation:
Minnesota

Certificates of authority expire on June 30 each year, unless renewed prior to that date or sooner revoked. The certificates are subject to subsequent annual renewal so long as the companies remain qualified (31 CFR Part 223). A list of qualified companies is published annually as of July 1 in Department Circular 570, with details as to underwriting limitations, areas in which licensed to transact surety business and other information. Federal bond-approving officers should annotate their reference copies of the Treasury Circular 570, 1983 Revision, at page 30540 to reflect this addition. Copies of the circular, when issued, may be obtained from the Operations Staff, Banking and Cash Management, Department of the Treasury, Washington, DC 20226.

Dated: October 31, 1983.

W. E. Douglas,

Commissioner.

[FR Doc. 83-30873 Filed 11-15-83; 8:45 am]

BILLING CODE 4810-35-M

VETERANS ADMINISTRATION

National Cemetery Bath, New York; Development of Six Acres; Finding of no Significant Impact

The Veterans Administration (VA) has assessed the potential environmental impacts that may occur as a result of the proposed donation of land to the VA for the purpose of expanding the National Cemetery at Bath, New York, and has determined that the potential environmental impacts will be minimal from the development of this project.

The project is the acquisition and development of six acres of land at Bath National Cemetery through donation by the American Legion. The land is contiguous to the north boundary of the existing cemetery and will be developed for burial as needed.

Development of the project will cause minor short term impacts in the form of air pollution (dust and fumes) and soil erosion during construction operations. The VA will adhere to all applicable Federal, State, and local environmental regulations during construction and operation of this project.

The significance of the identified impacts has been evaluted relative to the considerations of both context and intensity so defined by the Council on Environmental Quality, 40 CFR 1508.27.

The Environmental Assessment has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) Regulations 1501.3 and 1508.9. A Finding of No Significant Impact has been reached based on the information in the assessment. The results of the assessment are available for public examination at the Veterans Administration, Washington, D.C. Persons wishing to examine a copy of the document may do so at the following office: Mr. William F. Sullivan, Director, Office of Environmental Affairs (088C), Room 423, Veterans Administration, 811 Vermont Avenue, NW., Washington, D.C. 20420, (202) 389-3316. Questions or requests for single copies of the Environmental Assessment may be addressed to the above office.

Dated: November 8, 1983.

By direction of the Administrator.

Everett Alvarez, Jr.,

Deputy Administrator.

[FR Doc. 83-30819 Filed 11-15-83; 8:45 am]

BILLING CODE 8320-01-M

Agency Forms Under OMB Review

AGENCY: Veterans Administration.

ACTION: Notice.

The Veterans Administration has submitted to OMB for review the following proposals for the collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35). This document contains proposed extensions and revisions and lists the following information: (1) The department or staff office issuing the form; (2) The title of the form; (3) The agency form number, if applicable; (4) How often the form must be filled out; (5) Who will be required or asked to report; (6) An estimate of the number of responses; (7) An estimate of the total number of hours needed to fill out the form; and (8) An indication of whether section 3504(h) of Public Law 96-511 applies.

ADDRESSES: Copies of the proposed forms and supporting documents may be obtained form Patricia Viers, Agency Clearance Officer (004A2), Veterans Administration, 810 Vermont Avenue, NW, Washington, DC 20420, (202) 389-2146. Comments and questions about the items on this list should be directed to the VA's OMB Desk Officer, Dick Eisenger, Office of Management and Budget, 726 Jackson Place, NW, Washington, DC 20503, (202) 395-6880.

DATES: Comments on the forms should be directed to the OMB Desk Officer on or before January 16, 1984.

Dated: November 10, 1983.

By direction of the Administrator.

Dominick Onorato,

Associate Deputy Administrator for Information Resources Management.

Extension

1. Department of Veterans Benefits.
2. Request for Employment Report in Connection with a Claim for Disability Insurance Benefits.
3. Va Form Letter 29-30a.
4. On occasion.
5. Individuals or households.
6. 8,400 responses.
7. 2,100 hours.
8. Not applicable.

Revisions

1. Department of Veterans Benefits.
2. Claim for Monthly Payments of United States Government Life Insurance.
3. VA Form 29-4125k.
4. On occasion.
5. Individuals or households.
6. 1,080 responses.
7. 270 hours.
8. Not applicable.

1. Department of Veterans Benefits.
2. Application for Reinstatement (Non-medical Insurance Age 50 and Under).
3. VA Form 29-353a.
4. On occasion.
5. Individuals or households.
6. 1,500 responses.
7. 500.
8. Not applicable.

[FR Doc. 83-30880 Filed 11-15-83; 8:45 am]

BILLING CODE 8320-01-M

Sunshine Act Meetings

Federal Register
Vol. 48, No. 222
Wednesday, November 16, 1983

This section of the FEDERAL REGISTER contains notices of meetings published under the "Government in the Sunshine Act" (Pub. L. 94-409) 5 U.S.C. 552b(e)(3).

CONTENTS

1

FEDERAL RESERVE SYSTEM

TIME AND DATE: 10 a.m., Monday, November 21, 1983.

PLACE: 20th Street and Constitution Avenue NW., Washington, D.C. 20551.

STATUS: Closed.

MATTERS TO BE CONSIDERED:

1. Federal Reserve Bank and Branch director appointments. (This matter was originally announced for a meeting on November 17, 1983.)
2. Proposed purchase of computers within the Federal Reserve System.
3. Personnel actions (appointments, promotions, assignments, reassignments, and salary actions) involving individual Federal Reserve System employee.
4. Any items carried forward from a previously announced meeting.

CONTACT PERSON FOR MORE INFORMATION: Mr. Joseph R. Coyne, Assistant to the Board (202) 452–3204.

Dated: November 10, 1983.

James McAfee,

Associate Secretary of the Board.

[S-1597-83 Filed 11-10-83; 4:07 pm]

BILLING CODE 6210-01-M

2

NUCLEAR REGULATORY COMMISSION

DATE: Thursday, November 17, 1983 and Week of November 21, 1983.

PLACE: Commissioner's Conference Room, 1717 H Street NW., Washington, D.C.

STATUS: Open and closed.

MATTERS DISCUSSED: *Thursday, November 17:*

9:30 a.m.
Briefing on State of the Nuclear Industry (SESE) (Public Meeting) (As Announced)
10:30 a.m.
Briefing on State of the Nuclear Industry (USC) (Public Meeting) (As Announced)
1:30 p.m.
Meeting with ACRS (Public Meeting) (As Announced)
3:00 p.m.
Affirmation/Discussion and Vote (Public Meeting) (Items Revised):
a. Final Immediate Effectiveness Order for San Onofre 2 and 3 (*Postponed* from November 10)

Week of November 21: Tuesday, November 22:

10:00 a.m.
Discussion of Stockpiling of Potassium Iodide for Public Use (Public Meeting)
2:00 p.m.
Briefing on Status of Low Level Waste Compacts (Public Meeting)

Wednesday, November 23:

11:30 a.m.
Affirmation/Discussing and Vote (Public Meeting):
a. Review of ALAB–729 and Review of ALAB–744 (*Tentative*) (*Postponed* from November 17)

TO VERIFY THE STATUS OF MEETINGS: Call (Recording)—(202) 634–1498.

CONTACT PERSON FOR MORE INFORMATION: Walter Magee (202) 634–1410.

Dated: November 14, 1983.

Walter Magee,

Office of the Secretary.

[S-1600-83 Filed 11-14-83; 3:56 pm]

BILLING CODE 7590-01-M

Wednesday
November 16, 1983

Part II

Environmental Protection Agency

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86

[AMS-FRL 2416-8]

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Gaseous Emission Regulations for 1985 and Later Model Year Light-Duty Trucks, Gaseous and Evaporative Emission Regulations for 1985 and Later Model Year Heavy-Duty Engines, and Emission Regulations for 1978 and Later Model Year Motorcycles

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This document announces the Environmental Protection Agency's decisions on gaseous and evaporative emissions from 1985 and later model year light-duty trucks and heavy-duty engines. It also includes a number of revisions to certification and testing requirements as well as other technical amendments. In taking these actions, EPA finalizes earlier proposed rules and responds to a petition from General Motors. Implementation will result in emission reductions by 1995 and should mean a capital savings to the industry and the nation.

DATES: These regulations take effect on December 16, 1983.

Note.—Under Section 307(b)(1) of the Clean Air Act, EPA hereby finds that these regulations are of national applicability. Accordingly, judicial review of this action is available only by the filing of a petition for review in the United States Court of Appeals for the District of Columbia Circuit within 60 days of publication. Under Section 307(b)(2) of the Act, the requirements which are the subject of today's notice may not be challenged later in judicial proceedings brought by EPA to enforce these requirements.

ADDRESSES: Material relevant to this final rule is contained in Public Docket Nos. A-81-11, A-81-20, and OMSAPC 79-1 at the U.S. EPA Central Docket Section. The dockets are located in the West Tower Lobby, Gallery 1, at 401 M Street, S.W., Washington, D.C. 20460, (202) 382-7548. The dockets may be inspected between 8 a.m. and 4 p.m. on weekdays, and a reasonable fee may be charged for photocopying. In addition, free single copies of both EPA's Regulatory Support Document (containing environmental, economic, and useful-life analyses), and the Summary and Analysis of Comments, will be made available through: Director, Emission Control Technology Division, Environmental Protection Agency, 2565 Plymouth Rd., Ann Arbor, Michigan 48105 (Attention: Heavy-Duty Section).

FOR FURTHER INFORMATION CONTACT: Mr. Glenn W. Passavant, Emission Control Technology Division, U.S. Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, MI 48105, (313) 668-4408.

SUPPLEMENTARY INFORMATION: OMB Control Number: 2000-0390.

I. Extended Summary

This notice is comprised of four major components and a number of other lesser elements. The major components are:

1. A 2-year revision (1985-86) of the heavy-duty gasoline engine hydrocarbon (HC) and carbon monoxide (CO) emission standards from the statutory levels to 2.5 grams per brake horsepower-hour (g/BHP-hr) HC and 40.0 g/BHP-hr CO measured on the EPA test cycle or 1.9 g/BHP-hr HC and 37.1 g/BHP-hr CO measured on the Motor Vehicle Manufacturers Association (MVMA) test cycle. Heavy-duty diesel engine emission standards remain at the statutory levels.

2. Implementation of a "split-class" approach for 1987 and later model year heavy-duty gasoline engine HC and CO emission standards. Under this approach, heavy-duty gasoline engines used in heavy-duty vehicles of 14,000 lbs. gross vehicle weight or less will meet the statutory standards of 1.1 g/BHP-hr HC and 14.4 g/BHP-hr CO on the Motor Vehicle Manufacturers Association test cycles and heavy-duty gasoline engines used in vehicles exceeding 14,000 lbs. gross vehicle weight will continue to meet the standards set for 1985.

3. A new test cycle for heavy-duty gasoline engines. For 1985 and 1986, manufacturers will have the option of using either the new cycle (the MVMA cycle) or the original cycle developed by EPA, with appropriate specified adjustments in emission standards. For 1987 and beyond, all new testing will be done using only the MVMA cycle.

4. Modifications to the full-life useful-life provisions for 1985 and later model year light-duty trucks and heavy-duty engines. Among other things, these modifications establish full-life periods for various vehicle and engine categories as follows:

Category	Full-life useful life
Light-Duty Trucks	11 years/120,000 miles.
Heavy-Duty Gasoline Engines	8 years/110,000 miles.
Light Heavy-Duty Diesel Engines	8 years/110,000 miles.
Medium Heavy-Duty Diesel Engines.	8 years/185,000 miles.
Heavy Heavy-Duty Diesel Engines.	8 years/290,000 miles.

In addition to these provisions, today's action contains a number of elements involving revisions to certification and testing requirements and a number of less significant changes and technical amendments. EPA is adding spark plug and exhaust gas recirculation allowable-maintenance intervals for heavy-duty gasoline engines certified to use leaded fuel, and is revising downward the turbocharger and injector allowable-maintenance intervals for heavy-duty diesel engines. The idle CO standard for heavy-duty gasoline engines is delayed until 1987, at which time it will be applied only to heavy-duty gasoline vehicles using catalysts. EPA is also revising the deterioration factor requirements for heavy-duty engines to allow the use of additive deterioration factors unless aftertreatment control technology is used, in which case multiplicative deterioration factors are required.

EPA is also revising the heavy-duty diesel engine certification and testing procedure by allowing a manufacturer, at its own risk, to waive the use of the cold-start requirement during certification testing. EPA will accept certification test data which does not include the cold-start requirement, but the cold start will remain part of the official test procedure, and EPA may use the cold start in any confirmatory, Selective Enforcement Audit, or recall testing.

This action includes several items related to the control of evaporative emissions from 1985 and later model year heavy-duty gasoline engines. First, it grants the petition from General Motors to change the implementation date of the new heavy-duty gasoline-fueled vehicle evaporative emission regulations from the 1985 *vehicle* model year to the 1985 *engine* model year. Second, it adopts a technical amendment changing the minimum test fuel temperature for both light-duty and heavy-duty evaporative emissions testing. It also amends Subpart M to allow manufacturers to use coastdown road load determinations (as originally intended), and corrects an error in a reference to a figure.

Finally, this action also includes a number of minor changes and technical amendments to the certification, Selective Enforcement Audit, and emission test procedure provisions applicable to light-duty trucks and heavy-duty engines. This action deletes a proposal that addresses suspending audit activities when a hearing is held due to procedural violations, and corrects a number of clerical errors that were made in the amendments to the SEA procedures in the January 13, 1982 notice of proposed rulemaking, and in Appendix X in the January 12, 1983 final rule for 1984 and later model year light-duty trucks and heavy-duty engines. This action also includes technical amendments to the exhaust emissions calculation provisions applicable to motorcycles.

Today's rule represents the culmination of three of the regulatory relief initiatives which EPA committed to propose or study as part of the Administration's regulatory relief program announced in April 1981 (46 FR 21628). Even though EPA has revised the heavy-duty gasoline engine HC and CO emission standards to non-catalyst levels for two years, the standards promulgated here for heavy-duty gasoline engines still represent lifetime per-vehicle emission reductions of more than 27 percent for HC and more than 59 percent for CO from current levels. When the split-class approach is implemented in 1987, at least 70 percent of all heavy-duty gasoline engines will be meeting the statutory standards. In addition, all heavy-duty diesel engines will meet the statutory HC and CO standards beginning in 1985. These gains translate into total HC and CO emission reductions from all sources of 1.3 and 17 percent, respectively, by 1995.

At the same time, the revisions included in these new regulations should result in an aggregate capital savings of at least $40.1 million to the industry and a 5-year savings to the nation of approximately $371 million, compared to the projected costs of compliance with the originally promulgated rule.

II. Background of the Rule

In December 1979, EPA promulgated gaseous emission regulations for 1984 and later model year heavy-duty engines (HDEs) (45 FR 4136). A similar rulemaking affecting 1984 and later model year light-duty trucks (LDTs) was promulgated in September 1980 (45 FR 63734). The primary function of these rulemakings was to promulgate the statutory HC and CO emission standards called for in Section 202(a)(3)(A)(ii) of the Act as amended in 1977. As these original actions are pertinent to today's action, the dockets established in support of them (OMSAPC-78-4 and OMSAPC-78-2) have been incorporated by reference.

In addition to the statutory emission standards, these rulemakings implemented a number of other provisions also to be effective for the 1984 model year. The major provisions common to both rulemakings included:

1. Revised useful-life definition;
2. Revised certification requirements;
3. An idle test and an idle CO emission standard for gasoline-powered LDTs and heavy-duty gasoline engines (HDGEs); and
4. The implementation of a 10 percent Acceptable Quality Level for Selective Enforcement Audit (SEA) testing.

The HDE final rule also included a new emission test procedure and initiated an SEA program for HDEs.

At the time that these rules were being prepared, the industry had just finished a year of record sales (1978) and sales continued strong into 1979. However, in late 1979 and early 1980, a general economic downturn began. As 1980 progressed, the recession became more severe, and the effects on the recession persisted through 1981 and into late 1982. Engine and truck sales dropped dramatically and most manufacturers reported operating losses for 1980 and 1981. For some companies, these losses continued through 1982.

In response to these economic problems, on April 6, 1981, the Administration announced a number of regulatory relief initiatives aimed at reducing the economic impact of government regulations on the industry. Preliminary analyses by EPA indicated that several provisions of the 1984 LDT/HDE Final Rules which required substantial capital investment could be relaxed without causing a significant loss in expected emission reductions and air quality improvements. This announcement included a commitment: (1) To propose a temporary revision of the 1984 model year HDE emission standard to "non-catalyst" levels, (2) to delay for two years the implementation of SEA testing for HDEs and, (3) to propose relaxing the Acceptable Quality Level for LDT and HDE SEA from 10 percent to 40 percent. In addition, EPA announced a commitment to study further the 1984 HDE requirements, with special emphasis on EPA's new emission test procedure (known as the transient test), and the revised useful-life definition for LDTs and HDEs. A Notice of Intent on these first three actions was published in the **Federal Register** on April 13, 1981 (46 FR 21628), and a request for information on the areas for further study was published on June 17, 1981 (46 FR 31677).

On January 13, 1982 (47 FR 1642), EPA formally proposed a 3-year revision of the HDE CO standard to non-catalyst levels, proposed to relax the Acceptable Quality Level as mentioned above, and announced a 2-year deferral of the implementation date for the HDE SEA program. EPA did not propose to revise the statutory HDE HC standard, but solicited comment on the technological feasibility of the standard, especially for "non-catalyst" HDGEs. In the Notice of Proposed Rulemaking (NPRM), the statutory HC and CO standards were left in place after the 3-year temporary revision. Any subsequent revisions of the standards were left open for later consideration in the appropriate time period as provided in the Act. In addition, based on the responses received to the request for information, EPA formally reopened the useful life and HDE transient test procedure provisions for further comment.

The NPRM drew a large amount of comment in several significant areas. Manufacturers concurred with EPA's assessment of the need for non-catalyst standards for HDGEs, but disagreed with EPA on the appropriate levels for the standards, and expressed serious concern over the leadtime available for implementing non-catalyst standards in 1984. The useful life and transient test provisions also received significant comment. It was suggested, among other things, that the 1984 full-life useful-life provisions for LDTs and HDEs were impractical and unworkable, and entailed an unacceptably large increase in warranty and recall exposure. Also, the MVMA, on behalf of HDGE manufacturers, and the Engine Manufacturers Association (EMA), on behalf of heavy-duty diesel engine (HDDE) manufacturers, proposed alternative test cycles to the EPA transient test cycles and less stringent HC and CO emission standards than the statutory HC and CO emission standards. Comments received from the manufacturers generally concurred with EPA's proposal to relax the Acceptable Quality Level applicable to LDT and HDE SEA testing as well as EPA's decision to defer HDE SEA testing until 1986. Several comments were also received which expressed serious concern over the air quality impact of the changes proposed by EPA.

EPA agreed with the manufacturers' concerns over leadtime for the 1984 model year, and recognized that the issues raised by the manufacturers concerning the level of non-catalyst standards, useful-life provisions, and test procedure could not be resolved quickly. Given this situation, EPA decided to break the final rule into two separate actions. In the first portion of the final rulemaking (FRM), published January 12, 1983 (48 FR 1406). EPA acted to revise the 1984 HDE emission standards to 1983 levels for a period of one year, and to allow full carryover of the other 1983 HDE provisions. EPA also finalized its proposal to revise the Acceptable Quality Level, deferred the start of LDT/HDE SEA testing from 1984 to 1986, and deferred the final implementation of the full-life useful-life provisions for LDTs and HDEs until 1985. Final decisions on the four remaining major issues (useful life, the level of the 1985 non-catalyst standards, HDE test procedures, and the longer term HDGE HC and CO standards) were left to the second portion of the FRM, as were final actions on a number of minor issues raised during the course of the rulemaking.

In a parallel action also published on January 12, 1983, EPA proposed modifications to the full-life useful-life provisions and also identified an alternative half-life useful-life provision. Based on earlier comments received, it was evident that implementation problems existed with the original full-life useful-life requirement. The goal of the proposal was to change the portions of the full-life requirement which led to implementation problems or unnecessary increases in jeopardy, while at the same time essentially retaining the benefits associated with the original full-life useful-life requirement.

As the most recent step in this process, on March 16, 1983, EPA released for comment a staff paper [1] which presented EPA's preliminary positions on three of the four remaining major areas which were not addresed in the first portion of the FRM. (Notice of availability of the staff paper was subsequently published in the **Federal Register** on April 21, 1983 (48 FR 17119), and a public workshop to discuss the staff paper was held in Ann Arbor, Michigan, on April 6, 1983.) The staff paper addressed the level of the "non-catalyst" HC and CO emission standards for 1985, the HDE emission test procedure issues related to the alternative test cycles and emission standards suggested by EMA and MVMA, and the question of the level of the HDGE HC and CO emission standards after the temporary revision to non-catalyst levels.

Today's action presents EPA's final decisions on the four major unresolved areas discussed above, and a number of lesser issues raised during the rulemaking process. These are described in the section which follows.

III. Description of the Action

The discussion below will describe the actions being taken today. The "Summary and Analysis of Comments" [2] provides additional analysis in support of today's actions, and is available in the public docket. Although the effect of the comments received on the actions being taken here may be mentioned, a more detailed presentation and analysis of the comments, and how they relate to the requirements prescribed in this final rule can be found in the section entitled "Public Participation." The public dockets referred to above constitute the record in support of EPA's final actions.

A. Emission Standards for 1985 and 1986 Model Year Heavy-Duty Gasoline Engines and for 1985 and Later Model Year Heavy-Duty Diesel Engines

Today's action promulgates HC and CO emission standards for 1985 and 1986 model year HDGEs, for 1987 and later model year HDGEs, and for 1985 and later model year HDDEs. Today's action also provides that 1985 and 1986 model year HDGEs shall be tested for emissions using either the EPA HDGE transient test cycle, or the alternative heavy-duty transient test cycle developed by the Motor Vehicle Manufacturers Association (MVMA cycle). HDDEs will only be certified using the EPA HDDE transient test cycle.

Heavy-duty gasoline engines certified using the MVMA cycle in the 1985 and 1986 model years must meet standards of equivalent stringency to 2.5 g/BHP-hr HC and 40.0 g/BHP-hr CO on the EPA transient cycle. The table below shows the levels that HDGEs must meet on each cycle:

Pollutant	EPA HDGE transient test cycle standards (g/BHP-hr)	Equivalent MVMA cycle standards (g/BHP-hr)
HC	2.5	1.9
CO	40.0	37.1
NO_x	10.7	10.6

HDDEs must meet the statutory standards of 1.3 g/BHP-hr HC and 15.5 g/BHP-hr CO as measured over the EPA HDDE transient test cycle.

Each manufacturer of HDGEs will choose one of the two cycles provided as options, and will certify all of its HDGE families using that cycle. After a manufacturer has chosen one of these cycles, all testing of that manfacturer's HDGEs by EPA (*e.g.*, confirmatory, in-use recall, SEA testing) will be conducted using the same cycle.

B. Emission Standards for 1987 and Later Model Year Heavy-Duty Gasoline Engines

Today's action promulgates a "split-class" approach to HDGE emission control beginning with the 1987 model year. This approach was originally contained in an EPA Staff Paper released for public comment in March 1983, and is adopted today with minor modifications. In general, the approach will necessitate the use of catalytic converters in the lighter HDGEs, but not the heavier HDGEs.

The alternative test cycle provisions for HDGEs in the 1985–86 model years will no longer be effective beginning with the 1987 model year. Instead, all HDGEs will be certified using the MVMA cycle. Effective with the 1987 model year, HDGEs intended for use in Classes IIB and III applications (up to 14,000 lbs. gross vehicle weight (GVW)) will be required to meet standards of 1.1 g/BHP-hr HC, 14.4 g/BHP-hr CO, and 10.6 g/BHP-hr NO_x as measured over the MVMA cycle. These standards are of equivalent stringency to standards of 1.3 g/BHP-hr HC, 15.5 g/BHP-hr CO, and 10.7 g/BHP-hr NO_x as measured over the EPA HDGE transient test cycle, and for HC and CO represent the 90 percent reductions from baseline levels established as a goal in the statute.

Heavy-duty gasoline engines intended for use in Classes IV–VIII applications (over 14,000 lbs. GVW) will be required to meet the 1985 model year MVMA cycle standards set forth in the preceding section. Although all *new* certification testing of 1987 and later model year HDGEs will be performed using only the MVMA cycle and standards, carryover of EPA cycle-based certification for HDGEs in Classes IV–VIII will be permitted.

There will be no change in the emission standards applicable to HDDEs, which will remain at the statutory goals of 1.3 g/BHP-hr HC and 15.5 g/BHP-hr CO as measured over the EPA HDDE transient test cycle.

In response to industry concerns regarding the inclusion of HDGEs in Class III applications (10,001–14,000 lbs. GVW) under the statutory standards, EPA has modified the split-class approach to allow up to 5 percent of a

[1] "Issue Analysis: Final Heavy-Duty HC and CO Standards," EPA Staff Report, March 1983. (All documents footnoted in this preamble are available in the public dockets referenced in the *Addresses* section.)

[2] "Summary and Analysis of Comments on the Notice of Proposed Rulemaking for Revised Gaseous Emission Regulations for 1984 and Later Model Year Light-Duty Trucks and Heavy-Duty Engines," U.S. EPA, OANR, OMS, ECTD, SDSB, April 1983.

manufacturer's combined Classes IIB and III sales to be reclassified. Manufacturers will be permitted to certify one or more configurations to the less stringent standards, provided that model year sales of those configuration(s) do not exceed 5 percent of their total model year sale of all Classes IIB and III configurations. These reclassified configuration(s) will be required to meet the emission standards applicable to HDGEs in Classes IV–VIII applications.

C. Useful Life

In response to comments on the useful-life proposal, modifications are being made to the HDE/LDT useful-life provisions. The heavy-duty diesel engine class has been divided into three subclasses based on intended service application. The light heavy-duty diesel subclass consists of lighter duty engines sold primarily for use in pickups, delivery vehicles and recreational vehicles; the medium heavy-duty diesel subclass is comprised of engines typically used for short-haul intra-city vehicles, and the heavy heavy-duty diesel subclass consists of engines primarily used in long-haul inter-city operations. At the time of certification, each HDDE manufacturer will classify its engine families into the appropriate classes based upon intended use and service life. The former useful-life labeling requirement has been withdrawn and is replaced by a requirement to label HDDEs as to their certified subclass, as defined above. Any HDDE, LDT or HDGE granted an alternative useful-life period by the Administrator will also be required to label the vehicle/engine with the alternative useful-life value.

Based on the comments,[2] the useful-life periods for the various vehicle and engine classes have been revised as follows:

Light-Duty Truck	11 Years/120,000 mi.
Heavy-Duty Gasoline Engine	8 Years/110,000 mi.
Light Heavy-Duty Diesel Engine	8 Years/110,000 mi.
Medium Heavy-Duty Diesel Engine.	8 Years/185,000 mi.
Heavy Heavy-Duty Diesel Engine	8 Years/290,000 mi.

As proposed, warranty exposure is reduced to the previous limits of 5 years/50,000 miles for LDTs, HDGEs, and light-HDDEs and 5 years/100,000 miles for medium-HDDE's and heavy/HDDE's. In addition, EPA is establishing a policy of not selecting engines for recall testing that are past 75 percent of their useful lives, although recall *liability* extends beyond that point; *see* 45 FR 36396, May 30, 1980. The rebuild criteria formerly specified in 40 CFR 86.084–21(b) are also eliminated.

D. Revisions to Certification and Testing Requirements

During the course of the rulemaking, a number of changes to the certification and testing a requirements were raised either by EPA in proposal, or by the commenters in their responses to requests for information on the proposal. The changes being made are discussed below.

1. *Allowable Maintenance.* In response to the temporary revision of the HDGE HC and CO standards to "non-catalyst" levels, EPA is modifying two of the allowable-maintenance intervals to accommodate the use of leaded fuel. The unleaded fuel intervals of 25,000 miles for spark plugs and 50,000 miles for exhaust gas recirculation (EGR) values are being retained. However, EPA is also including less demanding intervals of 12,000 miles for spark plugs and 24,000 miles for EGR valves for HDGEs certified for use with leaded fuel.

In addition, EPA is correcting an omission from the original publication of the LDT and HDE EGR allowable-maintenance interval, and is continuing the current requirement that any scheduled EGR maintenance conducted by the manufacturer and recommended to the owner must be accompanied by an audible or visual signal to alert the owner to the need for such maintenance. This requirement is part of the current-maintenance provisions for LDTs and HDEs. Finally, in response to comments and submitted data, EPA is revising the HDDE allowable-maintenance intervals for injector replacement and turbocharger rebuild or replacement from 200,000 miles to 150,000 miles.

2. *Idle Carbon Monoxide Standard and Test Procedure.* In response to the temporary revision of the HDGE emission standards to "non-catalyst" levels and to several comments received during the course of the rulemaking, EPA is revising three portions of the idle CO emission requirements for gasoline-powered LDTs and HDEs. First, the idle CO requirement for HDGEs is being deferred until 1987. At that time, only HDGEs using catalytic converters will be required to meet the idle CO standard. Second, to make the idle CO standard conform to a more practical degree of accuracy, the original standard is being rounded from 0.47 to 0.50 percent. This provides the accuracy necessary to demonstrate compliance without demanding impractical precision. Third, in the first portion of the Final Rule, EPA established provisions to allow LDT manufacturers to develop their own means of determining the 1984 model year idle CO deterioration factors (DFs). For sake of clarification, EPA, notes that this approach is being retained for 1985 and later model year LDTs as an inherent portion of the useful-life provisions being implemented in this action.

3. *Deterioration Factors for Heavy-Duty Engines.* For non-catalyst technology for HDGEs for 1985 and 1986, EPA is revising its approach to HDE DF requirements. HDEs certified without aftertreatment devices will use additive DFs, as has been done in the past; those certified with aftertreatment devices (*e.g.*, catalytic converters, trap-oxidizers) will use multiplicative DFs.

4. *Cold-Start Requirement for Heavy-Duty Diesel Engine Testing.* As a part of the comments received on the HDDE transient test procedure, several manufacturers requested that the cold-start requirement for HDDE emission testing be removed. As discussed below, EPA is reluctant to remove this requirement entirely. However, as part of today's action, EPA is allowing a manufacturer to bypass the cold-start requirement at its own risk.

EPA will accept emission test data for certification which does not include the cold start. However, all SEA, recall, and confirmatory testing conducted by EPA may include the cold start. Manufacturers choosing to skip the cold-start data requirement in certification testing do so with the full understanding that they accept any jeopardy which might arise from any differences in emission test results.

E. Minor Changes and Technical Amendments

As a part of today's action, EPA is implementing a number of minor changes and technical amendments to the certification, SEA, and emission test procedure provisions applicable to LDTs and HDEs (Subparts A, I, K, N, and P of Part 86).

Test procedure changes arose as experience was gained by EPA and the manufacturers with the transient, smoke, and idle test procedures. Changes were both requested by the manufacturers and initiated by EPA. Many of these test procedure changes are simply corrections of typographical and other errors, inadvertent omissions, and clarification of previous provisions. Other changes are being made to minimize repeated EPA approvals for previously allowed inconsequential deviations from the existing procedures, to reduce costs associated with testing and certification, and to incorporate technical improvements.

Another change being made is that 2-stroke HDDEs are being excluded from the closed crankcase requirements for naturally aspirated engines. Also included in this action are changes to the certification and SEA provisions.

When "Appendix X—Sampling Plans for Selective Enforcement Auditing of Heavy-Duty Engines and Light-Duty Trucks" was promulgated (48 FR 1414), it included a clerical error. Table 2, entitled "Sampling Plan Code For Letter 'A'," should have been published with a 16 in the column headed "Pass No." in stage 30 of the sample criteria, rather than with the 15 that appeared there in the final rule.

Section 86.544–78 (Calculations) of Subpart F (Motorcycles) is also being amended to make its terminology consistent with analogous sections in other subparts. Specifically, the concentration of carbon dioxide in the dilution air (CO_{2d}) is now being shown in terms of percent rather than ppm, and the equation applying this concentration is adjusted accordingly. Also, portions of variable names have been subscripted to be consistent with other subparts. These changes have no substantive effect.

The number of minor changes being implemented is too large to warrant discussion of each here. However, the substantive changes mentioned above are identified and discussed in several portions of the "Summary and Analysis of Comments" [2] which supports this rule. The reader is referred to that document for further information. In addition, a thorough listing of all of the changes and amendments to the HDE/LDT SEA Regulations is available in Public Docket No. A–81–11 as a memorandum entitled "Minor Amendments to the HDE/LDT SEA Regulations Contained in the Final Rule." Interested parties are referred to that memorandum for further information.

F. Delay of the Heavy-Duty Gasoline Vehicle Evaporative Emission Standards

On January 12, 1983, EPA published new regulations for the control of evaporative emissions from heavy-duty gasoline-fueled vehicles (48 FR 1430). These new standards were to be met beginning with 1985 model year heavy-duty gasoline vehicles, or in the September-October 1984 timeframe.

After publication of the final rule, EPA received a petition for reconsideration from General Motors (GM), requesting that implementation of these new evaporative emission standards be delayed from the start of the 1985 *vehicle* model year to the start of the 1985 *engine* model year, a period of 3–4 months. Although it is normal practice to introduce new model year vehicles and engines at the same time, GM expressed some concern over the leadtime remaining for the more stringent 1985 HC and CO standards, and suggested that these leadtime concerns might force delay of the introduction of new 1985 HDGEs until calendar year 1985. In the interim, GM planned to use 1984 model year engines in its 1985 model year vehicles. If the HDGV evaporative emission standards remained in place for 1985 model year vehicles, GM would be required to design and certify evaporative emission control systems for 1985 model year vehicles with 1984 model year engines for the first few months of the 1985 vehicle model year, only to do the same for 1985 model year vehicles and engines several months later. This would represent a significant financial outlay for GM (and possibly other manufacturers) for only three to four months of vehicle/engine production, and would not be a cost effective use of resources.

EPA tentatively agreed with the petition, and on June 3, 1983 (48 FR 24932), EPA published a Notice of Intent to grant GM's petition. As part of that notice, EPA indicated its intent to issue a technical amendment to lower the minimum test fuel temperature from 50°F to 45°F for both light- and heavy-duty vehicles for evaporative emissions testing. The only comments received in response to this notice supported GM's concerns and EPA's proposed technical amendment. Therefore, as part of today's action, EPA is acting to revise the implementation date for the start of the new evaporative emission standards for heavy-duty gasoline vehicles from the 1985 vehicle model year to the 1985 engine model year and to change the test fuel temperature specification.

EPA is also taking this opportunity to make two minor corrections to the heavy-duty evaporative emissions test procedure. The first change corrects an error of omission. The Summary and Analysis of Comments and the Preamble of the heavy-duty evaporative Final Rule both explicitly stated that EPA would allow the manufacturers to use coastdown procedures in order to determine the road load power for dynamometer settings. However, the regulatory text of the Final Rule inadvertently did not include this provision. Therefore, this action corrects § 86.1229–85(b)(2) to include the option for manufacturers to use coastdown procedures. The second correction is for a typographical error. The reference in the text of § 86.1230–85 to the figure in that section is incorrect. This action changes that reference from Figure M82–1 to Figure M85–1.

IV. Economic Impact

EPA expects that the interim non-catalyst standards and split-class approach being implemented in this action will result in significant cost savings for the HDGE manufacturers and consumers purchasing trucks and buses powered by HDGEs. EPA has prepared a full analysis of the capital and consumer costs and savings of these regulations. This is available as part of the Regulatory Support Document.[3] The major points are summarized below, with all costs in 1983 dollars.

EPA now expects that compliance with the original rule would have required a capital investment of approximately $135.3 million and would have caused a $383 increase in the purchase price of the average truck or bus powered by an HDGE to cover emission control hardware, research and development, and other fixed costs. Operating and maintenance costs would have increased $249 due to the use of unleaded fuel, but this was largely offset by the decreased maintenance benefits of unleaded fuel. Thus, an increase in operating and maintenance costs of $17 would remain. No fuel economy penalty was associated with the original standards; in fact, a modest improvement seemed likely.

Compliance with the interim non-catalyst standards (1985–86) is expected to require a capital investment of $68.6 million, for a savings of $66.7 million over the original rule. An average purchase price increase of $113 is now expected over current engine costs with a $20 increase in operating and maintenance costs, resulting in a savings of $267 per engine over the original rule.

Implementing the split-class approach in 1978 will necessitate a capital investment of approximately $26.6 million for light heavy-duty gasoline engines to use catalyst technology. Thus, the overall capital costs savings mentioned above will be reduced by this amount. Compliance costs will rise for light heavy-duty gasoline engines but will remain the same for heavy heavy-duty gasoline engines. The use of catalyst technology is expected to result in a purchase price increase of $155 for each light heavy-duty gasoline vehicle. However, changes in operating and maintenance costs will actually result in a net savings of $46 in this area, leaving a net consumer cost increase of $109. Both cost increases and savings are

[3] "Regulatory Support Document-Revised Gaseous Emission Regulations for 1984 and Later Model Year Heavy-Duty Engines," U.S. EPA. OANR, OMS, ECTD, SDSB, July 1983.

incremental over 1985–86 costs and fuel economy will remain at the levels anticipated with the interim standards. Since heavy HDGEs will continue, for now, to meet the interim standards after 1986, no further costs will be incurred for these engines. Therefore, on a fleetwide average basis, HDGE compliance costs are $110 for purchase price and −$32 in operating and maintenance costs.

In summary, EPA expects HDGE manufacturers will accrue a capital cost savings of approximately $40.1 million, compared with the original rule, primarily as a result of the split-class approach. On an aggregate cost basis for the first five years of sales, the interim standards and split-class approach should result in an aggregate vehicle lifetime savings (purchase price and operating and maintenance) of $349 million for the users of heavy-duty gasoline vehicles over costs which would have occurred under the original rule.

V. Air Quality Impact

Although the net air quality benefit of these regulations is not quite as large as that expected from the rule promulgated in 1979, the implementation of the emission standards and regulations contained in this rule will nevertheless substantially reduce the amount of HC and CO emitted to the atmosphere by heavy-duty vehicles. EPA has prepared a comprehensive air quality impact analysis, the results of which are discussed below. The full analysis is available as part of the Regulatory Support Document.[3]

Heavy-duty diesel engines will meet the statutory standards beginning in 1985 and most other requirements for diesels remain largely unchanged. Therefore, EPA expects that most of the emission reduction benefits originally expected from HDDEs will still occur.

Beginning in 1985, HDGEs will meet revised HC and CO standards. Even though these are less stringent than the statutory standards, average per vehicle lifetime HC and CO emissions will be reduced more than 27 percent and 59 percent, respectively, compared to current levels. Beginning in 1987, light HDGEs will meet the statutory HC and CO standards, resulting in average lifetime HC and CO emission reductions of 48 and 84 percent over current levels, and 29 and 62 percent over interim standard levels. Light heavy-duty gasoline vehicles account for the majority of all HDG vehicle sales, so on a fleetwide basis average lifetime HC and CO emission reductions of 40 and 74 percent, compared to the base case of no new standards, and 16 and 35 percent, compared to the revised interim standards, are expected. These average lifetime reductions will reduce total non-methane HC emissions from all sources by 1.3 to 1.5 percent in the late 1990's for low-altitude areas and 2.6 to 3.0 percent in high-altitude areas. Similarly, total CO emissions from all sources will be reduced 17 to 18 percent in low-altitude areas and 18 to 20 percent in high-altitude areas in the same time period.

When these reductions are translated into air quality improvements, average ozone air quality in the late 1990's will improve up to 1 percent in low-altitude areas and 1 to 2 percent in high-altitude areas. Average CO air quality will improve by about 5 percent in both low- and hight-altitude areas in the late 1990's.

Had the original rule been left in place for 1985 slightly greater reductions in low-altitude non-methane HC emissions, and in low- and high-altitude CO emissions, would have occurred during the 1990's. Non-methane HC emissions would have decreased about an additional 0.1 percent at low altitude. CO emissions would have decreased an additional 2.3 to 2.4 percent at low altitude and 1.7 to 2.3 percent at high altitude. These additional reductions are relatively slight in comparison to the reduction which will occur under this rule, and would substantially increase the costs of compliance both to the manufacturers and the consumers of HDEs.

VI. Public Participation

The structure and content of the final rules promulgated here today were shaped considerably by the public participation during the course of the rulemaking. Opportunities for public participation included two formal EPA requests for information and comment, two formal public hearings, and two public workshops. In addition, EPA provided opportunity for comment on the petition to delay the implementation date of the heavy-duty gasoline vehicle evaporative emission regulations.

A wide variety of organizations and individuals presented oral and/or written comments on the proposed actions. These included manufacturers, trade associations, public interest and environmental groups, one government agency, two private citizens, and one U.S. Senator.

This section of the preamble highlights the major comments submitted in each area, and describes how these comments affected the rulemaking. A review of this section should make clear how the final rule differs from the proposal and why. However, this section is not a detailed response to all comments received, and the reader is encouraged to consult the separate document entitled "Summary and Analysis of Comments,"[2] as well as other comprehensive EPA staff analyses on various issues discussed below. These, as well as all public comments, are assembled in the public dockets referenced above.

A. Model Year 1985 Emission Standards

There have been several iterations of EPA action and public reaction as this issue has developed over time.

On January 13, 1982, EPA proposed that the 1984 statutory emission standards for HDGEs be relaxed to non-catalyst levels of 1.3 g/BHP-hr HC, 35.0 g/BHP-hr CO, and 10.7 g/BHP-hr NO_x. It was intended that this action defer the capital investments required for catalyst development, and thus provide economic relief to an industry beset by recession and decreased sales.

In public comments to this NPRM, only Ford and GM submitted transient test data. Chrysler and IH did not comment on technological feasibility, and, in fact, indicated that they were leaving the HDGE market. (Both Chrysler and IH have since indicated that they might reverse these decisions; see the discussion later in this preamble.) Ford recommended non-catalyst emission standards of 3.3 g/BHP-hr HC and 42 g/BHP-hr CO; GM recommended emission standards of 2.9 g/BHP-hr HC and 43.0 g/BHP-hr CO. GM also argued that standards of 3.5 g/BHP-hr HC and 70 g/BHP-hr CO were justified on the basis of air quality needs, fuel economy, and cost. GM also argued that EPA's proposed standards could severely degrade engine durability because of increased in-cylinder and exhaust system temperatures.

In reviewing these comments, EPA staff felt that additional engineering data were required to determine the lowest emission standards achievable without catalysts. Specific requests for more detailed information were made to HDGE manufacturers on June 17, 1982; Ford provided additional engineering data; GM declined to do so. At a meeting with EPA on January 28, 1983, GM again claimed that EPA's proposed standards would adversely affect engine durability and fuel economy.

In a Federal Register Notice of January 12, 1983, EPA officially delayed the 1984 model year emission requirements until 1985. This 1-year revision of the standards was justified on the basis of leadtime, economics, and the number of other issues yet to be resolved (*i.e.*, alternative test cycles, useful life, etc.).

Reviewing all comments and data available at the time, and taking into account the additional year of development leadtime, EPA then reanalyzed the feasibility issue. This feasibility analysis,[4] the summarized results of which were discussed at an April 6, 1983 public workshop, was also distributed for public comment on April 12, 1983. The analysis recommended that non-catalyst emission standards of 2.5 g/BHP-hr HC and 35.0 g/BHP-hr CO be promulgated for 1985. EPA's intent to relax the proposed non-catalyst HC standard was based upon a review of the development data submitted by Ford and GM in April 1982. All but one engine family were still well above the target emission level needed to assure compliance with a 1.3 g/BHP-hr HC standard, while all but one engine family met the target level for CO. Using data provided by Ford, EPA concluded that modest reductions in HC were still possible, and that compliance with a 2.5 g/BHP-hr HC standard in 1985 would be possible even for the highest emitting engines.

In comments received by May 6, 1983, the conclusions and methodology of EPA's latest feasibility analysis were again challenged. GM vigorously disputed the conclusions of EPA's feasibility analysis, characterizing the analysis as "entirely inadequate." In GM's opinion, forced compliance with the 35.0 g/BHP-hr CO standard would preclude the production of reasonably durable engines, and would invite tampering in the field. With respect to data, GM submitted a confidential qualitative discussion of various aspects of its development work, but submitted no new emission data. GM claimed that it has only just begun to evaluate the feasibility of the 2.5/35.0 g/BHP-hr standards.

On the other hand, Ford provided a comprehensive review of the emissions status of its HDGE product line. Ford also disputed EPA's feasibility analysis, characterizing it as overly optimistic, and as having overestimated the capabilities of some HDGEs. Ford recommended half-life standards of 2.19 g/BHP-hr HC and 42.6 g/BHP-hr CO based upon the MVMA cycle; according to Ford, these are equivalent to full-life EPA cycle standards of 3.07 g/BHP-hr HC and 47.8 g/BHP-hr CO.

For this rulemaking, EPA's determination of feasible interim standards is based largely upon the only available data, that of Ford. EPA notes that Ford has achieved significant reductions in HDGE emissions, although very little of them in the last year. Based upon reasonable estimates of full-life deterioration, four out of five of Ford's engine families today fail to comply with a 35.0 g/BHP-hr CO standard. EPA agrees that reductions in low-mileage CO targets for most of these engines would be necessary to comply with a 35.0 g/BHP-hr standard, and that these recalibrations could carry risks of decreased engine durability. This, plus the diminishing leadtime until the 1985 model year, leads EPA to the conclusion that an iterim CO standard of 40.0 g/BHP-hr should be promulgated. On the other hand, four out of five of Ford's engine families already substantially comply with the 2.5 g/BHP-hr HC standard, and EPA concludes that the 2.5 g/BHP-hr standard is feasible and should also be promulgated. At these standards, only one Ford engine family requires additional development work; given the remaining leadtime and the fairly modest amount of further reduction required, EPA concludes that even Ford's highest emitting engine can be certified to 2.5 g/BHP-hr HC and 40.0 g/BHP-hr CO in 1985. Based upon EPA's analysis of GM's submissions, the same conclusions are applied to GM's engines.

The final technological feasibility analysis appears as Issue A.1., "Technological Feasibility," in the "Summary and Analysis of Comments."[2]

B. 1987 and Later Heavy-Duty Gasoline Engine Emission Standards

Of the various commenters to this rulemaking, only Ford, GM, the Natural Resources Defense Council (NRDC), and the Manufacturers of Emissions Controls Association (MECA) commented specifically on the split-class approach.

Ford's comments were supportive of the split-class approach with two major reservations. Ford recommended that the breakpoint between catalyst and non-catalyst classes be set at 10,000 lbs. GVW (between Classes IIB and III). Ford also claimed that implementation of the split-class approach should be set for model year 1988, on the bases of both technological grounds and statutory requirements for HDE leadtime.

General Motors responded to the EPA Staff Paper with an alternative split-class approch of its own, which had little in common with the EPA approach. GM recommended that the breakpoint be set at 10,000 lbs. GVW, and that testing below this point be conducted on chassis dynamometers with emission standards and test procedures similar to those applicable to LDTs. GM did not dispute the feasibility of the lighter subclass of HDGEs attaining compliance with the statutory standards in 1987.

Both manufacturers expressed concern that LDT catalyst systems would not be as readily adaptable to HDGE applications as EPA had claimed.

The NRDC argued for implementation of the split-class approach in model year 1985 (with some exemptions), and that the breakpoint should be raised to 20,000 lbs. GVW. NRDC also noted that the heavier HDGEs must also comply with the statutory standards as some future date.

The MECA agreed with the rationale behind EPA's split-class approach. MECA also commented that, assuming that Classes IIB and III HDGEs are not significantly different than current LDTs, they foresaw no difficulty in making catalysts available on an as-needed basis for model year 1987.

In analyzing these comments, EPA believes that the breakpoint should be established at 14,000 lbs. (Class III) for two main reasons (see Issue B.12 in the "Summary and Analysis of Comments"[2]). Roughly 70 percent of the Class IIB vehicles could "migrate" to Class III (thus avoiding catalysts), while the number of Class III vehicles able to migrate to Class IV is small. Also, different engine models are generally used in vehicles above and below 14,000 lbs GVW, providing a natural breakpoint.

EPA still does not foresee significant problems in applying LDT type catalytic converter technology to Classes IIB and III vehicles. As discussed in more detail in the "Summary and Analysis of Comments"[2] the only significant difference affecting compliance technology between LDTs and the lighter HDEs is engine exhaust mass flow induced by the heavy-duty transient engine test. This difference should only affect CO emissions, and EPA's analysis shows several feasible modifications to the air injection system and catalyst system to permit compliance with the CO standard on the heavy-duty test.

Although EPA believes the application of the heavy-duty transient test to the Class IIB vehicles is appropriate, the Agency remains open to the future development of equivalent test procedures, such as a chassis dynamometer test, for this class of vehicles.

There may be a few unique applications which are more appropriately grouped with the heavy-HDGEs meeting non-catalyst standards. EPA will, therefore, allow manufacturers to certify up to five percent of their light-HDGEs to the less stringent standards

[4] Letter to commenters (plus attachments) from Charles L. Gray, Jr., U.S. EPA, OANR, OMS, ECTD, April 12, 1983.

applicable to the heavy-HDGEs. This option will not apply to the evaporative emission standard.

EPA believes this approach is permissible under the Agency's broad authority to subcategorize heavy-duty engines in establishing emission standards. *See* Section 202(a)(3)(A)(iv) of the Act. As described in more detail in the "Summary and Analysis of Comments," [2] this approach arose from the fact, noted by commenters, that some Classes IIB and III HDCEs are in fact used in applications, *e.g.*, dual rear-wheel and "fifth-wheel" (pop truck), that are more similar to Classes IV–VIII vehicles than to LDTs. Since the split-class approach is based on the transfer of LDT catalyst technology to HDGEs which are used in similar applications, it would be inappropriate to implement this approach without taking this fact into account.

EPA considered evaluating vehicle usage on a case-by-case basis to determine which vehicles in Classes IIB and III would appropriately qualify for certification to Classes IV–VIII standards, but concluded that the administrative burdens of that mechanism would be unwieldy, and could not be justified in light of the relatively small segment of the vehicle population involved. The 5 percent figure is the Agency's projection, based on recent actual and projected future sales data, of the number of vehicles in legitimate need of this relief. However, EPA will consider moving to a case-by-case approach if experience with the current system shows it is being abused, *i.e.*, that a significant number of vehicles are being certified to standards not appropriate to their applications in use.

EPA has also determined that implementation of the split-class approach in model year 1987 is both legally permissible and feasible (see Issue A. 1 in the "Summary and Analysis of Comments".[2] Considering first the legal issues, EPA believes it has the authority to implement catalyst-based standards in 1987. It is true, as noted by Ford, that the statute grants to manufacturers four years leadtime before implementing revised standards; however, manufacturers have in fact had more than four years to meet the catalyst-based standards. EPA first promulgated those standards in January of 1980, to become effective in 1984, and did not propose to alter them for two years, until January of 1982. Final action to revise the standards was not taken for another year, until January of 1983.

Therefore, depending on how one calculates the period of uncertainty during which the final standards were in doubt, manufacturers had two or three years in which to prepare to meet the standards. The rules published today provide three more years. As suggested by NRDC, therefore, EPA could legally have made these rules effective earlier than 1987; however, the Agency believes that would provide inadequate leadtime for compliance, as explained below.

Moreover, given the delays in meeting the 90 percent reductions, EPA believes it is consistent with Congress' intent to implement those standards at the earliest feasible date. Although Congress was concerned that manufacturers be given adequate leadtime for compliance, the overriding message of the statutory provisions for heavy-duty trucks and engines is for EPA to require the greatest degree of emission reduction feasible. As explained in the "Summary and Analysis of Comments,"[2] the record plainly reflects an ability to meet the statutory reductions, now delayed from the statutory 1983 deadline, by 1987.

Finally, EPA notes that at least one manufacturer has implicitly agreed that EPA has authority to make these standards effective earlier than 1988. As noted earlier, GM's alternative proposal called for the implementation of catalyst-based standards for a portion of the heavy-duty fleet in 1987.

With respect to technical leadtime, it is clear from the history of this action and from manufacturer comments that preliminary development work has already been underway for some time. Early catalyst testing has been in progress throughout 1983, and a significant portion of the necessary work (*e.g.*, reduction of engine-out emission levels for 1985) will soon be completed.

The most significant problem to be solved during development is determining the catalyst configurations and engine calibrations that will be needed to certify on the HDGE transient test. This is a relatively straightforward engineering problem of applying known LDT catalyst technology to another application. Worst case HDGE applications, in terms of catalyst use, need not be certified to the statutory standards under the split-class approach adopted today. In-use durability should, therefore, be similar to that of LDTs and should not represent a problem. Thus, the Agency is confident that 1987 implementation is within EPA's authority and poses no insurmountable technical difficulties for the industry.

Concerning the NRDC comment on the requirement for further reductions from the heavier HDGEs in the future, EPA agrees that the Agency lacks authority to grant the heavier truck classes a permanent exemption from the 90 percent reductions, unless those standards are revised based on pollutant-specific studies under Section 202(a)(3)(E) of the Act. The question of more stringent standards for the heavier classes will be addressed in future rulemakings as appropriate.

C. Alternative Test Cycles

In April 1982, EMA, MVMA, and their member companies recommended that EPA adopt their proposed alternative test cycles for diesel and gasoline-fueled HDEs.

The EMA believed that EPA's test cycle was unrepresentative of heavy-duty diesel operation. During the spring and summer of 1982, EPA reviewed the technical basis for the creation of the real time cycle (RTC) and the accumulated data base for comparison of the RTC to the EPA cycle. The Agency's analysis was distributed for public comment in early summer of 1982 This analysis forms Chapter 5 of Transient Test Study, which is Appendix B to the "Summary and Analysis of Comments." [2]

The EMA and its member companies took issue with two of EPA's conclusions. First, EMA disputed the need for an emission standard adjustment if the RTC was to be adopted, because the heavy-duty diesel cycle was never used in the standard setting process. Secondly, if a standard adjustment was to be made, EMA proposed a methodology which yielded a RTC-based HC standard of 1.2 g/BHP-hr instead of the 1.1 g/BHP-hr that EPA's methodology yielded. EMA and its member companies formalized their position on May 13, 1983 in a submission to EPA, and also recommended that only a single test cycle be used for certification (*i.e.*, either the RTC with a 1.2 g/BHP-hr HC standard or the EPA test cycle with the 1.3 g/BHP-hr HC standard).

In its analysis of the comments and the RTC,[2] EPA determined that the EPA and RTC cycles were statistically similar, and correlated very well with each other. While the cycles generate somewhat different emissions, both cycles would be technically acceptable for certification testing.

Since the two cycles yield somewhat different emission results, it was necessary to establish adjustments for the standards when using the EMA cycle to maintain equivalency with previously promulgated requirements. Through a correlation study of emissions data for engines operated over both test cycles, EPA has determined that a RTC-based HC standard of 1.1 g/BHP-hr is equivalent in emissions to the EPA cycle-based HC standard of 1.3 g/BHP-hr. Since CO emissions from diesels are well below even the statutory CO standard, the HC standard adjustment is the only issue.

In their final comments the EMA and its member companies stated that they would perfer the EPA test cycle with its standard of 1.3 g/BHP-hr HC over the RTC-based HC standard of 1.1 g/BHP-hr. Since EPA retains confidence in its test procedure, and cannot accept the loss of benefits that would result from an RTC standard at the level suggested by EMA, the Agency is maintaining the EPA test cycle with its 1.3 g/BHP-hr HC standard for diesels.

The test cycle background for HDGEs is similar to that for HDDEs, but not the outcome. MVMA developed an alternative test cycle to the EPA test cycle because of its concern that the EPA cycle was not representative of real-world heavy-duty truck operation. EPA's analysis of MVMA's test cycle revealed that both cycles are very similar statistically. However, total engine work is about 10 percent higher on the MVMA cycle, and the MVMA cycle is less transient than EPA's. Because of these operational differences, the MVMA cycle gives lower emissions than the EPA cycle. See Issue A.3 of the "Summary and Analysis of Comments".[2]

A comparison of the two cycles using a data base of 35 gasoline-fueled engines revealed excellent correlation between them. This strong correlation implies that there is no advantage to using one cycle over the other to predict in-use emissions, provided standards are adjusted. Therefore, both cycles are acceptable to EPA.

The methology used to adjust the EPA cycle-based standards to MVMA cycle-based standards split the 35 engines into catalyst and non-catalyst technologies because different correlations exist between the test cycles for each technology. At the level of the 1985–86 HDGE standards, the resultant MVMA cycle-based standards equivalent to the EPA cycle-based standards are 1.9, 37.1 and 10.6 g/BHP-hr for HC, CO and NO_x respectively. For the statutory levels of 1.3 g/BHP-hr HC, 15.5 g/BHP-hr CO, and 10.7 g/BHP-hr NO_x, the equivalent levels on the MVMA cycle are 1.1, 14.4, and 10.6 g/BHP-hr, respectively.

When MVMA originally proposed their alternative test cycle, they indicated their overall preference for a single cycle, as opposed to various optional cycles. Environmental interests commenting on the test cycle issue also strongly supported adoption of only a single cycle, to prevent manipulation of the options to minimize the degree of emission control required. EPA agrees with these positions and intends to replace the existing HDGE test cycle with the MVMA cycle. However, EPA finds that the goal of a single set of test procedures is not reasonably attainable for the 1985 model year. Lacking resolution of the issue, some HDGE manufacturers have pursued their 1985 development work on the EPA cycle and others on the MVMA cycle. Because of this, MVMA has requested that both cycles be available in 1985. Therefore, for the 1985 standards EPA is providing the option of using either test cycle. However, each manufacturer must use the same test cycle for all of its HDGEs. This should minimize the potential for manufacturers to select the more advantageous cycle for particular engines. Beginning in 1987, EPA will accommodate what it perceives from the comments to be the technical preference of the industry by adopting the MVMA cycle for all subsequent testing.

EPA remains open to comment on the 1987 test cycle for gasoline-fueled engines. The Agency may reconsider its decision regarding cycle selection and standards adjustment if appropriate justification is presented.

D. Useful Life

As noted earlier, the January 12, 1983 NPRM proposed modifications to the full-life useful-life provision (limiting warranty and recall liability), or, as an alternative, an extended half-life useful-life provision. The extended half-life alternative included adjusted emission standards reflecting the reduced stringency of half-life plus extended durability testing using the 1983 model year procedures. In the NPRM EPA expressed its preference for the modified full-life proposal and offered the half-life alternative only in the event that further comments revealed unexpected problems with full life which could not be resolved. Industry response indicated a universal unwillingness to accept the half-life proposal because of the adjusted standards and extended durability testing requirements. On the other hand, some industry commenters indicated their support for the modified full-life provisions. One commenter (NRDC), while opposed to the extended half-life proposal, indicated that, in any event, adjusted standards would have to be an essential part of any half-life approach. EPA concurs with this view, and rejects the approach of promulgating half-life useful-life provisions without adjusting the emission standards to achieve comparable stringency. Moreover, EPA believes that in today's action it has been able to resolve all significant problems with the full-life program. Therefore, the basis for EPA's proposing the extended half-life alternative has been removed, and EPA has decided to promulgate a modified full-life program. Additional discussion of the following areas is given below: (1) Legal authority for the modified full-life requirement (2) the basis for dividing HDDEs into subclasses (3) potential recall problems (4) length of the assigned useful-life periods, and (5) the air quality benefits, or lack thereof, of full-life useful life.

A substantial number of comments were received concerning the legal authority for both the establishment of full-life useful life and for the proposed modifications. Manufacturers reiterated earlier comments that EPA lacked statutory authority to establish anything other than half-life useful-life periods for any vehicle class except motorcycles. Volkswagen of America (VW), in fact, stated that LDTs of less than 6,000 lbs. GVW fall into the LDV category of the Act and so had a statutory useful life of 5 years/50,000 miles. Comments regarding the proposed modifications argued that the Act requires a single useful life for certification, warranty, and recall purposes, which would preclude the proposed warranty limitation. Commenters cited examples purporting to show Congressional intent along the lines suggested.

The EMA suggested that the proposed HDDE classification system based on GVW of vehicles would unduly restrict sales, which might cross a number of vehicle class lines for any given engine. The EMA suggested an alternative classification system based on the intended service application for which the engine was sold. This system would classify HDDEs into one of three subclasses, dependent upon the type of service anticipated. The light heavy-duty diesel subclass would include lighter duty engines sold primarily for use in pickups, light delivery trucks, and recreational vehicles. The medium heavy-duty diesel subclass would encompass engines intended largely for intra-city short-haul commercial vehicles, while the heavy heavy-duty diesel subclass would consist of engines used in trucks for long-haul inter-city operation. An engine's classification under this approach would be based upon its expected primary use, but there would be no restriction on use in other applications. For example, a buyer might employ a medium-HDDE in what would usually be a heavy-HDDE application. EMA suggested that EPA review and approve the manufacturer's determinations of applicable classes for the individual engine families.

The EMA and others also believed that some of EPA's assigned useful-life periods were too long. Ford pointed out that the LDT figure was based on an average that included two different numbers from the same set of data (but using different analysis techniques). EMA suggested that the medium-HDDE useful-life period was too long, due to the inclusion of premium engines in the medium-HDDE miles-to-rebuild data set. Manufacturers also objected to the use of scrappage rate data in the determination of average useful-life values, since it included already rebuilt engines that would tend to raise the averages.

Virtually all the industry commenters pointed to potential problems in screening worn out and rebuilt engines from samples selected for recall testing, since they estimated that up to 30 percent of the engines might be rebuilt at 75 percent of useful life.

Finally, a number of commenters stated their opinion that there would be little or no air quality benefit from the full-life useful-life requirement. They therefore believed that full-life useful-life provisions would not be cost effective.

Legal questions regarding EPA's authority to establish full life were raised during the initial LDT and HDE rulemaking process. EPA concluded then, and still believes, that the language of the Act is consistent with the establishment of full-life useful-life periods for other-than light-duty vehicles. Nor is there any clear indication of Congressional intent to the contrary. EPA also rejects VW's argument on the basis of *International Harvester v. Ruckelshaus* (478 F. 2d 615 D.C. Cir. 1973), which removed LDTs from the LDV class for regulatory purposes, and placed them in the other-than-light-duty vehicles category, over which the Administrator has broad general regulatory authority. This general authority also is sufficient to enable the Administrator to establish reduced warranty periods for LDTs and HDEs. No specific prohibition to that effect is contained in the Act, despite the fact that Congress was clearly aware of the fact that reduced warranty periods are appropriate in certain cases and in fact established one such reduced period in the CAA Amendments of 1977. A more detailed discussion of EPA's legal position can be found in the "Summary and Analysis of Comments"[2] for both today's action and for the original HDE and LDT rulemakings.

EPA accepts the EMA suggestion for subdividing the HDD engine class on the basis of intended usage. This service application plan accomplishes the necessary goal of subdividing the HDDE class into subclasses that reflect the three generally recognized HDDE design categories, while at the same time allowing manufacturers and customers the maximum flexibility to match vehicles with the needs of the purchaser. The Agency does not feel the need to review all of the manufacturers' subclass determinations as EMA suggested, however. Rather, EPA feels that the classification system can be made "self-policing" by requiring engines to be labeled as to the subclass for which they are certified, to enable the consumer to choose an engine that satisfies his durability needs. It is of little concern to the Agency if a purchaser wishes to put a heavy-HDDE in his medium-duty truck, or a medium-HDDE in his long-haul tractor, as occasionally happens today within the industry. The labeling requirement is intended to assure, however, that the manufacturer does not artificially downgrade the classification of its engines to ease certification.

Regarding the issue of useful-life periods, a review of the data and comments which have been submitted suggests that some revisions are appropriate, particularly given the change in the method by which the HDDE subclasses are defined. Manufacturers have raised some valid points concerning the data and analysis techniques used in determining the assigned useful-life periods. In response to this, the periods for LDTs, HDGEs, and light- and medium-HDDEs have been reduced somewhat. In the latter instance the revised useful-life period is based on engine design characteristics for that subclass that were not fully reflected in the GVW-based calculation that formed the basis for the value originally proposed. It also follows from this change in HDD classification methodology that the assigned useful-life values for heavy-HDDEs must be revised upward to reflect the fact that this subclass will now be comprised almost exclusively of premium, long-haul engines. The revised useful-life periods are derived in the "Summary and Analysis of Comments"[2] and were set forth earlier in this Preamble.

EPA recognizes that the available data for useful-life determinations are far from perfect. Neither vehicle scrappage data nor surveys are able to unequivocally establish current useful-life periods. Moreover, the difficulties with these various data sets are not ones which can be easily remedied. Thus, the approach used has been to draw upon a wide variety of data from a number of sources and, bearing in mind the particular weaknesses of each, establish a consistent set of useful-life figures. It should also be pointed out that a manufacturer will still have the option of petitioning the Administrator for an alternative useful-life period if it finds a significant departure from the assigned value in the actual useful life of an individual engine family.

Regarding potential recall problems, EPA believes the concerns expressed by the manufacturers are overstated. There is as yet no heavy-duty recall program in existence, and it is likely to take some time to implement one. The Agency will work closely with the manufacturers in implementing a recall program, particularly in the area of screening engines for testing. EPA does not intend to include such things as rebuilt engines in any recall testing and procedures will be developed with the manufacturers' assistance to minimize the potential of such occurrences. As an example, the current LDT recall program allows manufacturers a full opportunity to challenge vehicle selections in an adjudicatory hearing.

Some HDE manufacturers argued that recall should apply only to add-on engine components installed solely or primarily for the purpose of emissions control. They believed that performance-related items would be kept in good repair through normal market forces (*e.g.*, increased fuel consumption or reduced power). EPA cannot accept the need to make such a distinction for recall purposes. If such forces are indeed acting effectively, then performance-related emission problems will not be found in significant numbers. If they are not, then it is appropriate for such areas to be coverd by recall. Moreover, the statute focuses on vehicles and engines exceeding standards, not just on problems caused by particular components.

Finally, a number of manufacturers have expressed doubts concerning the benefits versus the projected costs of full-life useful life. In response to these concerns, EPA has undertaken to update its full-life cost-effectiveness analysis, using manufacturer cost data and EPA air quality analysis techniques. The results of this study show full life to be very cost effective. The costs per ton of pollutant removed range from $230–505 per ton of HC, with the majority of the vehicle/engine classes falling in the lower end of the range, and $11–28 per ton for CO. The reader is referred to the chapter "Useful-Life Cost Effectiveness" in the Regulatory Support Document,[3] as well as Issue A.2 in the "Summary and Analysis of Comments,"[2] for more detail.

E. Revisions to Certification and Testing Requirements

1. *Allowable Maintenance.* The comments received agreed with EPA's proposal to establish a leaded fuel spark plug maintenance interval for HDGEs. In addition, one commenter requested that EPA provide leaded fuel maintenance intervals for a number of other components, including EGR. EPA's review of the technological basis for this request concluded that only the EGR interval would be needed. Therefore, EPA has also included a leaded fuel maintenance interval for EGR.

During the course of this rulemaking, an inquiry from the industry noted that the 1985 provisions no longer required an audible or visual signal to the owner as a condition for the manufacturer to recommend or conduct scheduled EGR maintenance. This provision is currently in place for LDTs and HDEs and was unintentionally omitted when the new allowable-maintenance provisions were promulgated in 1979. Provisions have been added to correct this omission.

Two commenters presented new data to support their claims that the turbocharger and injector allowable-maintenance intervals currently specified by EPA are longer than "technologically necessary." EPA has studied the data submitted by the commenters and also the significant changes in the HDDE market since the original maintenance intervals were promulgated in 1979. During the past three to four years, a significant number of HDDEs have been introduced which are targeted for heavy-duty vehicles with a GVW under 20,000 lbs. These engines are priced to compete with HDGEs and are not designed to have the same durability as HDDEs designed for larger trucks and buses. Therefore, EPA is revising the HDDE turbocharger and injector-maintenance intervals from 200,000 miles to 150,000 miles, as supported by the data submitted in the comments. See Issue B.4 in the "Summary and Analysis of Comments"[2] for further information.

2. *Idle CO Test and Standards.* In the NPRM, EPA solicited comments on the feasibility of the idle CO standard for HDGEs when catalytic converter technology is not used. EPA's original technological feasibility analysis was based on the use of catalysts, and given the limited experience of both EPA and the manufacturers with the idle CO test and standards, there was some uncertainty about the feasibility of the standard without catalysts.

Although several commenters did address the feasibility of the standard without catalysts, the major thrust of the comments was a strong objection to the idle test requirement. Manufacturers commenting on this issue claimed that the idle test was redundant due to the large amount of idle time in the transient emission test cycle and they also asserted that the idle CO requirement carried no air quality benefit.

EPA rejects both of the claims presented in the comments. First, time spent at idle during the transient test cycle does little to assure low idle emissions, since the emission standard for CO is on a mass per unit of work basis, and the mass flow at idle contributes little to the overall results of the test. This was demonstrated in the data and comments submitted by one HDGE manufacturer.

On the second point, it should be noted that one of the major air quality benefits of implementing the idle test requirement is the detection of failed (or disabled) catalytic converter emission control systems in-use, thus reducing the number of gross emitters.

EPA remains convinced that the idle CO requirement is appropriate for catalyst-equipped vehicles and engines, and will be a useful tool in the detection of failed and disabled catalytic converter-based emission control systems. Therefore, EPA believes it is appropriate to defer the idle CO requirement for HDGEs until more stringent emission standards requiring the use of catalytic converter technology take effect in 1987. At that time, catalytic converter equipped HDGEs will be required to meet the idle CO requirement. For a more detailed discussion of this subject, see Issue B.2 of the "Summary and Analysis of Comments." [2]

3. *Deterioration Factors.* Several comments claimed that the multiplicative DFs currently in effect for 1985 and later HDEs were no longer appropriate since aftertreatment control technology (catalytic converters) would no longer be required on HDGEs. At the time when multiplicative DFs were first promulgated in favor of additive DFs, EPA's analysis was not conclusive that one type of DF was preferable over another for HDEs not using aftertreatment control technology. However, that same analysis did conclude that multiplicative DFs are more representative of actual emission deterioration when aftertreatment control technology is used, since such technology reduces emissions on a proportional basis. Multiplicative DFs were adopted for HDGEs because catalytic converter technology was expected. Multiplicative DFs were also adopted for HDDEs to be consistent with HDGEs and light-duty diesel vehicles and trucks, since EPA's analysis did not conclude that additive DFs were more appropriate.

However, since HDGEs are not expected to use catalytic converter technology in 1985, EPA is revising the HDE DF requirements. In the future, HDEs using aftertreatment control technology will use multiplicative DFs and HDEs not using aftertreatment control technology will use additive DFs. Deterioration factors are discussed in Issue B.1 of the "Summary and Analysis of Comments". [2]

4. *Heavy-Duty Diesel Engine CO Standard.* Although no HDE manufacturer provided substantive comment on the proposed revision to the CO standard, several manufacturers requested that the requirement to measure CO be deleted, since HDDE CO emissions are substantially below even the statutory HDE CO standard. The comments noted that costs savings of approximately $20,000 per manufacturer per year would be possible, in addition to a slight increase in available laboratory test time.

EPA concurred with this request, and on November 2, 1982 (47 FR 49802), published provisions allowing the manufacturers to seek a waiver of the requirement to measure CO during formal HDDE certification testing. In lieu of this testing, manufacturers could demonstrate compliance through other test data or engineering analyses. These provisions will be continued for 1985 and later HDDEs. See Issue B.8 of the "Summary and Analysis of Comments" [2] for further discussion.

5. *Cold-Start Test Procedure Requirement for Heavy-Duty Diesel Engines.* Several HDDE manufacturers and EMA requested that EPA delete the cold-start portion of the HDDE transient test procedure. The manufacturers claimed that deleting the cold start would lead to a significant cost savings, because delays in development and certification testing would not be incurred while the engine returns to cold-start conditions. To support their request, the manufacturers cited test data to demonstrate that emissions from HDDEs are not sensitive to the cold-start requirement. Using this data, the commenters claimed that EPA could remove the cold-start portion of the transient test, without compromising the effectiveness of the test procedure.

EPA agrees with the manufacturers' claims that, in general, the results of the cold-start portion of the transient test for current HDDEs are not significantly different from the hot-start results. However, EPA is reluctant to remove the cold-start portion of the transient test completely. Because some engines are more sensitive to the cold-start requirement, new engines are being introduced with unknown cold-start characteristics, and virtually all HDDEs are now undergoing some significant technological changes which will affect emissions performance *(e.g.,* electronic controls). In addition, particulate trap-oxidizers may be used on HDDEs in the future, and their cold-start characteristics are not well understood.

Therefore, to deal with the manufacturers' concerns while at the same time maintaining the integrity of the HDDE transient test, EPA has decided to allow the manufacturers to decide the importance of the cold-start portion of the transient test for each of their engine families. At the manufacturer's option, EPA will accept emission test data based only on the hot-start portion of the transient test for certification. However, the official HDDE certification test procedure will include both the cold- and hot-start portions, and EPA may use both portions in any confirmatory, recall, and SEA testing. Any manufacturer choosing to submit HDDE certification test data based only on the hot-start portion of the test procedure must accept for itself any liability associated with that decision. The cold-start test for HDDEs is discussed in Issue B.7 of the "Summary and Analysis of Comments".[2]

6. *HDE Trial Audits.* As the Agency announced in its January 12, 1983 final rule (48 FR 1406), SEA testing for HDEs has been deferred two years until the 1986 model year. One of the affected manufacturers proposed that the HDE/LDT regulations include a provision to allow for a reasonable phase-in period for trial test orders for HDE SEAs. As a result, the Agency will make its SEA personnel available, to the extent possible, to monitor trial HDE SEAs prior to the 1986 model year. Any HDE manufacturer that is interested in conducting a voluntary trial audit, pursuant to the provisions of Subpart K, may contact EPA in writing to make the appropriate arrangements. These trial audits are designed to provide both EPA and the manufacturer with logistical and procedural experience in running the new HDE SEA program. The Agency will not impose any of the sanctions contained in subpart K as a result of data generated during a trial audit. This issue is discussed in greater detail in Issue B.5 of the "Summary and Analysis of Comments"[2], "Minor Amendments to HDE/LDT SEA."

F. Minor Changes and Technical Amendments

In addition to comments received on the proposed changes to the regulations governing LDT and HDE SEA, EPA also received a number of requests for minor changes and amendments to the certification and emission test procedures. EPA had planned to implement some technical amendments to these regulations as more experience was gained with the certification provisions and test procedures, so the comments received were both timely and constructive.

A manufacturer commented to EPA that 2-stroke heavy-duty diesel engines are similar to turbocharged engines with respect to the method of inlet air induction, and thus should have been excluded from the closed crankcase requirements for naturally aspirated engines. EPA agrees with this observation, and makes this change to correct the oversight.

The number of minor changes and technical amendments being implemented here is too large to permit even a brief discussion of each. However, detail on each is provided in the pertinent portion of the "Summary and Analysis of Comments"[2]. The reader is referred to the public docket for additional background.

G. Environmental Impact

The impact of this rule on the nation's air quality was a topic of substantial comment. Many commenters (primarily environmental and public interest groups) were critical of the proposed rule on the grounds that it would not lead to the maximum possible air quality improvements. Others (primarily manufacturers) criticized the proposed rule as being more stringent than necessary.

Commenters opposing revision of the HDE emission standards maintained that these revisions posed an unnecessary threat to public health and welfare, and that the HC and CO reductions anticipated from the statutory standards are necessary if areas which are either marginal or in nonattainment status are to be brought into compliance. These commenters also noted that control of HC and CO emissions from HDEs had previously been found to be cost effective by EPA and the National Commission on Air Quality, and that neither had provided information to reverse that position. Specifically, comments received from NRDC cited numerous studies and reports stressing the need for further control of HDE emissions and criticized EPA for its slow progress in requiring further control of HDE emissions. In their comments of EPA's split-class proposal for control of HDGEs, NRDC asserted that Classes IIB and III trucks should be required to meet the statutory HC and CO emission standards as soon as possible to minimize any further losses in possible air quality improvements.

Comments received which supported further revision stated that EPA had overestimated the urban air quality impact of controlling HDEs, and argued that further control was simply not cost effective. Several commenters attacked various aspects of EPA's emission factors for HDEs, claiming that the current emission factors significantly overstated the HDE emission rates and therefore the impact of HDEs on urban air quality. Several commenters noted that the use of HDDEs in all GVW class trucks was expected to increase through the decade of the 1980s and argued that the inherently lower HC and CO emissions from diesel engines would soften the need to demand stringent emission control from the remaining HDGEs.

Clearly, the revised HDE emission regulations being promulgated here will not provide the same emission control benefits as those anticipated in the original rule. However, the emission standards and regulations being promulgated here are as stringent as available considering concerns such a leadtime, costs, technological feasibility and fuel economy effects. The HDDE emission standards and regulations are being retained with only minor revisions. Even though the HDGE emission standards are being temporarily revised, the majority of HDGEs will be meeting the statutory standards beginning in 1987. The changes in the emission test procedure will not compromise its stringency as compared to EPA's transient test for HDGEs.

EPA also notes that several of the points raised by the manufacturers are valid concerns. Issues such as the precise amount of the urban air quality impact of HDEs and the accuracy of the HDE emission factors are worthy of pursuit, and EPA agrees that improvements in the accuracy of the air quality projections will always be possible. However, EPA does not believe that any of the points raised are significant enough to justify a delay in the rulemaking (which would definitely have an adverse environmental impact). None of these matters would be expected to change the current air quality projections enough to alter the course of this rulemaking.

H. Separate Standards for Heavy-Duty Gasoline Engines and Heavy-Duty Diesel Engines

During the course of the rulemaking, EPA sought comment on the question of setting the emission standards (HC and CO) at different levels for HDGEs and HDDEs. From the comments received at the public hearing, it was evident that HDDEs could meet the statutory standards at little cost, while HDGEs could have trouble meeting even the revised standards proposed by EPA. Seven HDE manufacturers and one trade association commented on this issue.

The commenters generally took position either for or against separate standards. The one trade association which commented took no position, but suggested that EPA make another proposal for comment.

Those manufacturers which produce only HDDEs supported the separate-standards approach and agreed with EPA that the technological capability dictated by engine type is an appropriate determinant in setting emission standards. However, at the same time each of these manufacturers requested that similar consideration be given in the setting of future HDE NO_x and particulate emission standards.

Those manufacturers who are expected to produce HDGEs in 1985 opposed the separate-standards approach for three reasons: Competitive effects, statutory intent, and EPA precedent. On the first point, the manufacturers were concerned that a separate-standards approach may place one engine type at a competitive disadvantage as a result of more stringent emission standards. Even though the more stringent standards may be technologically feasible, they argued that the costs of compliance may be large enough to place the lower emitting engine at a competitive disadvantage with the other engine type which is emitting at a higher level. Second, those opposing the separate-standards approach cited portions of the House and Senate Committee Reports which accompanied the 1977 Clean Air Act Amendments. The commenters claimed that the text of these reports indicated that separate standards were not intended. Third, the commenters noted that EPA had never before set separate standards, and EPA had previously taken the position that separate standards were not appropriate for HDE NO_x. The commenters asserted that the arguments put forth supporting a uniform HDE NO_x standard were also applicable to HC and CO.

EPA believes that the separate-standards approach is appropriate and consistent with the final provisions of the Act as amended in 1977. EPA acknowledges the commenters' concerns about competitive effects and believes that separate standards should be implemented with caution to guard against such problems. However, EPA notes that HDDEs, which will be meeting more stringent HC and CO standards than HDGEs, can do so for less total cost. Secondly, EPA disagrees with the commenters' claims that the Act disallows the setting of separate standards. There is no evidence that either the Senate or House Committee's position on separate standards was ever endorsed by the Conference Committee, nor was that position written into law. On the contrary, the actual wording of the Act confers broad authority on EPA in this area. On the third point, EPA precedent, several facts are worth noting. First, even though separate standards have never been set for HDE HC, CO, or NO_x, EPA notes that a type of separate standards has been in place for years in the form of smoke standards which apply to HDDEs only. Also, the use of separate standards has recently been extended to cover evaporative HC and idle CO emissions from HDGVs and HDGEs. With regard to the EPA position outlined in the LDT/HDE NO_x ANPRM, those statements did not reflect a final Agency policy statement, but indicated a preliminary EPA position on the single- vs. separate-standards issue for HDE NO_x, published for public comment in an ANPRM. That position was clearly subject to change as is Agency policy in general. This is especially true when circumstances and conditions change or when new regulations arise. It is in this light that EPA has considered the issue of split standards for HDE HC and CO.

Given that section 202(a)(3)(A)(iv) of the Act gives EPA the authority to set separate standards and section 202(a)(3)(C)(i) compels that the emission standards be set at levels as stringent as reasonably possible, EPA is implementing separate standards for HDGEs and HDDEs. No competitive disadvantage will ensue from this action, since costs for HDDEs to meet the statutory standards will probably be less than costs for HDGEs to meet the revised standards. In addition, the majority of HDGEs will still be required to meet the statutory standards, although admittedly two years later than for HDDEs. Overall then, EPA believes that setting separate standards in this unique situation is good public policy. The issue of separate standards for HDGEs and HDDEs is discussed in more detail in Issue B.6 of the "Summary and Analysis of Comments."[2]

I. Potential Impacts on Specific Manufacturers

Even with the revisions proposed in the NPRM, two HDGE manufacturers (Chrysler and International Harvester (IH)) claimed that the new emission control requirements would have a significant impact on their operations and might be a factor is their decisions to abandon the HDGE market.

In its initial submittal, Chrysler indicated that it would probably leave the HDGE market when compliance with the new emission-control requirements became necessary. Chrysler's position at that time was based on the belief that the potential profitability of the HDGE market did not justify the use of its scarce capital resources for new test facilities and the development of emission-control systems. To stay in the market, Chrysler requested a "small-volume waiver" which would permit it to continue certification using the steady-state test.

International Harvester stated that given its current financial difficulties and the anticipated reduction in demand for HDGEs, it would leave the market whenever the new emission-control requirements were implemented. With the decision to leave the market apparently already made, the model year of implementation for the new regulations was IH's major concern. IH requested that the new regulations be deferred until 1985 to allow them an orderly withdrawal from the market.

In subsequent comments submitted by Chrysler, it reversed its initial position and is now preparing to remain in the market. This change was apparently precipitated by the turnaround in Chryler's financial situation since the NPRM, and the stabilization in gasoline prices, presumably leading to an acceptable level of demand for Chrysler's HDGEs. These regulations are being implemented for 1985, which will allow leadtime for Chrysler to comply with the new regulations and enable IH to produce HDGEs until the end of 1984, as desired.

Given that Chrysler has decided to remain in the HDGE market and that IH's decision to withdraw from the market is not based on the effects of these regulations, EPA concludes that these regulations will not be a factor in either manufacturer's decision to continue producing HDGEs. More discussion on this subject may be found in Issue B.10 of the "Summary and Analysis of Comments".[2]

VII. Authority

As noted throughout this preamble, today's action is based on a number of provisions in Titles II and III of the Clean Air Act. These include the authority to establish heavy-duty emission standards in Section 202(a)(3) of the Act, and particularly the authority to revise those standards under paragraphs (a)(3) (B) and (C) of that section. Based on the analysis in this preamble and the supporting documents, EPA finds that compliance with the emission standards that would apply but for these revisions cannot be achieved by technology available for those model years, without increasing cost to an excessive and unreasonable degree. The revised standards in today's action, as discussed earlier, represent the maximum degree of emission reduction which EPA believes can be achieved by means reasonably expected to be available for production during the periods for which revised standards apply.

The reader is referred to the January 12, 1983, final rule for a more detailed discussion of the provisions for revising heavy-duty standards (48 FR 1411). The only challenge by commenters in this rulemaking to EPA's authority to revise the standards concerns the requirement that EPA provide four years leadtime before implementing revised standards. As discussed previously, EPA believes it has satisfied that requirement. One commenter also noted that EPA could not permanently revise standards for the heaviest HDGEs under this authority, and, as discussed earlier, EPA agreed.

Other sources of statutory authority from which EPA has drawn in promulgating these rules include: Sections 202(a) (1) and (2), providing general authority to promulgate emission standards (standards for LDTs were set under this authority); Section 202(a)(3)(A)(iv), providing the authority to establish classes or categories of heavy-duty engines; Section 202(d)(2), providing the authority to establish appropriate useful-life periods for LDTs and HDEs; Section 206, conferring authority, among other things, to certify vehicles and engines under specified test procedures and to test assembly-line vehicles and engines; Section 207, establishing in-use requirements, including warranty, recall, maintenance and use, and labeling; Section 208, providing authority to establish requirements for reporting, recordkeeping, and information gathering; and Section 301(a), conferring general rulemaking authority to implement statutory requirements.

Administrative Designation

Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore subject to the requirement of a Regulatory Impact Analysis. This regulation is not major because it involves no negative cost impacts and has no significant adverse effects on competition, productivity, investment, employment, or innovation.

This regulation was submitted to the Office of Management and Budget for review as required by Executive Order 12291.

Effect on Small Entities

Section 605 of the Regulatory Flexibility Act requires the Administrator to certify regulations that do not have a significant impact on a substantial number of small entities. I certify that this regulation does not have such an effect because it primarily affects only motor vehicle engine manufacturers, a group which does not include a substantial number of small entities. Also, the primary effect of this action is to provide regulatory relief, so no private parties should see any substantial adverse impact.

Information Collection Requirements

Information collection requirements contained in these regulations have been approved by the Office of Management and Budget under the provisions of the Paperwork Reduction Act of 1980 U.S.C. 3501 et seq. and have been assigned OMB Control Numbers 2000-0390.

List of Subjects in 40 CFR Part 86

Administrative practice and procedure, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements.

Dated: October 25, 1983.

Alvin L. Alm,

Acting Administrator.

PART 86—[AMENDED]

For the reasons set forth in the Preamble, Part 86 of Title 40 of the *Code of Federal Regulations* is amended as set forth below:

Authority: Secs. 202, 206, 207, 208, 301a, Clean Air Act as amended; 42 U.S.C. 7521, 7525, 7541, 7542, 7601a.

Subpart A—[Amended]

1. Section 86.084-9 of Subpart A is amended by revising paragraphs (a)(1)(ii)(B) and (f) and adding a new paragraph (h), to read as follows:

§ 86.084-9 Emission standards for 1984 and later model year light-duty trucks.

(a)(1) * * *

(ii) * * *

(B) 0.50 percent of exhaust gas flow at curb idle (gasoline-fueled vehicles only).

* * * * *

(f) No crankcase emissions shall be discharged into the ambient atmosphere from any 1984 and later model year gasoline-fueled light-duty trucks sold for principal use at a designated high-altitude location.

* * * * *

(h) Manufacturers choosing to certify using the half-life useful-life option as defined in § 86.084-2, which is available only for the 1984 model year, are restricted to using only the certification procedures applicable for the 1983 model year, with the exception of the determination of idle CO deterioration factors as noted in § 86.084-23(b)(3).

2. Section 86.084-10 of Subpart A is amended by revising paragraph (a)(1)(ii)(B), to read as follows:

§ 86.084-10 Emission standards for 1984 and later model year gasoline-fueled heavy-duty engines.

(a)(1) * * *

(ii) * * *

(B) 0.50 percent of the exhaust gas flow at curb idle.

* * * * *

3. Section 86.084-11 of Subpart A is amended by revising paragraph (c), to read as follows:

§ 86.084-11 Emission standards for 1984 and later model year diesel heavy-duty engines

* * * * *

(c) No crankcase emissions shall be discharged into the atmosphere from any new 1984 model year naturally aspirated diesel heavy-duty engine. This provision does not apply to engines using turbochargers, pumps, blowers, or superchargers for air induction.

* * * * *

4. Section 86.084-28 of Subpart A is amended by revising paragraphs (c)(4)(ii) and (c)(4)(iii), to read as follows:

§ 86.084-28 Compliance with emission standards.

* * * * *

(c) * * *

(4) * * *

(ii) Separate exhaust emission deterioration factors, determined from tests on engines, subsystems, or components conducted by the manufacturer, shall be supplied for each engine-system combination. For gasoline-fueled and diesel engines, separate factors shall be established for transient HC, CO, and NO_x. For gasoline-fueled engines utilizing aftertreatment technology (e.g., catalytic converters), a separate factor shall be established for idle CO. For diesel smoke testing, separate factors shall also be established for the acceleration mode (designated as "A"), the lugging mode (designated as "B"), and the peak opacity (designated as "C").

(iii)(A) Paragraph (c)(4)(iii)(A) of this section applies to gasoline-fueled heavy-duty engines.

(*1*) *Gasoline-fueled heavy-duty engines not utilizing aftertreatment technology (e.g., catalytic converters).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Gasoline-fueled heavy-duty engines utilizing aftertreatment technology (e.g., catalytic converters).* For transient HC, CO, and NO_x, and for idle CO, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(B) Paragraph (c)(4)(iii)(B) of this section applies to diesel heavy-duty engines.

(*1*) *Diesel heavy-duty engines not utilizing aftertreatment technology (e.g., particulate traps).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Diesel heavy-duty engines utilizing aftertreatment technology (e.g., particulate traps).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(*3*) For acceleration smoke ("A"), lugging smoke ("B"), and peak smoke ("C"), the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

* * * * *

5. Section 86.084-35 of Subpart A is amended by revising paragraphs (d)(2), (d)(3) and (f) to read as follows:

§ 86.084-35 Labeling.

* * * * *

(d) * * *

(2) The subordinate addition to the statement in paragraph (d)(1) of this section: "This vehicle's actual life may vary depending on its service application. (For additional information see the owner's maintenance instructions.) This engine conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks when installed in a vehicle completed at a curb weight of not more than ———— pounds or with a frontal area not greater than ———— square feet for its useful life."

(3) For incomplete light-duty trucks or incomplete heavy-duty vehicles optionally certified as light-duty trucks whose useful-life period is determined by the assigned useful-life period option as described in § 86.084-2, the following statement shall be printed on the label required in paragraph (a)(2) of this section in lieu of the statement required by paragraph (a)(2)(iii)(H) of this section: "This vehicle conforms to U.S. EPA Regulations Applicable to 19—— Model Year New Motor Vehicles When Completed at a Maximum Curb Weight of ———— pounds and a Maximum Frontal Area of ———— Square Feet." These vehicles need not comply with the labeling requirements in paragraphs (d)(1) and (d)(2) of this section.

* * * * *

(f) The manufacturer of any incomplete light-duty vehicle or light-duty truck shall notify the purchaser of such vehicle of any curb weight, frontal area, or gross vehicle weight rating limitations affecting the emission certificate applicable to that vehicle. This notification shall be transmitted in a manner consistent with National Highway Traffic Safety Administration safety notification requirements published in 49 CFR Part 568.

6. Section 86.085-2 of Subpart A is amended by removing the designation (a) from the introductory text and adding new definitions to read as follows:

§ 86.085-2 Definitions.

* * * * *

"Primary intended service class" means:

(a) The primary service application group for whch a heavy-duty diesel engine in designed and marketed, as determined by the manufacturer. The primary intended service classes are designated as light, medium, and heavy heavy-duty diesel engines. The determination is based on factors such as vehicle GVW, vehicle usage and operating patterns, other vehicle design characteristics, engine horsepower, and other engine design and operating characteristics.

(1) Light heavy-duty diesel engines usually are non-sleeved and not designed for rebuild; their rated horsepower generally ranges from 70 to 170. Vehicle body types in this group might include any heavy-duty vehicle built for a light-duty truck chassis, van trucks, multi-stop vans, recreational vehicles, and some single axle straight trucks. Typical applications would include personal transportation, light-load commercial hauling and delivery, passenger service, agriculture, and construction. The GVWR of these vehicles is normally less than 19,500 lbs.

(2) Medium heavy-duty diesel engines may be sleeved or non-sleeved and may be designed for rebuild. Rated horsepower generally ranges from 170 to 250. Vehicle body types in this group would typically include school buses, tandem axle straight trucks, city tractors, and a variety of special purpose vehicles such as small dump trucks, and trash compactor trucks. Typical applications would include commercial short haul and intra-city delivery and pickup. Engines in this group are normally used in vehicles whose GVWR varies from 19,500-33,000 lbs.

(3) Heavy heavy-duty diesel engines are sleeved and designed for multiple rebuilds. Their rated horsepower generally exceeds 250. Vehicles in this group are normally tractors, trucks, and buses used in inter-city, long-haul applications. These vehicles normally exceed 33,000 lbs GVWR.

"Useful life" means:

(a) For light-duty vehicles a period of use of 5 years or 50,000 miles, whichever first occurs.

(b) For a light-duty truck engine family, a period of use of 11 years or 120,000 miles, whichever occurs first.

(c) For a gasoline-fueled heavy-duty engine family, a period of use of 8 years or 110,000 miles, whichever first occurs.

(d) For a diesel heavy-duty engine family:

(1) For light heavy-duty diesel engines, a period of use of 8 years or 110,000 miles, whichever first occurs.

(2) For medium heavy-duty diesel engines, a period of use of 8 years or 185,000 miles, whichever first occurs.

(3) For heavy heavy-duty diesel engines, a period of use of 8 years or 290,000 miles, whichever first occurs.

(e) As an option for both light-duty truck and heavy-duty engine families, an alternative useful life period assigned by the Administrator under the provisions of paragraph (f) of § 86.085-21.

(f) The useful-life period for purposes of the emissions defect warranty and emissions performance warranty shall be a period of 5 years/50,000 miles whichever first occurs, for light-duty trucks, gasoline heavy-duty engines, and light heavy-duty diesel engines. For all other heavy-duty diesel engines the aforementioned period is 5 years/100,000 miles, whichever first occurs. However, in no case may this period be less than the manufacturer's basic mechanical warranty period for the engine family.

7. Section 86.085-9 of Subpart A is amended by revising paragraph (a((1)(ii)(B) to read as follows:

§ 86.085-9 Emission standards for 1985 and later model year light-duty trucks.

(a)(1) * * *

(ii) * * *

(B) *Gasoline-fueled vehicles.* 0.05 percent of exhaust gas flow at curb idle (gasoline-fueled vehicles only).

* * * * *

8. Section 86.085-10 of Subpart A is amended by revising paragraphs (a)(1)(i) through (iii), (a)(2), (a)(3), (b)(1) and (b)(2) and by adding a new paragraph (b)(3) to read as follows:

§ 86.085-10 Emission standards for 1985 and later model year gasoline-fueled heavy-duty engines and vehicles.

(a)(1) * * *

(i) *Hydrocarbons.* (A) 1.9 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(1) of Appendix I to this part, or,

(B) 2.5 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(3) of Appendix I to this part.

(ii) *Carbon monoxide.* (A)(*1*) 37.1 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(1) of Appendix I to this part, or,

(*2*) 40.0 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(3) of Appendix I to this part.

(B) [Reserved]

(iii) *Oxides of nitrogen.* (A) 10.6 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(1) of Appendix I to this part, or,

(B) 10.7 grams per brake horsepower-hour, as measured under the transient operating conditions set forth in paragraph (f)(3) of Appendix I to this part.

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over operating schedules set forth in Appendix I to this part, and measured and calculated in accordance with the procedures set forth in Subparts N or P.

(3)(i) A manufacturer shall select to certify its gasoline-fueled heavy-duty engines using either the operating schedule set forth in the paragraph (f)(1) of Appendix I to this part and the emission standards set forth in paragraphs (a)(1)(i)(A), (a)(1)(ii)(A)(*1*), and (a)(1)(iii)(A) of this section or, the operating schedule set forth in paragraph (f)(3) of Appendix I to this part and the emission standards set forth in subparagraphs (1)(i)(B), (1)(ii)(A)(*2*), and (1)(ii)(B) of this paragraph.

(ii) All of a manufacturer's gasoline-fueled heavy-duty engine families shall be certified using the same operating schedule and emission standards.

(iii) All official testing of a manufacturer's gasoline-fueled heavy-duty engine families conducted by EPA shall be conducted using the operating schedule and emission standards selected by that manufacturer at the time of certification.

(b)(1) Evaporative emissions from 1985 and later model year gasoline-fueled heavy-duty vehicles, except as noted in paragraph (b)(3) of this section, shall not exceed:

(i) *Hydrocarbons.* (A) For vehicles with a Gross Vehicle Weight Rating of up to 14,000 pounds, 3.0 grams per test.

(B) For vehicles with a Gross Vehicle Weight Rating of greater than 14,000 pounds, 4.0 grams per test.

(2)(i) For vehicles with a Gross Vehicle Weight Rating of up to 26,000 pounds, the standards set forth in paragraph (b)(1) of this section refer to a composite sample of fuel evaporative emissions collected under the conditions set forth in Subpart M and measured in accordance with these procedures.

(ii) For vehicles with a Gross Vehicle Weight Rating of greater than 26,000 pounds, the standards set forth in paragraph (b)(1)(i)(B) of this section refer to the manufacturer's engineering design evaluation using good engineering practice (a statement of which is required in § 86.085-23(b)(4)(ii)).

(3) Model year 1985 heavy-duty vehicles equipped with model year 1984 gasoline-fueled heavy-duty engines shall not be required to comply with the evaporative emission standards set forth in paragraphs (1) and (2) of this section, nor with the related requirements set forth elsewhere in this subpart.

* * * * *

9. Section 86.085-11 of Subpart A is amended by revising paragraphs (a)(1)(i) through (iii), (a)(2), (c) and (d) to read as follows:

§ 86.085-11 Exhaust emissions from new 1985 and later model year diesel heavy-duty engines.

(a)(1) * * *

(i) *Hydrocarbons.* 1.3 grams per brake horsepower-hour, as measured under transient operating conditions.

(ii) *Carbon monoxide.* 15.5 grams per brake horsepower-hour, as measured under transient operating conditions.

(iii) *Oxides of nitrogen.* 10.7 grams per brake horsepower-hour, as measured under transient operating conditions.

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(2) of Appendix I to this part, and measured and calculated in accordance with the procedures set forth in Subpart N of this part, except as noted in § 86.085-23(c)(2)(i) and (ii).

* * * * *

(c) No crankcase emissions shall be discharged into the atmosphere from any new 1985 model year naturally aspirated diesel heavy-duty engine. This provision does not apply to engines using turbochargers, pumps, blowers, or superchargers for air induction.

(d) Every manufacturer of new motor vehicle engines subject to the standards prescribed in this section shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with applicable procedures in Subpart I or N of this part to ascertain that such test engines meet the requirements of paragraphs (a), (b), and (c) of this section.

10. Section 86.085-21 of Subpart A is amended by revising paragraph (b)(4)(iii)(A), revising paragraphs (b)(4)(iii)(B) and (C), and adding new paragraphs (b)(4)(iii)(D) and (f) to read as follows:

§ 86.085-21 Application for certification.

* * * * *

(b) * * *

(4) * * *

(iii)(A) A description of the test procedures to be used to establish the durability data or the exhaust emission deterioration factors required to be determined and supplied in § 86.085–23(b)(1).

(B)(*1)* For engine families provided an alternative useful life period under paragraph (f) of this section, a statement of that alternative period and a brief synopsis of the justification.

(*2)* For heavy-duty diesel engine families, a statement of the primary intended service class (light, medium, or heavy) and an explanation as to why that service class was selected. Each diesel engine family shall be certified under one primary intended service class only. After reviewing the guidance in § 86.085–2, the class shall be determined on the basis of which class best represents the majority of the sales of that engine family.

(C)(*1)* For each light-duty truck engine family and each heavy-duty engine family, a statement of recommended maintenance and procedures necessary to assure that the vehicles (or engines) covered by a certificate of conformity in operation conform to the regulations, and a description of the program for training of personnel for such maintenance, and the equipment required.

(*2)* A description of vehicle adjustments or modifications necessary, if any, to assure that light-duty trucks covered by a certificate of conformity conform to the regulations while being operated at any altitude locations, and a statement of the altitude at which the adjustments or modifications apply.

(D) At the option of the manufacturer, the proposed composition of the emission-data test fleet or (where applicable) the durability-data test fleet.

* * * * *

(f) Light-duty truck and heavy-duty engine manufacturers who believe that the useful life periods of § 86.085–2 are significantly unrepresentative for one or more engine families (either too long or too short), may petition the Administrator to provide an alternative useful-life period. This petition must include the full rationale behind the request, together with any supporting data and other evidence. Based on this or other information the Administrator may assign an alternative useful-life period. Any petition should be submitted in a timely manner, to allow adequate time for a thorough evaluation.

11. Section 86.085–22 of Subpart A is amended by revising paragraphs (d)(2) and (e)(1)(i), and adding a new paragraph (e)(1)(iv), to read as follows:

§ 86.085–22 Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges.

* * * * *

(d) * * *

(2) *Light-duty trucks and heavy-duty engines only.* The Administrator does not approve the test procedures for establishing exhaust emission deterioration factors. The manufacturer shall submit these procedures and determinations as required in § 86.085–21(b)(4)(iii) prior to determining the deterioration factors.

* * * * *

(e) * * *

(1)(i) Except as noted in paragraph (e)(1)(iv) of this section, the Administrator may determine to be subject to adjustment the idle fuel-air mixture parameter on gasoline-fueled vehicles (or engines) (carbureted or fuel injected); the choke valve action parameter(s) on any vehicle (or engine) (diesel or gasoline-fueled) which is physically capable of being adjusted, may significantly affect emissions, and was not present on the manufacturer's vehicles (or engines) in the previous model year in the same form and function.

* * * * *

(iv) Manual chokes of heavy-duty engines only will not be considered a parameter subject to adjustment under the parameter adjustment requirements.

* * * * *

12. Section 86.085–23 of Subpart A is amended by correcting paragraphs (b)(1)(ii) and (b)(2), redesignating paragraph (c)(2) as paragraph (c)(2)(i), and adding a new paragraph (c)(2)(ii) to read as follows:

§ 86.085–23 Required data.

* * * * *

(b)(1) * * *

(ii) Exhaust emission deterioration factors for light-duty trucks and heavy-duty engines and all test data that are derived from the testing described under § 86.085–21(b)(4)(iii)(A) as well as a record of all pertinent maintenance. Such testing shall be designed and conducted in accordance with good engineering practice to assure that the engines covered by a certificate issued under § 86.085–30 will meet the emission standards in § 86.085–9, § 86.085–10, or § 86.085–11 as appropriate, in actual use for the useful life of the engine.

(2) For light-duty vehicles and light-duty trucks, evaporative emission deterioration factors for each evaporative emission family-evaporative emission control system combination and all test data that are derived from testing described under § 86.085–21(b)(4)(i), designed and conducted in accordance with good engineering practice to assure that the vehicles covered by a certificate issued under § 86.085–30 will meet the evaporative emission standards in § 86.085–8 or § 86.085–9, as appropriate, for the useful life of the vehicle.

* * * * *

(c) * * *

(2) *Certification engines.* (i) Emission data on such engines tested in accordance with applicable emission test procedures of this subpart and in such numbers as specified. These data shall include zero-hour data, if generated, and emission data generated for certification as required under § 86.082–26(b)(5). In lieu of providing emission data on CO emissions from diesel certification engines the Administrator may, on request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other information) that the engine will conform with the CO emission standard of § 86.085–11.

(ii) For heavy-duty diesel engines, a manufacturer may submit hot-start data only, in accordance with Subpart N, when making application for certification. However, for confirmatory, SEA, and recall testing by the Agency, both the cold-start and hot-start test data, as specified in Subpart N, will be included in the official results.

* * * * *

13. A new § 86.085–25 is added to Subpart A, to read as follows:

§ 86.085–25 Maintenance.

(a) *Light-duty vehicles.* Paragraph (a) of this section applies to light-duty vehicles.

(1) Scheduled maintenance on the engine, emission control system, and fuel system of durability-data vehicles, selected by the Administrator or elected by the manufacturer under § 86.084–24(c)(1), shall be scheduled for performance during durability testing at the same mileage intervals that will be specified in the manufacturer's maintenance instructions furnished to the ultimate purchaser of the motor vehicle. This maintenance schedule may be updated as necessary throughout the durability-data vehicle's testing provided that no maintenance operation is deleted from the maintenance schedule after the operation has been performed on the test vehicle. Such maintenance shall be performed, except as provided in paragraph (a)(5)(iii) of

this section, only under the following provisions:

(i) Scheduled major engine tuneups to manufacturer's specifications may be performed no more frequently than every 12,500 miles of scheduled driving: Provided that no tuneup may be performed after 45,000 miles of scheduled driving. A scheduled major engine tuneup shall be restricted to paragraph (a)(1)(i) (A) or (B) of this section, and shall be conducted in a manner consistent with service instructions and specifications provided by the manufacturer for use by customer service personnel.

(A) *For gasoline-fueled vehicles*, the following items may be inspected, replaced, cleaned, adjusted, and/or serviced as required:

(*1*) Ignition system.

(*2*) Cold starting enrichment system (includes fast idle speed setting).

(*3*) Curb idle speed and air/fuel mixture.

(*4*) Drive belt tension on engine accessories.

(*5*) Value lash.

(*6*) Inlet air and exhaust gas control valves.

(*7*) Engine bolt torque.

(*8*) Spark plugs.

(*9*) Fuel filter and air filter.

(*10*) Crankcase emission control system.

(*11*) Fuel evaporative emission control system.

(B) *For diesel vehicles*, a major engine tuneup shall be restricted to the following:

(*1*) Adjust low idle speed.

(*2*) Adjust valve lash if required.

(*3*) Adjust injector timing.

(*4*) Adjust governor.

(*5*) Clean and service injector tips.

(*6*) Adjust drive belt tension on engine accessories.

(*7*) Check engine bolt torque and tighten as required.

(ii) Change of engine and transmission oil, and change or service of oil filter will be allowed at the same mileage intervals that will be specified in the manufacturer's maintenance instructions.

(iii) Readjustment of the engine idle speed (curb idle and fast idle) may be performed, in addition to adjustment during scheduled major engine tuneups, once during the first 5,000 miles of vehicle operation.

(2)(i) *For gasoline-fueled vehicles*, unscheduled maintenance on the engine, emission control system, and fuel system of durability vehicles may be performed, except as provided in paragraph (a)(5)(i) of this section, only under the following provisions:

(A) Any persistently misfiring spark plug may be replaced, in addition to replacement at scheduled major engine tuneup points.

(B) Readjustment of the engine cold starting enrichment system may be performed if there is a problem of stalling or if there is visible black smoke.

(C) Readjustment of the engine idle-speed (curb idle and fast idle) may be performed, in addition to that performed as scheduled maintenance under paragraph (a)(1) of this section, if the idle speed exceeds the manufacturer's recommended idle speed by 300 rpm or more, or if there is a problem of stalling.

(D) The idle mixture may be reset, other than during scheduled major engine tuneups, only with the advance approval of the Administrator.

(ii) *For diesel vehicles*, unscheduled maintenance on the engine emission control system, and fuel system of durability-data vehicles may be performed, except as provided in paragraph (a)(5)(i) of this section, only under the following provisions:

(A) Injectors may be changed if a persistent misfire is detected.

(B) Readjustment of the engine idle speed (curb idle and fast idle) may be performed in addition to that performed as scheduled maintenance under paragraph (a)(1) of this section, if the idle speed exceeds the manufacturer's recommended idle speed by 300 rpm or more, or if there is a problem of stalling.

(3) An exhaust gas recirculation (EGR) system may be serviced during durability testing only under one of the following provisions:

(i) Manufacturers may schedule service to the EGR system at the scheduled major engine tuneup, if an audible and/or visible signal approved by the Administrator alerts the vehicle operator to the need for EGR system maintenance at each of those mileage points. One additional servicing may also be performed as unscheduled maintenance if there is an overt indication of malfunction and if the malfunction or repair of the malfunction does not render the test vehicle unrepresentative of vehicles in use.

(ii) Manufacturers may service the EGR system a maximum of three times during the 50,000 miles either at a scheduled major engine tuneup point or as unscheduled maintenance, if an audible and/or visual signal approved by the Administrator alerts the vehicle operator to the need for EGR system maintenance. The signal may be activated either by EGR system failure (unscheduled maintenance) or need for scheduled periodic maintenance. If maintenance is performed, the signal for scheduled periodic maintenance shall be reset. One additional servicing may also be performed as unscheduled maintenance if there is an overt indication of malfunction and if the malfunction or repair of the malfunction does not render the test vehicle unrepresentative of vehicles in use.

(iii) Manufacturers may schedule service to the EGR system at the scheduled major engine tuneup(s) if failure to perform EGR system maintenance is not likely, as determined by the Administrator, to result in an improvement in vehicle performance. One additional servicing may also be performed as unscheduled maintenance if there is an overt indication of malfunction and if the malfunction or repair of the malfunction does not render the test vehicle unrepresentative of vehicles in use.

(4) The catalytic converter may be serviced once during 50,000 miles if an audible and/or visual signal approved by the Administrator alerts the vehicle operator to the need for maintenance. The signal may be activated either by component failure or need for maintenance at a scheduled point.

(5) Any other engine, emission control system, or fuel system adjustment, repair, removal, disassembly, cleaning, or replacement on durability-data vehicles shall be performed only with the advance approval of the Administrator.

(i) In the case of unscheduled maintenance, such approval will be given if the Administrator:

(A) Has made a preliminary determination that part failure or system malfunction, or the repair of such failure or malfunction, does not render the vehicle unrepresentative of vehicles in use, and does not require direct access to the combustion chamber, except for spark plug, fuel injection component, or removable prechamber removal or replacement; and

(B) Has made a determination that the need for maintenance or repairs is indicated by an overt indication of malfunction such as persistent misfiring, vehicle stalling, overheating, fluid leakage, loss of oil pressure, or charge indicator warning. For the evaporative emission control system this overt indication may be indicated by such items as fuel odor or fluid leakage.

(ii) Emission measurement may not be used as a means of determining the need for unscheduled maintenance under paragraph (a)(5)(i) of this section except under the conditions outlined in paragraph (a)(5)(ii)(A) of this section.

(A) *Conditions for unscheduled maintenance based upon emission* *results:* The Administrator may approve unscheduled maintenance on durability-data vehicles based upon a significant change in emission levels that indicates a vehicle malfunction. In these cases the Administrator may first approve specific diagnostic procedures to identify the source of the problem. The Administrator may further approve specific corrections to the problem after the problem has been identified. The Administrator may only approve the corrective action if the Administrator determines that:

(*1*) The malfunction was caused by nonproduction build practices or by a previously undetected design problem,

(*2*) The malfunction will not occur in production vehicles in use, *and*

(*3*) The deterioration factor generated by the durability-data vehicle will remain unaffected by the malfunction or by the corrective action (e.g., the malfunction was present only a short period of time before detection, replacement parts are functionally representative of the proper mileage, etc.).

(B) Following any unscheduled maintenance approved under paragraph (a)(5)(ii)(A) of this section, the manufacturer shall perform an after-maintenance emissions test. If the Administrator determines that the after-maintenance emission levels for any pollutant indicates that the deterioration factor is no longer representative of production, the Administrator may disqualify the durability-data vehicle.

(iii) Requests for authorization of scheduled maintenance of emission control-related components not specifically authorized to be maintained by these regulations must be made prior to the beginning of durability testing. The Administrator will approve the performance of such maintenance if the manufacturer makes a satisfactory showing that the maintenance will be peformed on vehicles in use.

(6) If the Administrator determines that part failure or system malfunction occurrence and/or repair rendered the vehicle unrepresentative of vehicles in use, the vehicle shall not be used as a durability-data vehicle.

(7) Where the Administrator agrees under § 86.084-26 to a mileage accumulation of less than 50,000 miles for durability testing, he may modify the requirements of this paragraph.

(8)(i) Adjustment of engine idle speed on emission-data vehicles may be performed once before the 6,436-kilometer (4,000-mile) test point. Any other engine, emission control system, or fuel system adjustment, repair, removal, disassembly, cleaning, or replacement on emission-data vehicles shall be performed only with the advance approval of the Administrator.

(ii) [Reserved]

(iii) [Reserved]

(9) Repairs to vehicle components of the durability-data or emission-data vehicle, other than the engine, emission control system, or fuel system, shall be performed only as a result of part failure, vehicle system malfunction, or with the advance approval of the Administrator.

(10) Complete emission tests (see §§ 86.106 through 86.145) are required, unless waived by the Administrator, before and after scheduled maintenance approved for durability-data vehicles. The manufacturers may perform emissions tests before unscheduled maintenance. Complete emission tests are required after unscheduled maintenance which may reasonably be expected to affect emissions. The Administrator may waive the requirement to test after unscheduled maintenance. These test data may be submitted weekly to the Administrator, but shall be air posted or delivered within 7 days after completion of the tests, along with a complete record of all pertinent maintenance, including a preliminary engineering report of any malfunction diagnosis and the corrective action taken. A complete engineering report shall be delivered to the Administrator concurrently with the manufacturer's application for certification. In addition, all test data and maintenance reports shall be compiled and provided to the Administrator concurrently in accordance with § 86.084-23.

(11) The Administrator shall be given the opportunity to verify the existence of an overt indication of part failure and/ or vehicle malfunction (e.g., misfiring, stalling, black smoke), or an activation of an audible and/or visual signal, prior to the performance of any maintenance to which such overt indication or signal is relevant under the provisions of this section.

(12) Equipment, instruments, or tools may not be used to identify malfunctioning, maladjusted, or defective engine components unless the same or equivalent equipment, instruments, or tools will be available to dealerships and other service outlets and,

(i) Are used in conjunction with scheduled maintenance on such components,

(ii) Are used subsequent to the identification of a vehicle or engine malfunction, as provided in paragraph (a)(5)(i) of this section for durability-data vehicles or paragraph (a)(8)(i) of this section for emission-data vehicles, or

(iii) Unless specifically authorized by the Administrator.

(b) *Light-duty trucks and heavy-duty engines.* Paragraph (b) of this section applies to light-duty trucks and heavy-duty engines.

(1) Any emission-related maintenance which is performed on vehicles, engines, subsystems, or components used to determine exhaust emission deterioration factors must be technologically necessary for compliance with the standards in actual use. All emission-related *scheduled* maintenance must occur at the same mileage intervals (or equivalent intervals if engines, subsystems, or components are used) that will be specified in the manufacturer's maintenance instructions furnished to the ultimate purchaser of the motor vehicle.

(i) The manufacturer must submit data to the Administrator which demonstrates that all of the emission-related scheduled maintenance which is to be performed on the durability-data vehicles is technologically necessary. EPA has determined that emission-related maintenance at shorter intervals than that outline in paragraphs (b)(1)(ii) and (b)(1)(iii) is not technologically necessary. The Administrator may determine that even maintenance more restrictive (e.g., longer intervals) than that listed in paragraphs (b)(1)(ii) and (b)(1)(iii) is not technologically necessary.

(ii) For gasoline-fueled vehicles or engines, emission-related maintenance in addition to or at shorter intervals than that listed below will not be accepted as technologically necessary, except as provided in paragraph (b)(1)(iv).

(A) (*1*) The cleaning or replacement of light-duty truck spark plugs at 30,000 miles of use and at 30,000-mile intervals thereafter.

(*2*) The cleaning or replacement of gasoline-fueled heavy-duty engine spark plugs at 12,000 miles (or 360 hours) of use and at 12,000-mile (or 360-hour) intervals thereafter, for engine certified for use with leaded fuel.

(*3*) The cleaning or replacement of gasoline-fueled heavy-duty engine spark plugs at 25,000 miles (or 750 hours) of use and at 25,000-mile intervals (or 750-hour) intervals thereafter, for engines certified for use with unleaded fuel only.

(B) The inspecting, cleaning, adjustment, or replacement of the following at 50,000 miles (or 1,500 hours) of use and at 50,000-mile (or 1,500-hour) intervals thereafter.

(*1*) Positive crankcase ventilation and exhaust gas recirculation valves.

(*2*) Emission-related hoses and tubes.

(*3*) Ignition wires.

(*4*) Oxygen sensor.

(*5*) Idle mixture.

(C) The replacement of the catalytic converter or inspecting and cleaning of the injector tips at 100,000 miles (or 3,000 hours) of use and at 100,000-mile (or 3,000-hour) intervals thereafter.

(D)(*1*) For heavy-duty engines certified for use with leaded fuel, the servicing of the exhaust gas recirculation (EGR) system at 24,000 miles (or 720 hours) of use and at 24,000-mile (or 720-hour) intervals thereafter.

(*2*) For heavy-duty engines certified for use with unleaded fuel only, the servicing of the EGR system at 50,000 miles (or 1,500 hours) of use and at 50,000-mile (or 1,500-hour) intervals thereafter.

(E) Manufacturers may schedule service to the EGR system at the intervals indicated in paragraphs (b)(1)(ii) (B) and (D) above, only if an audible and/or visible signal, approved by the Administrator, alerts the engine operator to the need for EGR system maintenance at each of those mileage points.

(iii) For diesel vehicles or engines, emission-related maintenance in addition to or at shorter intervals than that listed below will not be accepted as technologically necessary, except as provided in paragraph (b)(1)(iv) of this section.

(A) The following maintenance at 50,000 miles (or 1,500 hours) of use and at 50,000-mile (or 1,500-hour) intervals thereafter:

(*1*) Cleaning or replacement of the exhaust gas recirculation and positive crankcase ventilation valves;

(*2*) Cleaning of injector tips.

(B) The cleaning, rebuilding, or replacement of the turbocharger and injectors at 100,000 miles (or 3,000 hours) of use and at 100,000-mile (or 3,000-hour) intervals thereafter for light-duty trucks, or at 150,000 miles (or 4,500 hours) of use and at 150,000-mile (or 4,500-hour) intervals thereafter for heavy-duty engines.

(C) Manufacturers may schedule service to the EGR system at the intervals indicated in paragraph (b)(1)(iii)(A) above, only if an audible and/or visible signal, approved by the Administrator, alerts the engine operator to the need for EGR system maintenance at each of those mileage points.

(iv) Requests for authorization of scheduled maintenance of emission control related components in addition to those items of maintenance covered under paragraphs (b)(1)(ii) and (b)(1)(iii) of this section will be considered if the maintenance is a direct result of the implementation of new technology. New technology means any technology not found in production on any motor vehicle prior to the 1980 model year.

(v)(A) Only the maintenance items listed in paragraphs (b)(1)(i) and (b)(1)(ii) are currently considered by EPA to be emission-related maintenance. The Administrator may, however, determine additional maintenance items to be emission-related by announcement in a **Federal Register** notice. In no event may this notification occur later than September 1 of the calendar year two years prior to the affected model year.

(B) Any manufacturer may request a hearing on the Administrator's determinations in paragraph (b)(1)(v)(A) of this section. The request shall be in writing, signed by an authorized representative of the manufacturer, and shall include a statement specifying the manufacturer's objections to the Administrator's determinations, and data in support of such objections. If, after review of the request and supporting data, the Administrator finds that the request raises a substantial factual issue, he shall provide the manufacturer a hearing in accordance with § 86.078–6 with respect to such issue.

(vi) [Reserved].

(vii) Non-emission related vehicle maintenance which is reasonable and necessary (e.g., oil change, oil filter change, fuel filter change, air filter change, cooling system maintenance, accessory belt inspection, adjustment of idle speed, governor, engine bolt torque, valve lash, injector lash, timing, etc.) may be performed on durability-data vehicles at the intervals recommended by the manufacturer to the ultimate purchaser.

(viii) Unscheduled maintenance may be performed during the testing used to determine deterioration factors, except as provided in paragraph (b)(1)(ix)(A) of this section, only under the following provisions:

(A) An injector or spark plug may be changed if a persistent misfire is detected.

(B) Readjustment of a gasoline-fueled vehicle or engine cold-start enrichment system may be performed if there is a problem of stalling.

(C) Readjustment of the engine idle speed (curb idle and fast idle) may be performed, if the idle speed exceeds the manufacturer's recommended idle speed by 300 rpm or more, or if there is a problem of stalling.

(ix) Any other unscheduled vehicle, engine, emission control system, or fuel system adjustment, repair, removal, disassembly, cleaning, or replacement during testing to determine deterioration factors shall be performed only with the advance approval of the Administrator.

(A) Such approval will be given if the Administrator:

(*1*) Has made a preliminary determination that the part failure or system malfunction, or the repair of such failure or malfunction, does not render the vehicle or engine unrepresentative of vehicles or engines in use, and does not require direct access to the combustion chamber, except for spark plug, fuel injection component, or removable prechamber removal or replacement; and,

(*2*) Has made a determination that the need for maintenance or repairs is indicated by an overt indication of malfunction such as persistent misfiring, engine stalling, overheating, fluid leakage, loss of oil pressure, excessive fuel consumption or excessive power loss.

(B) Emission measurement may not be used as a means of determining the need for unscheduled maintenance under paragraph (b)(1)(ix)(A) of this section except under the conditions outlined in paragraph (b)(1)(ix)(B)(*1*) of this section.

(*1*) *Conditions for unscheduled maintenance based upon emission results:* The Administrator may approve unscheduled maintenance on durability-data vehicles or engines based upon a significant change in emission levels that indicates a vehicle or engine malfunction. In these cases the Administrator may first approve specific diagnostic procedures to identify the source of the problem. The Administrator may further approve of specific corrections to the problem after the problem has been identified. The Administrator may only approve the corrective action if the Administrator determined that:

(*i*) The malfunction was caused by nonproduction build practices or by a previously undetected design problem.

(*ii*) The malfunction will not occur in production vehicles or engines in use, *and*

(*iii*) The deterioration factor generated by the durability-data vehicle or engine will remain unaffected by the malfunction or by the corrective action (e.g., the malfunction was present for only a short period of time before detection, replacement parts are functionally representative of the proper mileage or hours, etc.).

(*2*) Following any unscheduled maintenance approved under paragraph (b)(1)(ix)(B)(*1*) of this section, the manufacturer shall perform an after-maintenance emissions test. If the Administrator determines that the after-maintenance emission levels for any pollutant indicates that the deterioration factor is no longer representative of production, the Administrator may disqualify the durability-data vehicle or engine.

(x) [Reserved].

(2) [Reserved].

(3)(i) Scheduled maintenance on emission-data vehicles (or engines) is limited to the adjustment of idle speed once before the low-mileage test point (or the low-hour test point for engines), provided the idle speed is outside the manufacturer's specifications.

(ii) [Reserved].

(iii) [Reserved].

(iv) Any other engine, emission control system, or fuel system, adjustment, repair, removal, disassembly, cleaning, servicing, or replacement shall be performed only with the advance approval of the Administrator.

(4) *Light-duty trucks.* Repairs to vehicle components of the emission-data vehicle other than the engine, emission control system, or fuel system, shall be performed only as a result of part failure, vehicle system malfunction, or with the advance approval of the Administrator.

(5)(i) Complete emission tests (see Subparts B and P of this part) are required, unless waived by the Administrator, before and after catalytic converter or oxygen sensor servicing on any vehicle.

(ii) The Administrator may require emission tests before and after any unscheduled maintenance.

(iii) [Reserved].

(iv) Test data required by paragraph (b)(5) of this section shall be air posted or delivered to the Administrator within 7 working days, along with a complete record of all pertinent maintenance.

(v) When unscheduled maintenance is approved, a preliminary engineering report, unless waived by the Administrator, shall be air posted or delivered within 7 working days. A final engineering report shall be completed and delivered to the Administrator, concurrently with the manufacturer's application for certification.

(vi) All test data, maintenance reports, and required engineering reports shall be compiled and provided to the Administrator in accordance with § 86.084–23.

(6) The Administrator shall be given the opportunity to verify the existence of an overt indication of part failure and/or engine malfunction (e.g., misfiring, stalling), or an activation of an audible and/or visual signal, prior to the performance of any maintenance to which such overt indication or signal is relevant under the provisions of this section.

(7) Equipment, instruments, or tools may not be used to identify malfunctioning, maladjusted, or defective engine components unless the same or equivalent equipment, instruments, or tools will be available to dealerships and other service outlets and:

(i) Are used in conjunction with scheduled maintenance on such components,

(ii) Are used subsequent to the identification of a vehicle or engine malfunction, as provided in paragraph (b)(3)(iv) of this section for emission-data vehicles, or

(iii) Unless specifically authorized by the Administrator.

14. Section 85.085–28 of Subpart A is amended by revising paragraphs (c)(4)(ii) and (c)(4)(iii) to read as follows:

§ 85.085–28 Compliance with emission standards.

* * * * *

(c) * * *

(4) * * *

(ii) Separate exhaust emission deterioration factors, determined from tests of engines, subsystems, or components conducted by the manufacturer, shall be supplied for each engine-system combination. For gasoline and diesel engines, separate factors shall be established for transient HC, CO, and NO_x. For diesel smoke testing, separate factors shall also be established for the acceleration mode (designated as "A"), the lugging mode (designated as "B"), and peak opacity (designated as "C").

(iii)(A) Paragraph (c)(4)(iii)(A) of this section applies to gasoline-fueled heavy-duty engines.

(*1*) *Gasoline-fueled heavy-duty engines not utilizing aftertreatment technology (e.g. catalytic converters).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Gasoline-fueled heavy-duty engines utilizing aftertreatment technology (e.g. catalytic converters).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(B) Paragraph (c)(4)(iii)(B) of this section applies to diesel heavy-duty engines.

(*1*) *Diesel heavy-duty engines not utilizing aftertreatment technology (e.g. particulate traps).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Diesel heavy-duty engines not utilizing aftertreatment technology (e.g. particulate traps).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragaph.

(*3*) For acceleration smoke ("A"), lugging smoke ("B"), and peak smoke ("C"), the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

* * * * *

15. Section 86.085–29 of Subpart A is amended by revising paragraphs (a)(3)(iii)(A)(*1*), (a)(3)(iii)(B)(*1*), (b)(3)(iii)(A) (*1*) and (*2*), and (b)(3)(iii)(B)(*1*), to read as follows:

§ 86.085–29 Testing by the Administrator.

(a) * * *

(3) * * *

(iii)(A)(*1*) The Administrator may adjust or cause to be adjusted any adjustable parameter of an emission data vehicle or engine which the Administrator has determined to be subject to adjustment for certification and Selective Enforcement Audit testing in accordance with § 86.085–22(e)(1), to any setting within the physically adjustable range of that parameter, as determined by the Administrator in accordance with § 86.085–22(e)(3)(i), prior to the performance of any tests to determine whether such vehicle or engine conforms to applicable emission standards, including tests performed by the manufacturer under § 86.085-23(c)(1). The Administrator, in making or specifying such adjustments, will consider the effect of the deviation from the manufacturer's recommended setting on emissions performance characteristics as well as the likelihood that similar settings will occur on in-use light-duty vehicles or light-duty trucks. In determining likelihood, the Administrator will consider factors such as, but not limited to, the effect of the adjustment on vehicle performance characteristics and surveillance information from similar in-use vehicles.

* * * * *

(B) * * *

(*1*) The manufacturer may request a retest. Before the retest, those vehicle or engine parameters which the Administrator has not determined to be subject to adjustment for certification and Selective Enforcement Audit testing in accordance with § 86.085-22(e)(1) may be readjusted to manufacturer's specification, if those adjustments were made incorrectly prior to the first test. The Administrator may adjust or cause to be adjusted any parameter which the Administrator has determined to be subject to adjustment to any setting within the physically adjustable range of that parameter, as determined by the Administrator in accordance with § 86.085-22(e)(3)(i). Other maintenance or repairs may be performed in accordance with § 86.085-25. All work on the vehicle shall be done at such location and under such conditions as the Administrator may prescribe.

* * * * *

(b) * * *

(3) * * *

(iii)(A)(*1*) The Administrator may adjust or cause to be adjusted any adjustable parameter of an emission-data engine which the Administrator has determined to be subject to adjustment for certification testing in accordance with § 86.085-22(e)(1), to any setting within the physically adjustable range of that parameter, as determined by the Administrator in accordance with § 86.085-22(e)(3)(i), prior to the performance of any tests to determine whether such engine conforms to applicable emission standards, including tests performed by the manufacturer under § 86.085-23(c)(2). The Administrator, in making or specifying such adjustments, may consider the effect of the deviation from the manufacturer's recommended setting on emissions performance characteristics as well as the likelihood that similar settings will occur on in-use heavy-duty engines. In determining likelihood, the Administrator may consider factors such as, but not limited to, the effect of the adjustment on engine performance characteristics and surveillance information from similar in-use engines.

(*2*) For those engine parameters which the Administrator has not determined to be subject to adjustment for certification testing in accordance with § 86.085-22(e)(1), the emission-data engine presented to the Administrator for testing shall be calibrated within the production tolerances applicable to the manufacturer's specifications to be shown on the engine label (see § 86.085-35(a)(3)(iii)) as specified in the application for certification. If the Administrator determines that an engine is not within such tolerances, the engine shall be adjusted at the facility designated by the Administrator prior to the test and an engineering report shall be submitted to the Administrator describing the corrective action taken. Based on the engineering report, the Administrator will determine if the engine shall be used as an emission-data engine.

(B) * * *

(*1*) The manufacturer may request a retest. Before the retest, those engine parameters which the Administrator has not determined to be subject to adjustment for certification testing in accordance with § 86.085-22(e)(1) may be readjusted to the manufacturer's specifications, if these adjustments were made incorrectly prior to the first test. The Administrator may adjust or cause to be adjusted any parameter which the Administrator has determined to be subject to adjustment in accordance with § 86.085-22(e)(3)(i). However, if the idle speed parameter is one which the Administrator has determined to be subject to adjustment, the Administrator shall not adjust it to a setting which causes a higher engine idle speed than would have been possible within the physically adjustable range of the idle speed parameter on the engine before it accumulated any dynamometer service, all other parameters being identically adjusted for the purpose of the comparison. Other maintenance or repairs may be performed in accordance with § 86.085-25. All work on the vehicle shall be done at such location and under such conditions as the Administrator may prescribe.

* * * * *

16. Section 86.085-35 of Subpart A is amended by revising paragraphs (a)(2)(iii)(E) and (F), (a)(3)(iii)(H) and (I), adding a new paragraph (a)(3)(iii)(J), revising paragraphs (c)(1)(ii)(B), (d), and (e), and revising paragraphs (f) and (g)(1) to read as follows:

§ 86.085-35 Labeling.

(a) * * *

(2) * * *

(iii) * * *

(E) The prominent statement: "This vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks."

(F) If the manufacturer is provided an alternate useful life period under the provisions of § 86.085-21(f), the prominent statement: "This vehicle has been certified to meet U.S. EPA standards for a useful-life period of ——— years or ——— miles of operation, whichever occurs first. This vehicle's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than years or miles (*e.g.*, hours, or miles only).

* * * * *

(3) * * *

(iii) * * *

(H) The prominent statement: "This engine conforms to U.S. EPA regulations applicable to 19—— Model Year New Heavy-Duty Engines."

(I) If the manufacturer is provided with an alternate useful life period under the provisions of § 86.085-21(f), the prominent statement: "This engine family has been certified to meet U.S. EPA standards for a useful-life period of ——— miles or ——— hours of operation, whichever occurs first. This engine's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than miles or hours (*e.g.*, years, or hours only).

(J) *For diesel engines.* The prominent statement: "This engine has a primary intended service application as a ———heavy-duty diesel engine." (The primary intended service applications are light, medium, and heavy, as defined in § 86.085-2.)

* * * * *

(c)(1) * * *

(ii) * * *

(B) *For light-duty trucks,*

(*1*) The statement: "This vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks."

(*2*) If the manufacturer is provided an alternate useful life period under the provisions of § 86.085-21(f), the prominent statement: "This vehicle has been certified to meet U.S. EPA standards for a useful-life period of —— years or ——— miles of operation, whichever occurs first. This vehicle's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than years or miles (*e.g.*, hours, or miles only).

* * * * *

(d) Incomplete light-duty trucks or incomplete heavy-duty vehicles optionally certified as light-duty trucks shall have the following prominent statement printed on the label required by paragraph (a)(2) of this section in lieu of the statement required by paragraph of (a)(2)(iii)(E) of this section: "This vehicle conforms to U.S. EPA regulations applicable to 19— Model Year New Light-Duty Trucks when completed at a maximum curb weight of ——— pounds or at a maximum gross vehicle weight rating of ——— pounds or with a maximum frontal area of ——— square feet."

(e) Incomplete heavy-duty vehicles having a gross vehicle weight rating of 8,500 pounds or less shall have one of the following statements printed on the label required by paragraph (a)(3) of this section in lieu of the statement required by paragraph (a)(3)(iii)(H) of this section: "This engine conforms to U.S. EPA regulations applicable to 19— Model Year Heavy-Duty Engines when installed in a vehicle completed at a curb weight of more than 6,000 pounds or with a frontal area of greater than 45 square feet."

(f) The manufacturer of any incomplete light-duty vehicle or light-duty truck shall notify the purchaser of such vehicle of any curb weight, frontal area, or gross vehicle weight rating limitations affecting the emission certificate applicable to that vehicle. This notification shall be transmitted in a manner consistent with National Highway Traffic Safety Administration safety notification requirements published in 49 CFR Part 568.

(g)(1) Incomplete gasoline-fueled heavy-duty vehicles shall have the following prominent statement printed on the label required in paragraph (a)(4) of this section: "(Manufacturer's corporate name) has determined that this vehicle conforms to U.S. EPA regulations applicable to 19— Model Year New Gasoline-Fueled Heavy-Duty Vehicles when completed with a nominal fuel tank capacity not to exceed ——— gallons. Persons wishing to add fuel tank capacity beyond the above maximum must submit a written statement to the Administrator that the hydrocarbon storage system has been upgraded according to the requirements of 40 CFR 86.085–35(g)(2)."

* * * * *

17. A new § 86.085–38 is added to Subpart A to read as follows:

§ 86.085–38 Maintenance instructions.

(a) The manufacturer shall furnish or cause to be furnished to the purchaser of each new motor vehicle (or motor vehicle engine) subject to the standards prescribed in § 86.085–8, § 86.085–9, § 86.085–10, or § 86.085–11, as applicable, written instructions for the maintenance and use of the vehicle (or engine) by the purchaser as may be reasonable and necessary to assure the proper functioning of the emission control system.

(1) Such instructions shall be provided for those vehicle and engine components listed in Appendix VI to this part (and for any other components) to the extent that maintenance of these components is necessary to assure the proper functioning of the emission control system.

(2) Such instructions shall be in clear, and to the extent practicable, nontechnical language.

(b) The maintenance instructions required by this section shall contain a general description of the documentation which the manufacturer will require from the ultimate purchaser or any subsequent purchaser as evidence of compliance with the instructions.

(c) *For gasoline-fueled light-duty vehicles.* (1) Such instructions shall specify the performance of all scheduled maintenance performed by the manufacturer under § 86.085–25(a), and shall explain the conditions under which EGR system and catalytic converter maintenance are to be performed (e.g., what type of warning device is being employed and whether the device is activated by component failure or the need for periodic maintenance).

(2) [Reserved].

(3) [Reserved].

(d) *For diesel light-duty vehicles.* (1) Such instructions shall specify the performance of all scheduled maintenance performed by the manufacturer under § 86.085–25(a) and shall explain the conditions under which EGR system and catalytic converter maintenance are to be performed (e.g., what type of warning device is being employed and whether the device is activated by component failure or the need for periodic maintenance).

(2) [Reserved].

(e) *For light-duty trucks.* (1) Maintenance shall specify the performance of all scheduled emission-related maintenance approved by the Administrator under § 86.085–25(b). Scheduled emission-related maintenance in addition to that performed under § 86.085–25(b) may be recommended for reasons such as to offset the effects of operating conditions which differ from the conditions experienced during the determination of deterioration factors. Such additional recommended maintenance shall be clearly differentiated, in a form approved by the Administrator from that approved under § 86.085–25(b). The instructions may schedule maintenance on a calendar time basis, mileage basis, engine service time basis, or combinations of each.

(2) If the vehicle has been granted an alternative useful-life period under the provisions of § 86.085–21(f), and thus is required to comply with the labelling requirements set forth in paragraphs (a)(2)(iii)(F) and (c)(1)(ii)(B)(*2*) of § 86.085–35, the manufacturer may choose to include in such instructions an explanation of the distinction between the alternative useful life specified on the label, and the emissions defect and emissions performance warranty period. The explanation must clearly state that the useful life period specified on the label represents the average period of use up to retirement or rebuild for the engine family used in the vehicle. An explanation of how the actual useful lives of engines used in various applications are expected to differ from the average useful life may be included. The explanation(s) shall be in clear, nontechnical language that is understandable to the ultimate purchaser.

(3) Such instructions shall indicate what adjustments or modifications, if any, are necessary to allow the vehicle to meet applicable emission standards at elevations above 4,000 feet, or at elevations of 4,000 feet or less.

(f) *For heavy-duty engines.* (1) Maintenance instructions shall specify the performance of all scheduled emission-related maintenance approved by the Administrator under § 86.085–25(b). Scheduled emission-related maintenance in addition to that performed under § 86.085–25(b) may be recommended for reasons such as to offset the effects of operating conditions which differ from the conditions experienced during the determination of deterioration factors. Such additional recommended maintenance shall be clearly differentiated, in a form approved by the Administrator from that approved under § 86.085–25(b). The instuctions may schedule maintenance on a calendar time basis, mileage basis.

engine service time basis, or combinations of each.

(2) If the engine has been granted an alternative useful-life period under the provisions of § 86.085–21(f), and thus is required to comply with the labelling requirements set forth in paragraph (a)(3)(iii)(J) of § 86.085–35, the manufacturer may choose to include in such instructions an explanation of the distinction between the useful life specified on the label, and the emissions defect and emissions performance warranty period. This explanation must clearly state that the useful life period specified on the label represents the estimated average period of use up to retirement or rebuild for the engine family. An explanation may be included of how the actual useful lives of engines used in various applications are expected to differ from the average useful life. The explanation(s) shall be in clear, nontechnical language that is understandable to the ultimate purchaser.

18. A new § 86.087–10 is added to Subpart A to read as follows:

§ 86.087–10 Emission standards for 1987 and later model year gasoline-fueled heavy-duty engines and vehicles.

(a)(1) Exhaust emissions from new 1987 and later model year gasoline-fueled heavy-duty engines shall not exceed:

(i) For engines intended for use in all vehicles except as provided in paragraph (a)(3) of this section,

(A) *Hydrocarbons*. 1.1 grams per brake horsepower-hour, as measured transient under operating conditions.

(B) *Carbon monoxide. (1)* 14.4 grams per brake horsepower-hour, as measured under transient operating conditions.

(2) Gasoline-fueled heavy-duty engines utilizing aftertreatment technology. 0.50 percent of exhaust gas flow at curb idle.

(C) *Oxides of nitrogen*. 10.6 grams per brake horsepower-hour, as measured under transient operating conditions.

(ii) For engines intended for use only in vehicles with a Gross Vehicle Weight Rating of greater than 14,000 pounds,

(A) *Hydrocarbons*. 1.9 grams per brake horsepower-hour as measured under transient operating conditions.

(B) *Carbon Monoxide. (1)* 37.1 grams per brake horsepower-hour as measured under transient operating conditions.

(2) Gasoline-fueled heavy-duty engines utilizing aftertreatment technology. 0.50 percent of exhaust gas flow at curb idle.

(C) *Oxides of nitrogen*. 10.6 grams per brake horsepower-hour, as measured under transient operating conditions.

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(1) of Appendix I to this part, and measured and calculated in accordance with the procedures set forth in Subparts N or P.

(3)(i) A manufacturer may certify one or more gasoline-fueled heavy-duty engine configurations intended for use in all vehicles to the emission standards set forth in paragraph (a)(1)(ii) of this section. *Provided that*, the total model year sales of such configuration(s) being certified to the emission standards in paragraph (a)(1)(ii) of this paragraph represent no more than 5 percent of total model year sales of all gasoline-fueled heavy-duty engines intended for use in vehicles with a Gross Vehicle Weight Rating of up to 14,000 pounds by the manufacturer.

(ii) The configurations certified to the emission standards of paragraph (a)(1)(ii) of this section under the provisions of paragraph (a)(3)(i) of this section shall still be required to meet the evaporative emission standards set forth in paragraphs (b)(1)(i)(A) and (b)(2)(i) of this section.

(b)(1) Evaporative emissions from 1987 and later model year gasoline-fueled heavy-duty vehicles shall not exceed:

(i) *Hydrocarbons*. (A) For vehicles with a Gross Vehicle Weight Rating of up to 14,000 pounds, 3.0 grams per test.

(B) For vehicles with a Gross Vehicle Weight Rating of greater than 14,000 pounds, 4.0 grams per test.

(2)(i) For vehicles with a Gross Vehicle Weight Rating of up to 26,000 pounds, the standards set forth in paragraph (b)(1) of this section refer to a composite sample of fuel evaporative emissions collected under the conditions set forth in Subpart M and measured in accordance with those procedures.

(ii) For vehicles with a Gross Vehicle Weight Rating of greater than 26,000 pounds, the standard set forth in paragraph (b)(1)(i)(B) of this section refers to the manufacturer's engineering design evaluation using good engineering practice (a statement of which is required in § 86.085–23(b)(4)(ii)).

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any new 1987 or later model year gasoline-fueled heavy-duty engine.

(d) Every manufacturer of new motor vehicle engines subject to the standards prescribed in this section shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with applicable procedures in Subparts N or P of this part to ascertain that such test engines meet the requirements of paragraphs (a) and (c) of this section.

19. A new § 86.087–21 is added to Subpart A to read as follows:

§ 86.087–21 Application for certification.

(a) A separate application for a certificate of conformity shall be made for each set of standards (or family particulate emission limits, as appropriate) and each class of new motor vehicles or new motor vehicle engines. Such application shall be made to the Administrator by the manufacturer and shall be updated and corrected by amendment.

(b) The application shall be in writing, signed by an authorized representative of the manufacturer, and shall include the following:

(1)(i) Identification and description of the vehicles (or engines) covered by the application and a description of their engine (vehicles only), emission control system and fuel system components. This shall include a detailed description of each auxiliary emission control device (AECD) to be installed in or on any certification test vehicle (or certification test engine).

(ii)(A) The manufacturer shall provide to the Administrator in the preliminary application for certification:

(*1*) A list of those parameters which are physically capable of being adjusted (included those adjustable parameters for which access is difficult) and that, if adjusted to settings other than the manufacturer's recommended setting, may affect emissions;

(*2*) A specification of the manufacturer's intended physically adjustable range of each such parameter, and the production tolerances of the limits or stops used to establish the physically adjustable range;

(*3*) A description of the limits or stops used to establish the manufacturer's intended physically adjustable range of each adjustable parameter, or any other means used to inhibit adjustment;

(*4*) The nominal or recommended setting, and the associated production tolerances, for each such parameter.

(B) The manufacturer may provide, in the preliminary application for certification, information relating to why certain parameters are not expected to be adjusted in actual use and to why the physical limits or stops used to establish the physically adjustable range of each parameter, or any other means used to inhibit adjustment, are expected to be effective in preventing adjustment of parameters on in-use vehicles to settings outside the manufacturer's intended physically adjustable ranges. This may include results of any tests to determine the difficulty of gaining access to an adjustment or exceeding a limit as intended or recommended by the manufacturer.

(C) The Administrator may require to be provided detailed drawings and descriptions of the various emission related components, and/or hardware samples of such components, for the purpose of making his determination of which vehicle or engine parameter will be subject to adjustment for new certifcation and Selective Enforcement Audit testing and of the physically adjustable range for each such vehicle or engine parameter.

(2) Projected U.S. sales data sufficient to enable the Administrator to select a test fleet representative of the vehicles (or engines) for which certification is requested. The sales data shall also include the altitude of intended sale for light-duty trucks.

(3) A description of the test equipment and fuel proposed to be used.

(4)(i) For light-duty vehicles and light-duty trucks, a description of the test procedures to be used to establish the evaporative emission deterioration factors required to be determined and supplied in §86.085–23(b)(2).

(ii) For gasoline-fueled heavy-duty vehicles, the Administrator does not assume that each evaporative emission family-evaporative emission control system combination will deteriorate in a unique manner during the useful life of the vehicle. The manufacturer shall therefore identify those evaporative emission deterioration factors which shall be applied to the various evaporative emission family-evaporative emission control system combinations which are expected to exhibit similar deterioration characteristics during the useful life of the vehicle.

(iii)(A) A description of the test procedures to be used to establish the durability data or the exhaust emission deterioration factors required to be determined and supplied in § 86.085–23(b)(1).

(B)(*1*) For engine families provided an alternative useful-life period under paragraph (f) of this section, a statement of that alternative period and a brief synopsis of the justification.

(*2*) For heavy-duty diesel engine families, a statement of the primary intended service class (light, medium, or heavy) and an explanation as to why that service class was selected. Each diesel engine family shall be certified under one primary intended service class only. After reviewing the guidance in § 86.085–2, the class shall be determined on the basis of which class best represents the majority of the sales of that engine family.

(C)(*1*) For each light-duty truck engine family and each heavy-duty engine family, a statement of recommended maintenance and procedures necessary to assure that the vehicles (or engines) covered by a certificate of conformity in operation conform to the regulations, and a description of the program for training of personnel for such maintenance, and the equipment required.

(*2*) A description of vehicle adjustments or modifications necessary, if any, to assure that light-duty trucks covered by a certificate of conformity conform to the regulations while being operated at any altitude locations, and a statement of the altitude at which the adjustments or modifications apply.

(D) At the option of the manufacturer, the proposed composition of the emission-data test fleet or (where applicable) the durability-data test fleet.

(5) If the manufacturer elects to participate in the particulate averaging program for diesel light-duty vehicles and/or diesel light-duty trucks, the application must list the family particulate emission limit and the projected U.S. production volume of the family for the model year.

(i) The manufacturer shall choose the level of the family particulate emission limits, accurate to one-hundredth of a gram per mile.

(ii) The manufacturer may at any time during production elect to change the level of any family diesel particulate emission limit(s) by submitting the new limit(s) to the Administrator and by demonstrating compliance with the limit(s) as described in § 86.085–2 and § 86.085–28(b)(5).

(6)(i) For gasoline-fueled heavy-duty engines, the application must state whether the engine family is being certified for use in all vehicles regardless of their Gross Vehicle Weight Rating (see § 86.087–10(a)(1)(i) and (a)(3)(i)), or, only for use in vehicles with a Gross Vehicle Weight Rating greater than 14,000 pounds.

(ii) If the engine family is being certified for use in all vehicles and, is being certified to the emission standards applicable to gasoline-fueled heavy-duty engines for use only in vehicles with a Gross Vehicle Weight Rating over 14,000 pounds under the provisions of paragraph (a)(3) of § 86.087–10, then the application must also attest that the engine family, together with all other engine families being certified under the povisions of paragraph (a)(3) of § 86.087–10, represent no more than 5 percent of model year sales of the manufacturer of all gasoline-fueled heavy-duty engines for use in vehicles with Gross Vehicle Weight Ratings of up to 14,000 pounds.

(iii)(A) A description of the test procedures to be used to establish the durability data or the exhaust emission deterioration factors required to be determined and supplied in § 86.087–23(b)(1).

(B)(*1*) A statement of the useful life of use of each light-duty truck engine family and heavy-duty engine family.

(*2*) For engine families provided an alternative useful life period under paragraph (f) of this section, a statement of that alternative period and a brief synopsis of the justification.

(*3*) For heavy-duty diesel engine families, a statement of the primary intended service class (light, medium, or heavy) and an explanation as to why that service class was selected. Each diesel engine family shall be certified under one primary intended service class only. After reviewing the guidance in § 86.085–2, the class shall be determined on the basis of which class best represents the majority of the sales of that engine family.

(C)(*1*) For each light-duty truck engine family and each heavy-duty engine family, a statement of recommended maintenance and procedures necessary to assure that the vehicles (or engines) covered by a certificate of conformity in operation conform to the regulations, and a description of the program for training of personnel for such maintenance, and the equipment required.

(*2*) A description of vehicle adjustments or modifications necessary, if any, to assure that light-duty trucks covered by a certificate of conformity conform to the regulations while being operated at any altitude locations, and a statement of the altitude at which the adjustments or modifications apply.

(D) At the option of the manufacturer, the proposed composition of the emission-data test fleet or (where applicable) the durability-data test fleet.

(c) Complete copies of the application and of any amendments thereto, and all notifications under § 86.079–32, § 86.079–33, and § 86.079–34 shall be submitted in such multiple copies as the Administrator may require.

(d) Incomplete light-duty trucks shall have a maximum completed curb weight and maximum completed frontal area specified by the manufacturer.

(e) For gasoline-fueled heavy-duty vehicles the manufacturer shall specify a maximum nominal fuel tank capacity for each evaporative emission family-evaporative emission control system combination.

(f) Light-duty truck and heavy-duty engine manufacturers who believe that the useful life periods of § 86.085-2 are significantly unrepresentative for one or more engine families (either too long or too short), may petition the Administrator to provide an alternative useful-life period. This petition must include the full rationale behind the request together with any supporting data and other evidence. Based on this or other information the Administrator may assign an alternative useful-life period. Any petition should be submitted in a timely manner, to allow adequate time for a thorough evaluation.

20. A new § 86.087-23 is added to Subpart A, to read as follows:

§ 86.087-23 Required data.

(a) The manufacturer shall perform the tests required by the applicable test procedures, and submit to the Administrator the following information: *Provided, however,* that if requested by the manufacturer, the Administrator may waive any requirement of this section for testing of vehicle (or engine) for which emission data are available or will be made available under the provisions of § 86.085-29.

(1) [Reserved.]

(2) [Reserved.]

(b)(1)(i) Exhaust emission durability data on such light-duty vehicles tested in accordance with applicable test procedures and in such numbers as specified, which will show the performance of the systems installed on or incorporated in the vehicle for extended mileage, as well as a record of all pertinent maintenance performed on the test vehicles.

(ii) Exhaust emission deterioration factors for light-duty trucks and heavy-duty engines and all test data that are derived from the testing described under § 86.085-21(b)(4)(iii)(A) as well as a record of all pertinent maintenance. Such testing shall be designed and conducted in accordance with good engineering practice to assure that the engines covered by a certificate issued under § 86.085-30 will meet the emission standards (or family particulate emission limits, as appropriate) in § 86.085-09, § 86.087-10, or § 86.085-11 as appropriate, in actual use for the useful life of the engine.

(2) For light-duty vehicles and light-duty trucks, evaporative emission deterioration factors for each evaporative emission family-evaporative emission control system combination and all test data that are derived from testing described under § 86.085-21(b)(4)(i) designed and conducted in accordance with good engineering practice to assure that the vehicles covered by a certificate issued under § 86.085-30 will meet the evaporative emission standards in § 86.085-8 or § 86.085-9, as appropriate, for the useful life of the vehicle.

(3) For gasoline-fueled heavy-duty vehicles, evaporative emission deterioration factors for each evaporative emission family-evaporative emission control system combination identified in accordance with § 86.087-21(b)(4)(ii). Furthermore, a statement that the test procedure(s) used to derive the deterioration factors includes, but need not be limited to, a consideration of the ambient effects of ozone and temperature fluctuations, and the service accumulation effects of vibration, time, and vapor saturation and purge cycling. The deterioration factor test procedure shall be designed and conducted in accordance with good engineering practice to assure that the vehicles covered by a certificate issued under § 86.085-30 will meet the evaporative emission standards in § 86.085-10 in actual use for the useful life of the engine. Furthermore, a statement that a description of the test procedure, as well as all data, analyses and evaluations, is available to the Administrator upon request.

(4)(i) For gasoline-fueled, heavy-duty vehicles with a Gross Vehicle Weight Rating of up to 26,000 pounds, a written statement to the Administrator certifying that the manufacturer's vehicles meet the standards of § 86.085-10 as determined by the provisions of § 86.085-28. Furthermore, a written statement to the Administrator that all data, analyses, test procedures, evaluations, and other documents, on which the above statement is based, are available to the Administrator upon request.

(ii) For gasoline-fueled, heavy-duty vehicles with a Gross Vehicle Weight Rating of greater than 26,000 pounds, a written statement to the Administrator certifying that the manufacturer's evaporative emission control systems are designed, using good engineering practice, to meet the standards of § 86.085-10 as determined by the provisions of § 86.085-28. Furthermore, a written statement to the Administrator that all data, analyses, test procedures, evaluations, and other documents, on which the above statement is based, are available to the Administrator upon request.

(c) *Emission data.* (1)(i) Emission data on such vehicles tested in accordance with applicable test procedures and in such numbers as specified. These data shall include zero-mile data, if generated, and emission data generated for certification as required under § 86.084-26(a)(3)(i) or § 86.084-26(a)(3)(ii).

(ii) [Reserved].

(2) *Certification engines.* (i) Emission data on such engines tested in accordance with applicable emission test procedures of this subpart and in such numbers as specified. These data shall include zero-hour data, if generated, and emission data generated for certification as required under § 86.082-26(b)(5). In lieu of providing emission data on CO emissions from diesel certification engines the Administrator may, on request of the manufacturer, allow the manufacturer to demonstrate (on the basis of previous emission tests, development tests, or other information) that the engine will conform with the CO emission standard of § 86.085-11.

(ii) For heavy-duty diesel engines, a manufacturer may submit hot-start data only, in accordance with Subpart N, when making application for certification. However, for conformity SEA and recall testing by the Agency, both the cold-start and hot-start test data, as specified in Subpart N, will be included in the official results.

(d) A statement that the vehicles (or engines) for which certification is requested conform to the requirements in § 86.078-5(b), and that the descriptions of tests performed to ascertain compliance with the general standards in § 86.078-5(b), and the data derived from such tests, are available to the Administrator upon request.

(e)(1) A statement that the test vehicles (or test engines) with respect to which data are submitted to demonstrate compliance with the applicable standards (or family particulate emission limits, as appropriate) of this subpart are in all material respects as described in the manufacturer's application for certification, have been tested in accordance with the applicable test procedures utilizing the fuels and equipment described in the application for certification and that on the basis of such tests the vehicles (or engines) conform to the requirements of this part. If such statements cannot be made with respect to any vehicle (or engine) tested, the vehicle (or engine) shall be identified, and all pertinent data relating thereto shall be supplied to the Administrator. If, on the basis of the data supplied and any additional data as required by the Administrator, the Administrator determines that the test vehicles (or test engine) was not as described in the application for certification or was not tested in accordance with the applicable test procedures utilizing the fuels and equipment as described in the application for certification, the Administrator may make the determination that the vehicle (or engine) does not meet the applicable standards (or family particulate emission limits, as appropriate). The provisions of § 86.084–30(b) shall then be followed.

(2) For evaporative emission durability, or light-duty truck or heavy-duty engine exhaust emission durability, a statement of compliance with paragraph (b)(1)(ii), (b)(2), or (b)(3) of this section, as applicable.

(f) Additionally, manufacturers participating in the diesel particulate averaging program shall submit:

(1) In the application for certification, a statement that the vehicles for which certification is requested will not, to the best of the manfacturer's belief, when included in the manufacturer's production-weighted average emission level, cause the applicable particulate standard(s) to be exceeded.

(2) No longer than 90 days after the end of a given model year of production of engine families included in the diesel particulate averaging program, the number of vehicles produced in each engine family at each certified family diesel particulate emission limit, along with the resulting production-weighted average particulate emission level.

21. A new § 86.087–28 is added to Subpart A to read as follows:

§ 86.087–28 Compliance with emission standards.

(a)(1) Paragraph (a) of this section applies to light-duty vehicles.

(2) The applicable exhaust and fuel evaporative emission standards (and family particulate emission limits, as appropriate) of this subpart apply to the emissions of vehicles for their useful life.

(3) Since it is expected that emission control efficiency will change with mileage accumulation on the vehicle, the emission level of a vehicle which has accumulated 50,000 miles will be used as the basis for determining compliance with the standards (or family particulate emission limit, as appropriate).

(4) The procedure for determining compliance of a new motor vehicle with exhaust emission standards (or family particulate emission limit, as appropriate) is as follows, except where specified by paragraph (a)(7) of this section for the Alternative Durability Program:

(i) Separate emission deterioration factors shall be determined from the exhaust emission results of the durability-data vehicle(s) for each engine-system combination. A separate factor shall be established for exhaust HC, exhaust CO, exhaust NO_x, and exhaust particulate (diesel vehicles only) for each engine-system combination. A separate evaporative emission deterioration factor shall be determined for each evaporative emission family-evaporative emission control system combination from the testing conducted by the manufacturer (gasoline-fueled vehicles only).

(A) The applicable results to be used unless excluded by paragraph (a)(4)(i)(A)(*4*) of this section in determining the exhaust emission deterioration factors for each engine-system combination shall be:

(*1*) All valid exhaust emission data from the tests required under § 86.084–26(a)(4) except the zero-mile tests. This shall include the official test results, as determined in § 86.085–29 for all tests conducted on all durability-data vehicles of the combination selected under § 86.085–24(c) (including all vehicles elected to be operated by the manufacturer under § 86.085–24(c)(1)(ii)).

(*2*) All exhaust emission data from the tests conducted before and after the scheduled maintenance provided in § 86.085–25.

(*3*) All exhaust emission data from tests required by maintenance approved under § 86.085–25, in those cases where the Administrator conditioned his approval for the performance of such maintenance on the inclusion of such data in the deterioration factor calculation.

(*4*) The manufacturer has the option of applying an outlier test point procedure to completed durability data within its certification testing program for a given model year. The outlier procedure will be specified by the Administrator. For any pollutant, durability-data test points that are identified as outliers shall not be included in the determination of deterioration factors if the manufacturer has elected this option. The manufacturer shall specify to the Administrator before the certification of the first engine family for that model year, it it intends to use the outlier procedure. The manufacturer may not change procedures after the first engine family of the model year is certified. Where the manufacturer chooses to apply both the outlier procedure and averaging (as allowed under § 86.082–26(b)(8)(ii) to the same data set, the outlier procedure shall be completed prior to applying the averaging procedure.

(B) All applicable exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The data will be acceptable for use in the calculation of the deterioration factor only if the interpolated 4,000-mile and 50,000-mile points on this line are within the low-altitude standards provided in § 86.085–8 or § 86.085–9, as applicable. Exceptions to this where data are still acceptable are when a best fit straight line crosses an applicable standard but no data points exceeded the standard, or the best fit straight line crosses as applicable standard with a negative slope (the 4,000-mile interpolated point is higher than the 50,000-mile interpolated point) but the 50,000-mile actual data point is below the standard. A multiplicative exhaust emission deterioration factor shall be calculated for each engine-system combination as follows:

Factor = Exhaust emissions interpolated to 50,000 miles divided by exhaust emissions interpolated to 4,000 miles.

These interpolated values shall be carried out to a minimum of four places to the right of the decimal point before dividing one by the other to determine the deterioration factor. The results shall be rounded to three places to the right of the decimal point in accordance with ASTME 29–67.

(C) An evaporative emissions deterioration factor (gasoline-fueled vehicles only) shall be determined from the testing conducted as described in § 86.084–21(b)(4)(i), for each evaporative emission family-evaporative emission control system combination to indicate the evaporative emission level at 50,000 miles relative to the evaporative emission level at 4,000 miles as follows:

Factor = Evaporative emission level at 50,000 miles minus the evaporative emission level at 4,000 miles.

The factor shall be established to a minimum of two places to the right of the decimal.

(ii)(A) The official exhaust emission test results for each emission-data vehicle at the selected test point shall be multiplied by the appropriate deterioration factor: *Provided*: That if a deterioration factor as computed in paragraph (a)(4)(i)(B) of this section is less than one, that deterioration factor shall be one for the purposes of this paragraph.

(B) The official evaporative emission test results (gasoline-fueled vehicles only) for each evaporative emission-data vehicle at the selected test point shall be adjusted by addition of the appropriate deterioration factor: *Provided:* That if a deterioration factor as computed in paragraph (a)(4)(i)(C) of this section is less than zero, that deterioration factor shall be zero for the purposes of this paragraph.

(iii) The emissions to compare with the standard (or the family particulate emission limit, as appropriate) shall be the adjusted emissions of paragraphs (a)(4)(ii) (A) and (B) of this section for each emission-data vehicle. Before any emission value is compared with the standard (or the family particulate emission limit, as appropriate), it shall be rounded, in accordance with ASTME 29-67, to two significant figures. The rounded emission values may not exceed the standard (or the family particulate emission limit, as appropriate).

(iv) Every test vehicle of an engine family must comply with the exhaust emission standards (or the family particulate emission limit, as appropriate), as determined in paragraph (a)(4)(iii) of this section, before any vehicle in that family may be certified.

(v) Every test vehicle of an evaporative emission family must comply with the evaporative emission standard, as determined in paragraph (a)(4)(iii) of this section before any vehicle in that family may be certified.

(5) If a manufacturer chooses to change the level of any family particulate emission limit(s) in the particulate averaging program, compliance with the new limit(s) must be based upon existing certification data.

(6) If a manufacturer chooses to participate in the diesel particulate averaging program, the production-weighted average of the family particulate emission limits of all affected engine families must comply with the particulate standards in § 86.085-8(a)(1)(iv) or § 86.085-9(a)(1)(iv), as appropriate, at the end of the production year.

(7) The procedure to determine the compliance of new motor vehicles in the Alternative Durability Program (described in § 86.085-13) is the same as described in paragraphs (a)(4)(iii) through (a)(4)(v) of this section. For the engine families that are included in the Alternative Durability Program, the exhaust emission deterioration factors used to determine compliance shall be those that the Administrator has approved under § 86.085-13(c). The evaporative emission deterioration factor for each evaporative emission family shall be determined and applied according to paragraph (a)(4) of this section. The procedures to determine the minimum exhaust emissions deterioration factors required under § 86.085-13(d) are as follows:

(i) Separate deterioration factors shall be determined for the exhaust emission results of the durability-data vehicles for each engine family group. A separate factor shall be established for exhaust HC, exhaust CO, and exhaust NO_x for each engine family group. The evaporative emission deterioration factor for each evaporative family will be determined and applied in accordance with paragraph (a)(4) of this section.

(ii) The deterioration factors for each engine family group shall be determined by the Administrator using historical durability data from as many as three previous model years. These data will consist of deterioration factors generated by durability-data vehicles representing certified engine families and of deterioration factors from vehicles selected under § 86.085-24(h). The Administrator shall determine how these data will be combined for each engine family group.

(A) The test results to be used in the calculation of each deterioration factor to be combined for each engine family group shall be those test results specified in paragraph (a)(4)(i)(A) of this section.

(B) For each durability-data vehicles selected under § 86.085-24(h), all applicable exhaust emissions results shall be plotted as a function of the mileage on the system rounded to the nearest mile, and the best fit straight lines, fitted by method of least squares, shall be drawn through all these data points. The exhaust deterioration factor for each durability-data vehicles shall be calculated as specified in paragraph (a)(4)(i)(B) of this section.

(C) *Line-crossing.* For the purposes of paragraph (a)(5) of this section, line crossing occurs when either of the interpolated 4,000- and 50,000-mile points of the best fit straight line exceeds the applicable emission standard and at least one applicable data point exceeds the standard.

(*1*) The Administrator will not accept for certification line-crossing data from preproduction durability-data vehicles selected under § 86.085-24(c), § 86.085-24(h)(2), or (h)(3).

(*2*) The Administrator will not accept for certification line-crossing data from production durability-data vehicles selected under § 86.085-24(h)(1) unless the 4,000-mile test result multiplied by the engine family group deterioration factor does not exceed the applicable emission standards. The deterioration factors used for this purpose shall be those that were used in the certification of the production vehicle. Manufacturers may calculate this product immediately after the 4,000-mile test of the vehicle. If the product exceeds the applicable standards, the manufacturer may, with the approval of the Administrator, discontinue the vehicle and substitute a new vehicle. The manufacturer may continue the original vehicle, but the data will not be acceptable if line crossing occurs.

(b)(1) Paragraph (b) of this section applies to light-duty trucks.

(2) The exhaust and fuel evaporation emission standards (and the family particulate emission limits, as appropriate) of § 86.085-9 apply to the emissions of vehicles for their useful life.

(3) Since emission control efficiency generally decreases with the accumulation of mileage on the vehicle, deterioration factors will be used in combination with emission-data vehicle test results as the basis for determining compliance with the standards (or the family particulate emission limit, as appropriate).

(4)(i) Paragraph (b)(4) of this section describes the procedure for determining compliance of a new vehicle with exhaust emission standards (or the family particulate emission limit, as appropriate), based on deterioration factors supplied by the manufacturers, except where specified by paragraph (b)(5) of this section for the Alternative Durability Program.

(ii) Separate exhaust emission deterioration factors, determined from tests of vehicles, engines, subsystems, or components conducted by the manufacturer, shall be supplied for each engine-system combination. Separate factors shall be established for transient HD, CO, and NO_x, idle CO (gasoline vehicles only), and exhaust particulate (diesel vehicles only).

(iii) For transient HC, CO, and NO_x, idle CO (gasoline vehicles only), and exhaust particulate (diesel vehicles only), the official exhaust emission results for each emission-data vehicle at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(iv) The emission values to compare with the standards (or family particulate emission limit, as appropriate) shall be the adjusted emission values of paragraph (b)(4)(iii) of this section rounded to two significant figures in accordance with ASTME 29-67 for each emission-data engine.

(5)(i) Paragraph (b)(5) of this section applies only to manufacturers which elect to participate in the particulate averaging program.

(ii) If a manufacturer chooses to change the level of any family particulate emission limit(s), compliance with the new limit(s) must be based upon existing certification data.

(iii) The production-weighted average of the family particulate emission limits of all applicable engine families rounded to two significant figures in accordance with ASTME 29-67 must comply with the particulate standards in § 86.085-8(a)(1)(iv) or § 86.085-9(a)(1)(iv), as appropriate, at the end of the product year.

(6) The procedure to determine the compliance of new motor vehicles in the Alternative Durability Program (described in § 86.085-13) is the same as described in paragraph (b)(4)(iv), (b)(7)(iv) and (b)(8) of this section. For the engine families that are included in the Alternative Durability Program, the exhaust emission deterioration factors used to determine compliance shall be those that the Administrator has approved under § 86.085-13(c). The evaporative emission deterioration factor for each evaporative emission family shall be determined and applied according to paragraph (b)(7) of this section. The procedures to determine the minimum exhaust emissions deterioration factors required under § 86.085-13(d) are as follows:

(i) Separate deterioration factors shall be determined from the exhaust emission results of the durability-data vehicles for each engine family group. A separate factor shall be established for exhaust HC, exhaust CO, and exhaust NO_x for each engine family group. The evaporative emission deterioration factor for each evaporative family will be determined and applied in accordance with paragraph (b)(6) of this section.

(ii) The deterioration factors for each engine family group shall be determined by the Administrator using historical durability data from as many as three previous model years. These data will consist of deterioration factors generated by durability-data vehicles representing certified engine families and of deterioration factors from vehicles selected under § 86.085-24(h). The Administrator shall determine how these data will be combined for each engine family group.

(A) The test results to be used in the calculations of each deterioration factor to be combined for each engine family group shall be those test results specified in paragraph (a)(4)(i)(A) of this section.

(B) For each durability-data vehicle selected under § 86.085-24(h), all applicable exhaust emission results shall be plotted as a function of the mileage on the system rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points. The exhaust deterioration factor for each durability-data vehicle shall be calculated as specified in paragraph (a)(4)(i)(B) of this section.

(C) *Line crossing.* For the purposes of paragraph (b)(5) of this section, line crossing occurs when either of the interpolated 4,000- and 5,000-mile points of the best fit straight line exceeds the applicable emission standard and at least one applicable data point exceeds the standard.

(*1*) The Administrator will not accept for certification line-crossing data from preproduction durability-data vehicles selected under § 86.085-24(c)(1), or § 86.085-24(h)(2) or (h)(3).

(*2*) The Administrator will not accept for certification line-crossing data from production durability-data vehicles selected under § 86.085-24(h)(1) unless the 4,000-mile test result multiplied by the engine family group deterioration factor does not exceed the applicable emission standard. The deterioration factors used for this purpose shall be those that were used in the certification of the production vehicle. Manufacturers may calculate this product immediately after the 4,000-mile test of the vehicle. If the product exceeds the applicable standard, the manufacturer may, with the approval of the Administrator, discontinue the vehicle and substitute a new vehicle. The manufacturer may continue the original vehicle, but the data will not be acceptable if line crossing occurs.

(7)(i) Paragraph (b)(7) of this section describes the procedure for determining compliance of a new vehicle with fuel evaporative emission standards. The procedure described here shall be used for all vehicles in all model years.

(ii) The manufacturer shall determine, based on testing described in § 86.085-21(b)(4)(i), and supply an evaporative emission deterioration factor for each evaporative emission family-evaporative emission control system combination. The factor shall be calculated by subtracting the emission level at the selected test point from the emission level at the useful life point.

(iii) The official evaporative emission test results for each evaporative emission-data vehicle at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(iv) The emission value to compare with the standards shall be the adjusted emission value of paragraph (b)(7)(iii) of this section rounded to two significant figures in accordance with ASTM E 29-67 for each evaporative emission-data vehicle.

(8) Every test vehicle of an engine family must comply with all applicable standards (and the family particulate emissions limits, as appropriate), as determined in paragraphs (b)(4)(iv) and (b)(7)(iv) of this section, before any vehicle in that family will be certified.

(c)(1) Paragraph (c) of this section applies to heavy-duty engines.

(2) The exhaust emission standards for gasoline-fueled engines in § 86.087-10 of for diesel engines in § 86.085-11 apply to the emissions of engines for their useful life.

(3) Since emission control efficiency generally decreases with the accumulation of service on the engine, deterioration factors will be used in combination with emission-data engine test results as the basis for determining compliance with the standards.

(4)(i) Paragraph (c)(4) of this section describes the procedure for determining compliance of an engine with emission standards, based on deterioration factors supplied by the manufacturer.

(ii) Separate exhaust emission deterioration factors, determined from tests of engines, subsystems, or components conducted by the manufacturer, shall be supplied for each engine-system combination. For gasoline and diesel engines, separate factors shall be established for transient HC, CO, and NO_x. For diesel smoke testing, separate factors shall also be established for the acceleration mode (designated as "A"), the lugging mode (designated as "B"), and peak opacity (designated as "C").

(iii) (A) Paragraph (c)(4)(iii)(A) of this section applies to gasoline-fueled heavy-duty engines.

(*1*) *Gasoline-fueled heavy-duty engines not utilizing aftertreatment technology (e.g., catalytic converters).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Gasoline-fueled heavy-duty engines utilizing aftertreatment technology (e.g., catalytic converters).*

For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(B) Paragraph (c)(4)(iii)(B) of this section applies to diesel heavy-duty engines.

(*1*) *Diesel heavy-duty engines not utilizing aftertreatment technology (e.g., particulate traps).* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(*2*) *Diesel heavy-duty engines utilizing aftertreatment technology (e.g., particulate traps.)* For transient HC, CO, and NO_x, the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by multiplication by the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than one, it shall be one for the purposes of this paragraph.

(*3*) For acceleration smoke ("A"), lugging smoke ("B"), and peak smoke ("C"), the official exhaust emission results for each emission-data engine at the selected test point shall be adjusted by the addition of the appropriate deterioration factor. However, if the deterioration factor supplied by the manufacturer is less than zero, it shall be zero for the purposes of this paragraph.

(iv) The emission values to compare with the standards shall be the adjusted emission values of paragraph (c)(4)(iii) of this section rounded to two significant figures in accordance with ASTME 29-67 for each emission-data engine.

(5) [Reserved].

(6) [Reserved].

(7) Every test engine of an engine family must comply with all applicable standards, as determined in paragraph (c)(4)(iv) of this section, before any engine in that family will be certified.

(d)(1) Paragraph (d) of this section applies to gasoline-fueled heavy-duty vehicles.

(2) The applicable fuel evaporative emission standard in § 86.085-10 applies to the emissions of vehicles for their useful life.

(3)(i) For vehicles with a GVWR of up to 26,000 pounds, because it is expected that emission control efficiency will change during the useful life of the vehicle, an evaporative emission deterioration factor shall be determined from the testing described in § 86.085-23(b)(3) for each evaporative emission family-evaporative emission control system combination to indicate the evaporative emission control system deterioration during the useful life of the vehicle (minimum 50,000 miles). The factor shall be established to a minimum of two places to the right of the decimal.

(ii) For vehicles with a GVWR of greater than 26,000 pounds, because it is expected that emission control efficiency will change during the useful life of the vehicle, each manufacturer's statement as required in § 86.085-23(b)(4)(ii) shall include, in accordance with good engineering practice, consideration of control system deterioration.

(4) The evaporative emission test results, if any, shall be adjusted by the addition of the appropriate deterioration factor: *Provided*, that if the deterioration factor as computed in paragraph (c)(3) of this section is less than zero, that deterioration factor shall be zero for the purposes of this paragraph.

(5) The emission level to compare with the standard shall be the adjusted emission level of paragraph (c)(4) of this section. Before any emission value is compared with the standard, it shall be rounded, in accordance with ASTME 29-67, to two significant figures. The rounded emission values may not exceed the standard.

(6) Every test vehicle of an evaporative emission family must comply with the evaporative emission standard, as determined in paragraph (c)(5) of this section, before any vehicle in that family may be certified.

22. A new § 86.087-35 is added to Subpart A to read as follows:

§ 86.087-35 Labeling.

(a) The manufacturer of any motor vehicle (or motor vehicle engine) subject to the applicable emission standards (and family particulate emission limits, as appropriate) of this subpart, shall, at the time of manufacture, affix a permanent legible label, of the type and in the manner described below, containing the information hereinafter provided, to all production models of such vehicles (or engines) available for sale to the public and covered by a certificate of conformity under § 86.084-30(a).

(1) *Light-duty vehicles.* (i) A permanent, legible label shall be affixed in a readily visible position in the engine compartment.

(ii) The label shall be affixed by the vehicle manufacturer who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label. The label shall not be affixed to any equipment which is easily detached from such vehicle.

(iii) The label shall contain the following information lettered in the English language in block letters and numerals, which shall be of a color that contrasts with the background of the label:

(A) The label heading: Vehicle Emission Control Information;

(B) Full corporate name and trademark of manufacturer;

(C) Engine displacement (in cubic inches), engine, family identification and evaporative family identification;

(D) Engine tune-up specifications and adjustments, as recommended by the manufacturer in accordance with the applicable emission standards (or family particulate emission limit, as applicable), including but not limited to idle speed(s), ignition timing, the idle air-fuel mixture setting procedure and value (e.g., idle CO, idle air-fuel ratio, idle speed drop), high idle speed, initial injection timing, and valve lash (as applicable), as well as other parameters deemed necessary by the manufacturer. These specifications should indicate the proper transmission position during tune-up and what accessories (e.g., air conditioner), if any, should be in operation;

(E) An unconditional statement of compliance with the appropriate model year U.S. Environmental Protection Agency regulations which apply to light-duty vehicles;

(F) For vehicles which are part of the diesel particulate averaging program, the family particulate emission limit to which the vehicle is certified;

(G) For vehicles that have been exempted from compliance with the emission standards at high altitude, as specified in § 86.085-8(h).

(*1*) A highlighted statement (e.g., underscored or boldface letters) that the vehicle is certified to applicable emission standards at low altitude only,

(*2*) A statement that the vehicle's unsatisfactory performance under high-altitude conditions makes it unsuitable for principal use at high altitude, and

(*3*) A statement that the emission performance warranty provisions of 40 CFR Part 85, Subpart V, do not apply when the vehicle is tested at high altitude; and

(H) For vehicles that have been exempted from compliance with the emission standards at low altitude, as specified in § 86.085–8(i).

(*1*) A highlighted statement (e.g., underscored or boldface letters) that the vehicle is certified to applicable emission standards at high altitude only, and

(*2*) A statement that the emission performance warranty provisions of 40 CFR Part 85, Subpart V, do not apply when the vehicle is tested at low altitude.

(2) *Light-duty trucks.* (i) A legible, permanent label shall be affixed in a readily visible position in the engine compartment.

(ii) The label shall be affixed by the vehicle manufacturer who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label. The label shall not be affixed to any equipment which is easily detached from such vehicle.

(iii) The label shall contain the following information lettered in the English language in block letters and numerals, which shall be of a color that contrasts with the background of the label.

(A) The label heading: Important Vehicle Information;

(B) Full corporate name and trademark of manufacturer;

(C) Engine displacement (in cubic inches) and engine family identification;

(D) Engine tune-up specifications and adjustments, as recommended by the manufacturer in accordance with the applicable emission standards (or family particulate limit as appropriate), including but not limited to idle speed(s), ignition timing, the idle air-fuel mixture setting procedure and value (e.g., idle CO, idle air-fuel ratio, idle speed drop), high idle speed, initial injection timing, and valve lash (as applicable), as well as other parameters deemed necessary by the manufacturer. These specifications should indicate the proper transmission position during tune-up and what accessories (e.g., air conditioner), if any, should be in operation. If adjustments or modifications to the vehicle are necessary to insure compliance with emission standards (or family particulate limit, as appropriate) at either high or low altitude, the manufacturer shall either include the instructions for such adjustments on the label, or indicate on the label where instructions for such adjustments may be found. The label shall indicate whether the engine tune-up or adjustment specifications are applicable to high altitude, low altitude or both;

(E) The prominent statement: "This vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks."

(F) If the manufacturer is provided an alternate useful-life period under the provisions of § 86.085–21(f), the prominent statement: "This vehicle has been certified to meet U.S. EPA standards for a useful-life period of —— years or ———— miles of operation, whichever occurs first. This vehicle's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than years or miles (*e.g.*, hours, or miles only);

(G) A statement, if applicable, that the adjustments or modifications indicated on the label are necessary to ensure emission control compliance at the altitude specified;

(H) A statement, if applicable, that the high-altitude vehicle was designated or modified for principal use at high altitude. This statement must be affixed by the manufacturer at the time of assembly or by any dealer who performs the high-altitude modification or adjustment prior to sale to an ultimate purchaser;

(I) For vehicles that have been exempted from compliance with the high-altitude emission standards, as specified in § 86.085–9(g)(2),

(*1*) A highlighted statement (e.g., underscored or boldface letters) that the vehicle is certified to applicable emission standards at low altitude only,

(*2*) A statement that the vehicle's unsatisfactory performance under high-altitude conditions makes it unsuitable for principal use at high altitude, and

(*3*) A statement that the emission performance warranty provisions of 40 CFR Part 85, Subpart I, do not apply when the vehicle is tested at high altitude; and,

(J) For vehicles which are part of the diesel particulate averaging program, the family particulate emission limit to which the vehicle is certified.

(3) *Heavy-duty engines.* (i) A permanent legible label shall be affixed to the engine in a position in which it will be readily visible after installation in the vehicle.

(ii) The label shall be attached to an engine part necessary for normal engine operation and not normally requiring replacement during engine life.

(iii) The label shall contain the following information lettered in the English language in block letters and numerals which shall be of a color that contrasts with the background of the label:

(A) The label heading: Important Engine Information;

(B) Full corporate name and trademark of manufacturer;

(C) Engine displacement (in cubic inches) and engine family and model designations;

(D) Date of engine manufacture (month and year). The manufacturer may, in lieu of including the date of manufacture on the engine label, maintain a record of the engine manufacture dates. The manufacturer shall provide the date of manufacture records to the Administrator upon request;

(E) Engine specifications and adjustments as recommended by the manufacturer. These specifications should indicate the proper transmission position during tuneup and what accessories (e.g., air conditioner), if any, should be in operation;

(F) For gasoline-fueled engines the label should include the idle speed, ignition timing, and the idle air-fuel mixture setting procedure and value (e.g., idle CO, idle air-fuel ratio, idle speed drop), and valve lash;

(G) For diesel engines the label should include the advertised hp at rpm, fuel rate at advertised hp in mm^3/stroke, valve lash, initial injection timing, and idle speed;

(H) The prominent statement: "This engine conforms to U.S. EPA regulations applicable to 19—— Model Year New Heavy-Duty Engines."

(I) If the manufacturer is provided with an alternate useful-life period under the provisions of § 86.085–21(f), the prominent statement: "This engine has been certified to meet U.S. EPA standards for a useful-life period of ———— miles or —— hours of operation, whichever occurs first. This engine's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than miles or hours (*e.g.*, years, or hours only);

(J) *For diesel engines.* The prominent statement: "This engine has a primary intended service application as a ————-heavy-duty diesel engine." (The primary intended service applications are light, medium, and heavy, as defined in § 86.085–2);

(K) *For gasoline-fueled engines.* One of the following statements as applicable:

(*1*) For engines certified to the emission standards under § 86.087–10(a)(1)(i), the statement: "This engine is certified for use in all heavy-duty vehicles."

(*2*) For engines certified under the provisions of § 86.087–10(a)(3)(i), the statement: "This engine is certified for use in all heavy-duty vehicles under the special provision of 40 CFR 86.087-10(a)(3)(i)."

(3) For engines certified to the emission standards under § 86.087-10(a)(1)(ii), the statement: "This engine is certified for use only in heavy-duty vehicles with a gross vehicle weight rating above 14,000 lbs."

(iv) The label may be made up of one or more pieces: *Provided*, That all pieces are permanently attached to the same engine or vehicle part as applicable.

(4)(i) *Gasoline-fueled heavy-duty vehicles.* A permanent, legible label shall be affixed in a readily visible position in the engine compartment. If such vehicles do not have an engine compartment, the label required in paragraphs (a)(4) and (g)(1) of this section shall be affixed in a readily visible position on the operator's enclosure or on the engine.

(ii) The label shall be affixed by the vehicle manufacturer who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label. The label shall not be affixed to any equipment which is easily detached from such vehicle.

(iii) The label shall contain the following information lettered in the English language in block letters and numericals, which shall be of a color that contrasts with the background of the label:

(A) The label heading: Vehicle Emission Control Information;

(B) Full corporate name and trademark of manufacturer;

(C) Evaporative family identification;

(D) The maximum nominal fuel tank capacity (in gallons) for which the evaporative control system is certified; and,

(E) An unconditional statement of compliance with the appropriate model year U.S. Environmental Protection Agency regulations which apply to gasoline-fueled heavy-duty vehicles.

(b) The provisions of this section shall not prevent a manufacturer from also reciting on the label that such vehicle (or engine) conforms to any applicable state emission standards for new motor vehicles (or new motor vehicle engines) or any other information that such manufacturer deems necessary for, or useful to, the proper operation and satisfactory maintenance of the vehicle (or engine).

(c)(1) The manufacturer of any light-duty vehicle or light-duty truck subject to the emission standards (or family particulate emission limits, as appropriate) of this subpart shall, in addition and subsequent to setting forth those statements on the label required by the Department of Transportation (DOT) pursuant to 49 CFR 567.4, set forth on the DOT label or on an additional label located in proximity to the DOT label and affixed as described in 40 CFR 567.4(b), the following information in the English language, lettered in block letters and numerals not less than three thirty-seconds of an inch high, of a color that contrasts with the background of the label:

(i) The Heading: "Vehicle Emission Control Information."

(ii)(A) *For light-duty vehicles*, the statement: "This Vehicle Conforms to U.S. EPA Regulations Applicable to 19—— Model Year New Motor Vehicles."

(B) *For light-duty trucks*,

(*1*) The statement: "This vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks."

(*2*) If the manufacturer is provided an alternate useful-life period under the provisions of § 86.085-21(f), the prominent statement: "This vehicle has been certified to meet U.S. EPA standards for a useful-life period of —— years or ———— miles of operation, whichever occurs first. This vehicle's actual life may vary depending on its service application." The manufacturer may alter this statement only to express the assigned alternate useful life in terms other than years or miles (*e.g.*, hours, or miles only).

(iii) One of the following statements, as applicable, in letters and numerals not less than six thirty-seconds of an inch high and of a color that contrasts with the background of the label:

(A) For all vehicles certified as non-catalyst-equipped: "NON-CATALYST"

(B) For all vehicles certified as catalyst-equipped which are included in a manufacturer's catalyst control program for which approval has been given by the Administrator: "CATALYST—APPROVED FOR IMPORT"

(C) For all vehicles certified as catalyst-equipped which are not included in a manufacturer's catalyst control program for which prior approval has been given by the Administrator: "CATALYST"

(2) In lieu of selecting either of the labeling options of paragraph (c)(1) of this section, the manufacturer may add the information required by paragraph (c)(1)(iii) of this section to the label required by paragraph (a) of this section. The required information will be set forth in the manner prescribed by paragraph (c)(1)(iii) of this section.

(d) Incomplete light-duty trucks or incomplete heavy-duty vehicles optionally certified as light-duty trucks shall have the following prominent statement printed on the label required by paragraph (a)(2) of this section in lieu of the statement required by paragraph (a)(2)(iii)(E) of this section: "This vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Light-Duty Trucks when completed at a maximum curb weight of ———— pounds or at a maximum gross vehicle weight rating of ———— pounds or with a maximum frontal area of ———— square feet."

(e) Incomplete heavy-duty vehicles having a gross vehicle weight rating of 8,500 pounds or less shall have one of the following statements printed on the label required by paragraph (a)(3) of this section in lieu of the statement required by paragraph (a)(3)(iii)(H) of this section: "This engine conforms to U.S. EPA regulations applicable to 19—— Model Year New Heavy-Duty Engines when installed in a vehicle completed at a curb weight of more than 6,000 pounds or with a frontal area of greater than 45 square feet."

(f) The manufacturer of any imcomplete light-duty vehicle or light-duty truck shall notify the purchaser of such vehicle of any curb weight, frontal area, or gross vehicle weight rating limitations affecting the emission certificate applicable to that vehicle. This notification shall be transmitted in a manner consistent with National Highway Traffic Safety Administration safety notification requirements published in 49 CFR Part 568.

(g)(1) Incomplete gasoline-fueled heavy-duty vehicles shall have the following prominent statement printed on the label required in paragraph (a)(4) of this section: "(Manufacturer's corporate name) has determined that this vehicle conforms to U.S. EPA regulations applicable to 19—— Model Year New Gasoline-Fueled Heavy-Duty Vehicles when completed with a nominal fuel tank capacity not to exceed ———— gallons. Persons wishing to add fuel tank capacity beyond the above maximum must submit a written statement to the Administrator that the hydrocarbon storage system has been upgraded according to the requirements of 40 CFR 86.085-35(g)(2)."

(2) Persons wishing to add fuel tank capacity beyond the maximum specified on the label required in paragraph (g)(1) of this section shall:

(i) Increase the amount of fuel tank vapor storage material according to the following function:

$$Cap_f = Cap_i \left(\frac{\text{T. Vol.}}{\text{Max. Vol.}} \right)$$

Where:

Cap_f = final amount of fuel tank vapor storage material, grams

Cap_i = initial amount of fuel tank vapor storage material, grams

T. Vol. = total fuel tank volume of completed vehicle, gallons

Max. Vol. = maximum fuel tank volume as specified on the label required in paragraph (g)(1) of this section, gallons

(ii) Use, if applicable, hosing for fuel vapor routing which is at least as impermeable to hydrocarbon vapors as that used by the primary manufacturer.

(iii) Use vapor storage material with the same adsorptive characteristics as that used by the primary manufacturer.

(iv) Connect, if applicable, any new hydrocarbon storage device to the existing hydrocarbon storage device in series such that the original hydrocarbon storage device is situated between the fuel tank and the new hydrocarbon storage device. The original hydrocarbon storage device shall be sealed such that vapors cannot reach the atmosphere. The elevation of the original hydrocarbon storage device shall be equal to or lower than the new hydrocarbon storage device.

(v) Submit a written statement to the Administrator that paragraphs (g)(2)(i) through (g)(2)(iv) of this section have been complied with.

(3) If applicable, the Administrator will send a return letter verifying the receipt of the written statement required in paragraph (g)(2)(v) of this section.

Subpart B—[Amended]

23. Section 86.133-78 of Subpart B is amended by revising paragraph (e) to read as follows:

§ 86.133-78 Diurnal breathing loss test.

* * * * *

(e) Immediately prior to the diurnal breathing loss test, the fuel tank(s) of the prepared vehicle shall be drained and recharged with the specified test fuel, § 86.113, to the prescribed "tank fuel volume," defined in § 86.078-2. The temperature of the fuel prior to its delivery to the fuel tank shall be between 45 and 60° F (7.2 and 16° C). The fuel tank cap(s) is not installed until the diurnal heat build begins.

* * * * *

Subpart F—[Amended]

24. Section 86.544-78 of Subpart F is revised to read as follows:

§ 86.544-78 Calculations; exhaust emissions.

The final reported test results, with oxides of nitrogen being optional, shall be computed by use of the following formulae: (The results of all emission tests shall be rounded, using the "Rounding-Off Method" specified in ASTM E 29-67, to the number of places to the right of the decimal point indicated by expressing the applicable standard to three significant figures.)

(a)

$$Y_{wm} = 0.43[(Y_{ct}+Y_s)/(D_{ct}+D_s)]+0.57[(Y_{ht}+Y_s)/(D_{ht}+D_s)]$$

Where:

Y_{wm} = Weighted mass emissions of CO_2 or of each pollutant, i.e., HC, CO, or NO_x, in grams per vehicle kilometer

Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold-start test, in grams per test phase

Y_{ht} = Mass emissions as calculated from the "transient" phase of the hot-start test, in grams per test phase

Y_s = Mass emissions as calculated from the "stabilized" phase of the cold-start test, in grams per test phase

D_{ct} = The measured driving distance from the "transient" phase of the cold-start test, in kilometers

D_{ht} = The measured driving distance from the "transient" phase of the hot-start test, in kilometers

D_s = The measured driving distance from the "stabilized" phase of the cold-start test, in kilometers

(b) The mass of each pollutant for each phase of both the cold-start test and the hot-start test if determined from the following:

(1) Hydrocarbon mass:

$$HC_{mass} = V_{mix} \times Density_{HC} \times (HC_{conc}/1{,}000{,}000)$$

(2) Oxides of nitrogen mass:

$$NO_{x\,mass} = V_{mix} \times Density_{NO2} \times (NO_{x\,conc} \times K_h/1{,}000{,}000)$$

(3) Carbon monoxide mass:

$$CO_{mass} = V_{mix} \times Density_{CO} \times (CO_{conc}/1{,}000{,}000)$$

(4) Carbon dioxide mass:

$$CO_{2\,mass} = V_{mix} \times Density_{CO2} \times (CO_{2\,conc}/100)$$

(c) Meaning of symbols:

(1) HC_{mass} = Hydrocarbon emissions, in grams per test phase

$Density_{HC}$ = Density of hydrocarbon in the exhaust gas, 576.8 g/m³/carbon atom (16.33 g/ft³/carbon atom), assuming an average carbon to hydrogen ratio of 1:1.85, at 20°C (68°F) and 101.325 kPa (760 mm Hg) pressure

HC_{conc} = Hydrocarbon concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent, i.e., equivalent propane × 3

$$HC_{conc} = HC_e - HC_d(1-1/DF)$$

Where:

HC_e = Hydrocarbon concentrations of the dilute exhaust sample as measured, in ppm carbon equivalent (propane ppm × 3)

HC_d = Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent (propane ppm × 3)

(2) $NO_{x\,mass}$ = Oxides of nitrogen emissions, in grams per test phase

$Density_{NO2}$ = Density of oxides of nitrogen in the exhaust gas, assuming they are in the form of nitrogen dioxide, 1.913 g/m³ (54.16 g/ft³), at 20°C (68°F) and 101.325 kPa (760 mm Hg) pressure

$NO_{x\,conc}$ = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm

$$NO_{x\,conc} = NO_{xe} - NO_{xd}(1-1/DF)$$

Where:

NO_{xe} = Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm

NO_{xd} = Oxides of nitrogen concentration of the dilution air as measured, in ppm

(3) CO_{mass} = Carbon monoxide emissions, in grams per test phase

$Density_{CO}$ = Density of carbon monoxide, 1.164 g/m³ (32.97 g/ft³), at 20°C (68°F) and 101.325 kPa (760 mm Hg) pressure

CO_{conc} = Carbon monixide concentration of the dilute exhaust sample corrected for background, water vapor, and CO_2 extraction, in ppm

$$CO_{conc} = CO_e - CO_d(1-1/DF)$$

Where:

CO_e = Carbon monoxide concentration of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in ppm. The calculation assumes the carbon to hydrogen ratio of the fuel is 1:1.85.

$$CO_e = (1-0.01925CO_{2e}-0.000323R)\ CO_{em}$$

Where:

CO_{em} = Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm

CO_{2e} = Carbon dioxide concentration of the dilute exhaust sample, in percent

R = Relative humidity of the dilution air, in percent (see § 86.542.78(n))

CO_d = Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm

$$CO_d = (1-0.000323R)\ CO_{dm}$$

Where:

CO_{dm} = Carbon monoxide concentration of the dilution air sample as measured, in ppm

Note.—If a CO instrument which meets the criteria specified in § 86.511 is used and the conditioning column has been deleted, CO_{em} can be substituted directly for CO_e and CO_{dm} can be substituted directly for CO_d.

(4) $CO_{2\,mass}$ = Carbon dioxide emissions, in grams per test phase

Density CO_2 = Density of carbon dioxide, 1,830 g/m³ (51.81 g/ft³), at 20°C (68°F) and 101.325 kPa (760 mm Hg) pressure

$CO_{2\,conc}$ = carbon dioxide concentration of the dilute exhaust sample corrected for background, in percent

$$CO_{2\,conc} = CO_{2e} - CO_{2d}(1-1/DF)$$

Where:

CO_{2d} = Carbon dioxide concentration of the dilution air as measured, in percent

(5) $DF=13.4/[CO_{2e}+(HC_e+CO_e)10^{-4}]$

V_{mix} = Total dilute exhaust volume in cubic meters per test phase corrected to standard conditions (293.15° K (528°R) and 101.325 kPa (760 mm Hg))

$V_{mix}=V_o \times N[P_b-P_i](293.15°K)]/[(101.325 kPa)(T_p)]$

Where:

V_o = Volume of gas pumped by the positive displacement pump, in cubic meters per revolution. This volume is dependent on the pressure differential across the positive displacement pump. (See calibration techniques in § 86.519–78)

N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected

P_b = Barometric pressure, in kPa

P_i = Pressure depression below atmospheric measured at the inlet to the positive displacement pump, in kPa

T_p = Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected, in degrees Kelvin

K_h = Humidity correction factor

$K_h=1/[1-0.0329(H-10.71)]$

where:

H = Absolute humidity in grams of water per kilogram of dry air

$H=[(6.211)R_a \times P_d]/[P_b-(P_d \times R_a/100)]$

R_a = Relative humidity of the ambient air, in percent

P_d = Saturated vapor pressure, in kPa at the ambient dry bulb temperature

(d) Sample calculation of mass emission values for vehicles with engine displacements equal to or greater than 170 cc (10.4 cu. in.):

(1) For the "transient" phase of the cold-start test, assume $V_o=0.0077934$ m^3 per revolution; $N=12,115$; $R=20.5$ percent; $R_a=20.5$ percent; $P_b=99.05$ kPa; $P_d=3.382$ kPa; $P_i=9.851$ kPa; $T_p=309.8$ K; $HC_e=249.75$ ppm carbon equivalent; $NO_{xe}=38.30$ ppm; $CO_{em}=311.23$ ppm; $CO_{2e}=0.415$ percent; $HC_d=4.90$ ppm; $NO_{xd}=0.30$ ppm; $CO_{dm}=8.13$ ppm; $CO_{2d}=0.037$ percent; $D_{ct}=5.650$ km.

Then:

$V_{mix}=[(0.0077934)(12,115)(99.05-9.851)(293.15)]/[(101.325)(309.8)]$

$V_{mix}=78.651$ m^3 per test phase

$H=[(6.211)(20.5)(3.382)]/[(99.05)-(3.382)(20.5/100)]$

$H=4.378$ grams H_2O per kg dry air

$K_h=1/[1-0.0329(4.378-10.71)]$

$K_h=0.8276$

$CO_e=[1-0.01925(0.415)-0.000323(20.5)](311.23)$

$CO_e=306.68$ ppm

$CO_d=[1-0.000323(20.5)](8.13)$

$CO_d=8.08$ ppm

$DF=13.4/[0.415+(249.75+306.68)10^{-4}]$

$DF=28.472$

$HC_{conc}=249.75-4.90(1-1/28.472)$

$HC_{conc}=245.02$ ppm

$HC_{mass}=(78.651)(576.8)(245.02)\ 10^{-6}$

$HC_{mass}=11.114$ grams per test phase

$NO_{xconc}=38.30-0.30(1-1/28.472)$

$NO_{xconc}=38.01$ ppm

$NO_{xmass}=(78.651)(1913)(38.01)(0.8276)10^{-6}$

$NO_{xmass}=4.733$ grams per test phase

$CO_{conc}=306.68-8.08(1-1/28.472)$

$CO_{conc}=298.88$ ppm

$CO_{mass}=(78.651)(1164)(298.88)10^{-6}$

$CO_{mass}=27.362$ grams per test phase

$CO_{2conc}=0.415-0.037(1-1/28.472)$

$CO_{2conc}=0.3793$ percent

$CO_{2mass}=(78.651)(1843)(0.3793)/100$

$CO_{2mass}=549.81$ grams per test phase

(2) For the "stabilized" portion of the cold-start test, assume that similar calculations resulted in $HC_{mass}=7.184$ grams per test phase; $NO_{xmass}=2.154$ grams per test phase; $CO_{mass}=64.541$ grams per test phase; and $CO_{2mass}=529.52$ grams per test phase. $D_s=6.070$ kilometers.

(3) For the "transient" portion of the hot-start test, assume that similar calculations resulted in $HC_{mass}=6.122$ grams per test phase; $NO_{xmass}=7.056$ grams per test phase; $CO_{mass}=34.964$ grams per test phase; and $CO_{2mass}=480.93$ per test phase. $D_{ht}=5.660$ kilometers.

(4) For a 1978 motorcycle with an engine displacement equal to or greater than 170 cc (10.4 cu. in.):

$HC_{wm}=0.43[(11.114+7.184)/(5.650+6.070)]+0.57[(6.122+7.184)/(5.660+6.070)]$

$HC_{wm}=1.318$ grams per vehicle kilometer

$NO_{xwm}=0.43[(4.733+2.154)/(5.650+6.070)]+0.57[(7.056+2.154)/(5.660+6.070)]$

$NO_{xwm}=0.700$ gram per vehicle kilometer

$CO_{wm}=0.43[(27.362+64.541)/(5.650+6.070)]+0.57[(34.964+64.541)/(5.660+6.070)]$

$CO_{wm}=8.207$ grams per vehicle kilometer

$CO_{2wm}=0.43[(549.81+529.52)/(5.650+6.070)]+0.57[(480.93+529.52)/(5.660+6.070)]$

$CO_{2wm}=88.701$ grams per vehicle kilometer

25. Subpart I is revised to read as follows:

* * * * *

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

Sec.

Authority: Secs. 202, 206, 207, 208, 301(a), Clean Air Act; as amended 42 U.S.C. 7521, 7524, 7541, 7542, and 7601.

* * * * *

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

§ 86.884–1 General applicability.

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

§ 86.884–2 Definitions.

The definitions in § 86.084–2 apply to this subpart.

§ 86.884–3 Abbreviations.

The abbreviations in § 86.078–3 apply to this subpart.

§ 86.884–4 Section numbering.

The section numbering system set forth in § 86.084–4(a) applies to this subpart.

§ 86.884–5 Test procedures.

The procedures described in this and subsequent sections will be the test program to determine the conformity of engines with the standards set forth in § 86.084–11(b).

(a) The test consists of a prescribed sequence of engine operating conditions on an engine dynamometer with continuous examination of the exhaust gases. The test is applicable equally to controlled engines equipped with means for preventing, controlling, or eliminating smoke emissions and to uncontrolled engines.

(b) The test is designed to determine the opacity of smoke in exhaust emissions during those engine operating conditions which tend to promote smoke from diesel vehicles.

(c) The test procedure begins with a preconditioned engine which is then run through preloading and preconditioning operations. After an idling period, the engine is operated through acceleration and lugging modes during which smoke emission measurements are made to compare with the standards. The engine is then returned to the idle condition and the acceleration and lugging modes are repeated. Three consecutive sequences of acceleration and lugging constitutes the full set of operating conditions for smoke emission measurement.

(d) Except in cases of component malfunction or failure, all emission control systems installed on or incorporated in a new motor vehicle engine shall be functioning during all procedures in this subpart. Maintenance to correct component malfunction or failure shall be authorized in accordance with § 86.084–24.

§ 86.884–6 Diesel fuel specifications.

The requirements of this section are set forth in § 86.1313–84(b).

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

(a) The following sequence of operations shall be performed during engine dynamometer testing of smoke emissions, starting with the dynamometer preloading determined and the engine preconditioned (§ 86.884–12(c)).

(1) *Idle mode.* The engine is caused to idle for 5 to 5.5 minutes at the manufacturer's recommended curb idle speed. The dynamometer controls shall be set to provide minimum load by turning the load switch to the "off" position or by adjusting the controls to the minimum load position.

(2) *Acceleration mode.* (i) The engine speed shall be increased to 200 ±50 rpm above the manufacturer's recommended curb idle speed within three seconds.

(ii) Immediately upon completion of the mode specified in paragraph (a)(2)(i) of this section, the throttle shall be moved rapidly to, and held in, the fully open position. The inertia of the engine and the dynamometer, or alternately a preselected dynamometer load, shall be used to control the acceleration of the engine so that the speed increases to 85 percent of the rated speed in 5 ±1.5 seconds. This acceleration shall be linear within 100 rpm as specified in § 86.884–13(c).

(iii) After the engine reaches the speed required in paragraph (a)(2)(ii) of this section, the throttle shall be moved rapidly to, and held in, the fully closed position. Immediately after the throttle is closed, the preselected load required to perform the acceleration in paragraph (a)(2)(iv) of this section shall be applied. For electric dynamometer operation in speed mode, the deceleration shall be performed in 2 ±1.5 seconds.

(iv) When the engine decelerates to the intermediate speed (within 50 rpm), the throttle shall be moved rapidly to, and held in, the fully open position. The preselected dynamometer load which was applied during the preceding transition period shall be used to control the acceleration of the engine so that the speed increases to at least 95 percent of the rated speed in 10 ±2 seconds.

(v) For electric dynamometer operation in speed mode, motoring assist may be used to offset excessive dynamometer inertia load when necessary. No negative flywheel torque shall occur during any of the three acceleration modes in (a)(2).

(3) *Lugging mode.* (i) Immediately upon 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 engine speed shall be maintained within 50 rpm of the rated speed, and the power (corrected, if necessary, to rating conditions) shall be no less than 95 percent of the maximum horsepower developed at the zero-hour point.

(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 (within 50 rpm). 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.* Immediately upon completion of 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 the curb idle condition within one minute after completion of the lugging mode.

(b) The procedures described in paragraphs (a)(1) through (a)(4) of this section shall be repeated until three consecutive valid cycles have been completed. If three valid cycles have not been completed after a total of six consecutive cycles have been run, the engine shall be preconditioned by operation at maximum horsepower at rated speed for 10 minutes before the test sequence is repeated.

§ 86.884–8 Dynamometer and engine equipment.

The following equipment shall be used for smoke emission testing of engines on engine dynamometers:

(a) An engine dynamometer with adequate characteristics to perform the test cycle described in §86.884–7.

(b) An engine cooling system having sufficient capacity to maintain the engine at normal operating temperatures during conduct of the prescribed engine tests.

(c) An exhaust system whose end is 15 ±5 feet from the exhaust manifold (or the crossover junction in the case of Vee engines). The 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 terminal two feet of the exhaust pipe used for smoke measurement shall be of 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	Exhaust pipe diameter (inches)
Less than 101	2
101 to 200	3
201 to 300	4
301 or more	5

(d) An engine air inlet system presenting an air inlet restriction within one inch of water of the upper limit for the engine operating condition which results in maximum air flow, as established by the engine manufacurer in his sales and service literature, for the engine being tested.

§ 86.884–9 Smoke measurement system.

(a) *Schematic drawing.* The Figure I84–1 is a schematic drawing of the optical system of the light extinction meter.

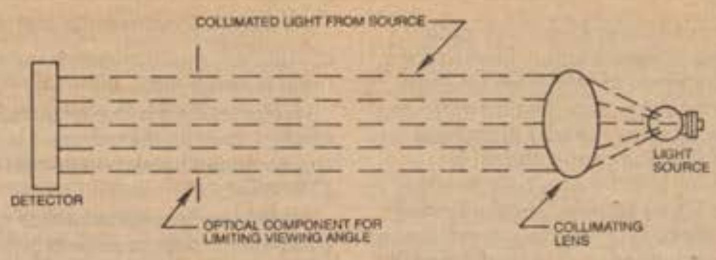


Figure I84-1 SMOKEMETER OPTICAL SYSTEM (SCHEMATIC)

(b) *Equipment.* The following equipment shall be used in the system.

(1) Adapter—the smokemeter optical unit may be mounted on a fixed or movable frame. The normal unrestricted shape of the exhaust plume shall not be modified by the adaptor, the meter, or any ventilatory system used to remove the exhaust from the test site.

(2) Smokemeter (light extinction meter)—continuous recording, full-flow light obscuration meter. It shall be positioned near the end of the exhaust pipe so that a built-in light beam traverses the exhaust smoke plume which issues from the pipe at right angles to the axis of the plume. The light source is an incandescent lamp operating at a constant voltage of not less than 15 percent of the manufacturer's specified voltage. The lamp output is collimated to a beam with a nominal diameter of 1.125 inches. The angle of divergence of the collimated beam shall be within a 4° included angle. A light detector, directly opposed to the light source, measures the amount of light blocked by the smoke in the exhaust. The detector sensitivity is restricted to the visual range and comparable to that of the human eye. A collimating tube with apertures equal to the beam diameter is attached to the detector. It restricts the viewing angle of the detector to within a 16° included angle. An amplified signal corresponding to the amount of light blocked is recorded continuously on a remote recorder. An air curtain across the light source and detector window assemblies may be used to minimize deposition of smoke particles on those surfaces provided that it does not measurably affect the opacity of the plume. The meter consists of two units, and optical unit and a remote control unit. Light extinction meters employing substantially identical measurement principles and producing substantially equivalent results but which employ other electronic and optical techniques may be used only after having been approved in advance by the Administrator.

(3) Recorder—a continuous recorder, with variable chart speed over a minimal range of 0.5 to 8.0 inch per minute (or equivalent) and an automatic marker indicating 1-second intervals shall be used for continuously recording the exhaust gas opacity, engine rpm and throttle position. The recorder shall be equipped to indicate only when the throttle is in the fully open or fully closed position. The recorder scale for opacity shall be linear and calibrated to read from 0 to 100 percent opacity full scale. The opacity trace shall have a resolution within 1-percent opacity. The recorder scale for engine rpm shall be linear and have a resolution of 30 rpm. The throttle position trace must clearly indicate when the throttle is in the fully open and fully closed positions. Any means other than a strip-chart recorder may be used provided it produces a permanent visual data record of quality equal to or better than that described above (e.g., tabulated data, traces, or plots).

(4) The recorder used with the smokemeter shall be capable of full-scale deflection in 0.5 second or less. The smokemeter-recorder combination may be damped so that signals with a frequency higher than 10 cycles per second are attenuated. A separate lowpass electronic filter with the following performance characteristics may be installed between the smokemeter and the recorder to achieve the high-frequency attenuation:

(i) Three decibel point—10 cycles per second.

(ii) Insertion loss—zero ±0.5 decibel.

(iii) Selectivity—12 decibels per octave above 10 cycles per second.

(iv) Attenuation—27 decibels down at 40 cycles per second minimum.

(5) In lieu of the use of chart recorders, automatic data collection equipment may be used to record all required data. Automatic data processing equipment may then be used to perform the data analysis specified in § 86.884–13. The automatic data collection equipment must be capable of sampling at least two records per second.

(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. The distance from the optical centerline to the exhaust pipe outlet shall be 5 ±1 inch. The full flow of the exhaust stream shall be centered between the source and detector apertures (or windows and lenses) and on the axis of the light beam.

(2) Power shall be supplied to the control unit of the smokemeter in time to allow at least 15 minutes for stabilization prior to testing.

§ 86.884–10 Information.

The following information, as applicable, shall be recorded for each test:

(a) Engine description and specifications. A copy of the information specified in this paragraph must accompany each engine sent to the Administrator for compliance testing. If the engine is submitted to the Administrator for testing under Subpart N, only the information specified in § 86.1344–84 need accompany the engine. The manufacturer need not record the information specified in this paragraph for each test if the information, with exception of paragraphs (a)(3), (a)(12), and (a)(13) of this section, is included in the manufacturer's Part I.

(1) Engine-system combination.

(2) Engine identification numbers.

(3) Number of hours of operation accumulated on engine.

(4) Rated maximum horsepower and torque.

(5) Maximum horsepower and torque speeds.

(6) Engine displacement.

(7) Governed speed.

(8) Curb-idle rpm.

(9) Fuel consumption at maximum power and torque.

(10) Maximum air flow.

(11) Maximum and test air inlet restriction.

(12) Exhaust pipe diameter(s).

(13) Maximum exhaust system backpressure.

(b) Test data; general. This information may be recorded at any time between four hours prior to the test and four hours after the test.

(1) Engine-system combination.

(2) Engine identification numbers.

(3) Instrument operator.

(4) Engine operator.

(5) Number of hours of operation accumulated on the engine prior to beginning the warm-up portion of the test.

(6) Calibration date(s) of neutral density filters used to calibrate the smokemeter.

(c) Test data; pre-test.

(1) Date and time of day.

(2) Test number.

(3) Barometric pressure.

(4) Smokemeter: Number-zero control setting—calibration control setting—gain.

(5) Intake air humidity and temperature:

(i) Humidity-conditioned air supply. Air that has had its absolute humidity altered is considered humidity-conditioned air. For this type of intake air supply, the humidity measurement must be made within the intake air supply system, and after the humidity conditioning has taken place.

(ii) Non-conditioned air supply. Humidity measurements in non-conditioned intake air supply systems must be made in the intake air stream entering the supply system and within 18 inches of the inlet for supply system. Alternatively, the humidity measurements can be measured within the intake air supply stream.

(iii) Engine intake air temperature measurement must be made within 48 inches of the engine. The measurement location must be made either in the supply system or in the air stream entering the supply system.

(d) Test data; modal.

(1) Observed engine torque and speed during the steady-state test conditions specified in § 86.884-7(a)(3)(i).

(2) On the recorder or automatic data collection equipment: Identify zero traces—calibration traces—idle traces (or printout of the zero and calibration values)—closed-throttle trace-open throttle trace—acceleration and lugdown test traces—start and finish of each test.

§ 86.884-11 Instrument checks.

(a) The smokemeter shall be checked according to the following procedure prior to each test:

(1) The optical surfaces of the optical section shall be visually checked to verify that they are clean and free of foreign material and fingerprints;

(2) The zero control shall be adjusted under conditions of "no smoke" to give a recorder or data collection equipment response of zero;

(3) Calibrated neutral density filters having approximately 10, 20, and 40 percent opacity shall be employed to check the linearity of the instrument. The filter(s) shall be inserted in the light path perpendicular to the axis of the beam and adjacent to the opening from which the beam of light from the light source emanates, and the recorder response shall be noted. Filters with exposed filtering media should be checked for opacity every six months; all other filters shall be checked every year, using NBS or equivalent reference filters. Deviations in excess of 1 percent of the nominal opacity shall be corrected.

(b) The instruments for measuring and recording engine rpm, engine torque, air inlet restrictions, exhaust system backpressure, throttle position, etc., which are used in the test prescribed herein, shall be calibrated in accordance with good engineering practice.

§ 86.884-12 Test run.

(a) The temperature of the air supplied to the engine shall be between 68° F and 86° F. The fuel temperature at the pump inlet shall be 100° F±10° F. The observed barometric pressure shall be between 28.5 inches and 31 inches Hg. Higher air temperature or lower barometric pressure may be used, if desired, but no allowance will be made for possible increased smoke emissions because of such conditions.

(b) The governor and fuel system shall have been adjusted to provide engine performance at the levels in the application for certification required under § 86.084-21.

(c) The following steps shall be taken for each test:

(1) Start cooling system;

(2) Warm up the engine by the procedure described in § 86.1332-84(d)(3) (i) through (v).

(3) Determine by experimentation the dynamometer inertia and dynamometer load required to perform the acceleration in the dynamometer cycle for smoke emission tests (§ 86.884-7(a)(2)). In a manner appropriate for the dynamometer and controls being used, arrange to conduct the acceleration mode;

(4) Install smokemeter optical unit and connect it to the recorder/data collection system. Connect the engine rpm and throttle position sensing devices to the recorder/data collection system;

(5) Turn on purge air to the optical unit of the smokemeter, if purge air is used;

(6) Check and record zero and span settings of the smokemeter. (If a recorder is used, a chart speed of approximately one inch per minute shall be used.) The optical unit shall be retracted from its position about the exhaust stream if the engine is left running;

(7) Precondition the engine by operating it for 10 minutes at maximum rated horsepower;

(8) Proceed with the sequence of smoke emission measurements on the engine dynamometer as prescribed in § 86.884-7;

(9) During the test sequence of § 86.844-7, continuously record smoke measurements, engine rpm, and throttle position. (If a chart recorder is used for data collection, it shall be run at a minimum chart speed of one inch per minute during the idle mode and transitional periods, and eight inches per minute during the acceleration and lugging modes. Automatic data collection equipment, if used, shall sample at least two records per second.) The smokemeter zero and full-scale response may be rechecked during the idle mode of each test sequence. If either zero or full-scale drift is in excess of 2 percent opacity, the smokemeter controls must be readjusted and the test must be repeated;

(10) Turn off engine;

(11) Check zero and reset if necessary, and check span response of the smokemeter by inserting neutral density filters. If either zero or span drift is in excess of 2 percent opacity, the test results shall be invalidated.

§ 86.884-13 Data analysis.

The following procedure shall be used to analyze the test data:

(a) Locate the modes specified in § 86.884-7(a)(1) through (a)(4) by applying the following starting and ending criteria:

(1) The idle mode specified in § 86.884-7(a)(1) starts when engine preconditioning or the lugging mode of a preceding cycle has been completed and ends when the engine speed is raised above the idle speed.

(2) The acceleration mode specified in § 86.884-7(a)(2)(i) starts when the preceding idle mode has been completed and ends when the throttle is in the fully open position, as indicated by the throttle position trace as specified in § 86.884-7(a)(2)(ii).

(3) The acceleration mode specified in § 86.884-7(a)(2)(ii) starts when the preceding acceleration mode has been completed and ends when the engine speed reaches 85 percent of the rated speed.

(4) The transition period specified in § 86.884-7(a)(2)(iii) starts when the preceding acceleration mode has been completed and ends when the throttle is in the fully open position as indicated by the throttle position trace as specified in § 86.884-7(a)(2)(iv).

(5) The acceleration mode specified in § 86.884–7(a)(2)(iv) starts when the preceding transition period has been completed and ends when the engine speed reaches 95 percent of the rated speed.

(6) The transition period specified in § 86.884–7(a)(3)(i) starts when the preceding acceleration mode has been completed and ends when the engine speed in 50 rpm below the rated speed and the provisions of § 86.884–7(a)(3)(i) are met.

(7) The lugging mode specified in § 86.884–7(a)(3)(ii) starts when the preceding transition period has been completed and ends when the engine speed is at the intermediate speed.

(b) Determined if the test requirements of § 86.884–7 are met by applying the following modal criteria:

(1) Idle mode as specified in § 86.884–7(a)(1):

(i) Duration: 5 to 5.5 minutes.

(ii) Speed: within specification during the last four minutes of the mode.

(2) Acceleration mode as specified in § 86.884–7(a)(2)(i).

(i) Duration: three seconds or less.

(ii) Speed increase: 200±50 rpm.

(3) Acceleration mode as specified in § 86.884–7(a)(2)(ii):

(i) Linearity: ±100 rpm as specified in paragraph (c) of this section.

(ii) Duration: 3.5 to 6.5 seconds.

(iii) Throttle position: fully open until speed is at least 95 percent of the rated speed.

(4) Transition period as specified in § 86.884–7(a)(2)(iii):

(i) Throttle position: moved rapidly to, and held in, the fully closed position.

(5) Acceleration mode as specified in § 86.884–7(a)(2)(iv):

(i) Duration: 8 to 12 seconds.

(ii) Throttle position: fully open when speed is at intermediate speed.

(6) Transition period as specified in § 86.884–7(a)(3)(i):

(i) Duration: 50 to 60 seconds.

(ii) Speed during last 10 seconds within ±50 rpm of rated speed.

(iii) Corrected power during last 10 seconds: At least 95 percent of horsepower developed during zero-hour testing.

(7) Lugging mode as specified in § 86.884–7(a)(3)(ii):

(i) Linearity: ±100 rpm as specified in paragraph (c) of this section.

(ii) Duration: 30 to 40 seconds.

(iii) Speed at end: intermediate speed.

(c) Determine if the linearity requirements of § 86.884–7 were met by means of the following procedure:

(1) For the acceleration mode specified in § 86.884–7(a)(2)(ii), note the maximum deflection of the rpm trace from a straight line drawn between the starting and ending points specified in paragraph (a)(3) of this section.

(2) For the lugging mode specified in § 86.884–7(a)(3)(ii), note the maximum deflection of the rpm trace from a straight line drawn from the starting and ending points specified in paragraph (a)(7) of this section.

(3) The test results will be invalid if any deflection is greater than 100 rpm.

(4) This linearity check may be performed by direct analysis of the recorder traces, or by computer analysis of data collected by automatic data collection equipment.

(d) Analyze the smoke trace by means of the following procedure:

(1) Starting at the beginning of the first acceleration, as defined in paragraph (a)(2) of this section, and stopping at the end of the second acceleration, as defined in paragraph (a)(3) of this section, divide the smoke trace into half-second intervals. Similarly, subdivide into half-second intervals the third acceleration mode and the lugging mode as defined by paragraphs (a) (5) and (7) respectively, of this section.

(2) Determine the average smoke reading during each half-second interval.

(3) Locate and record the 15 highest half-second readings during the acceleration mode of each dynamometer cycle.

(4) Locate and record the five highest half-second readings during the lugging mode of each dynamometer cycle.

(5) Examine the average half-second values which were determined in paragraphs (d)(3) and (d)(4) of this section and record the three highest values for each dynamometer cycle.

(6) This smoke trace analysis may be performed by direct analysis of the recorder traces, or by computer analysis of data collected by automatic data collection equipment.

§ 86.884–14 Calculations.

(a) Average the 45 readings in § 86.884–13(d)(3) and designate the value as "A".

(b) Average the 15 readings in § 86.884–13(d)(4) and designate the value as "B".

(c) Average the 9 readings in § 86.884–13(d)(5) and designate the value as "C".

Subpart K—[Amended]

26. Section 86.1002–84 of Subpart K is amended by revising paragraph (b) to read as follows:

§ 86.1002–84 Definitions.

* * * * *

(b) As used in this subpart, all terms not defined herein have the meaning given them in the Act.

"Acceptable Quality Level" (AQL) means the maximum percentage of failing engines or vehicles, that for purposes of sampling inspection, can be considered satisfactory as a process average.

"Configuration" means a subclassification, if any, of a heavy-duty engine family for which a separate projected sales figure is listed in the manufacturer's Application for Certification and which can be described on the basis of emission control system, governed speed, injector size, engine calibration, and other parameters which may be designated by the Administrator, or a subclassification of a light-duty truck engine family/emission control system combination on the basis of engine code, inertia weight class, transmission type and gear ratios, axle ratio, and other parameters which may be designated by the Administrator.

"Test Sample" means the collection of vehicles or engines of the same configuration which have been drawn from the population of engines or vehicles of that configuration and which will receive exhaust emission testing.

"Inspection Criteria" means the pass and fail numbers associated with a particular sampling plan.

"Test Engine" means an engine in a test sample.

"Test Vehicle" means a vehicle in a test sample.

27. Section 86.1003–84 of Subpart K is amended by revising paragraphs (b), (c)(1), and (f)(1)(ii), and adding a new paragraph (f)(1)(iii) to read as follows:

§ 86.1003–84 Test orders.

* * * * *

(b) The test order will be signed by the Assistant Administrator for Air, Noise and Radiation or his designee. The test order will be delivered in person by an EPA Enforcement Officer to a company representative or sent by registered mail, return receipt requested, to the manufacturer's representative who signs the Application for Certification submitted by the manufacturer pursuant to the requirements of the applicable section of Subpart A of this part. Upon receipt of a test order, the manufacturer shall comply with all of the provisions of this subpart and instructions in the test order.

(c)(1) The test order will specify the engine or vehicle configuration selected for testing, the manufacturer's vehicle or engine assembly plant or associated storage facility from which the engines or vehicles must be selected, the time and location at which engines or vehicles must be selected, and the procedure by which engines or vehicles of the specified configuration must be selected. The test order may include alternate configurations to be selected for testing the event that engines or vehicles of the specified configuration are not available for testing because those engines or vehicles are not being manufactured during the specified time, or not being stored at the specified assembly plant or associated storage facilities. If the specified configuration is not being manufactured at a rate of at least four vehicles per day, in the case of light-duty truck manufacturers, two engines per day, in the case of heavy-duty engine manufacturers specified in paragraph (g)(1) of § 86.1008-84, or one engine per day, in the case of heavy-duty engine manufacturers specified in paragraph (g)(2) of § 86.1008-84, over the expected duration of the audit, the Assistant Administrator or his designated representative may select engines or vehicles of the alternate configuration for testing. In addition, the test order may include other directions or information essential to the administration of the required testing.

* * * * *

(f) * * *

(1) * * *

(ii) For manufacturers of gasoline-fueled or diesel light-duty trucks, the number determined by dividing the projected light-duty truck sales bound for the United States market for that model year, as made by the manufacturer in its report submitted under paragraph (a)(2) of § 600.207-80 of the Automobile Fuel Economy Regulations, by 300,000 and rounding to the nearest whole number, unless the projected sales are less than 150,000, in which case the number is one.

(iii) If a manufacturer submits to EPA in writing prior to or during the model year a reliable sales projection update, that update will be used for recalculating the manufacturer's annual limit of SEA test orders.

* * * * *

28. Section 86.1005-84 of Subpart K is amended by revising paragraphs (a)(2) (iii) and (iv) and adding a new paragraph (g) to read as follows:

§ 86.1005-84 Maintenance of records; submittal of information.

(a) * * *

(2) * * *

(iii) The names of all supervisory personnel involved in the conduct of the audit;

(iv) A record and description of any repairs performed prior to and/or subsequent to approval by the Administrator, giving the date and time of the repair, the reason for it, the person authorizing it, and the names of all supervisory personnel responsible for the conduct of the repair;

* * * * * * *

(g) Whenever a manufacturer submits information pursuant to the requirements of this subpart, the manufacturer shall clearly identify over which information it wishes to assert a business confidentiality claim and shall specify the time period for which that confidentiality claim will apply. If no claim accompanies business information when it is received by EPA, it may be made available to the public by EPA without further notice to the manufacturer. If a claim is received, the information covered by the claim will be disclosed by EPA only to the extent, and by means of the procedures, specified in 40 CFR Part 2.

29. Section 86.1006-84 of Subpart K is amended by revising paragraph (h)(3) to read as follows:

§ 86.1006-84 Entry and access.

* * * * *

(h) * * *

(3) Where facilities or areas other than those covered by paragraph (h)(2) of this section are concerned, "operating hours" means all times during which an assembly line is in operation, engine or vehicle assembly is taking place, testing, repair, service accumulation, production or compilation of records is taking place, or any other procedure or activity related to engine or vehicle manufacture, assembly or testing is being carried out in a facility.

* * * * *

30. Section 86.1007-84 of Subpart K is amended by revising paragraphs (b) and (c) to read as follows:

§ 86.1007-84 Sample selection.

* * * * *

(b) The manufacturer shall have assembled the test engines or vehicles of the configuration selected for testing using its normal mass production process for engines or vehicles to be distributed into commerce. During the audit, the manufacturer shall inform the Administrator of any change(s) implemented in its production processes, including quality control, which may reasonably be expected to affect the emissions of the vehicles or engines selected, between the time the manufacturer is notified of a test order and the time the manufacturer finishes selecting test vehicles or engines. In the case of heavy-duty engines, if the test engines are selected at a location where they do not have their operational and emission control systems installed, the test order will specify the manner and location for selection of components to complete assembly of the engines. The manufacturer shall assemble these components onto the test engines using normal assembly and quality control procedures as documented by the manufacturer.

(c) No quality control, testing, or assembly procedures will be used on the completed test engine or vehicle or any portion thereof, including parts and subassemblies, that has not been or will not be used during the production and assembly of all other engines or vehicles of that configuration, except, that the Administrator may approve a modification in the normal assembly procedures pursuant to paragraph (b) of this section.

* * * * *

31. Section 86.1008-84 of Subpart K is amended by revising paragraphs (a)(4) (i), (d), (f), and (g), and adding a new paragraph (a)(5) to read as follows:

§ 86.1008-84 Test procedures.

(a) * * *

(4) * * *

(i) The manufacturer may use test fuel meeting the specifications of paragraph (a)(1) or (b)(2) of § 86.113-79 for mileage accumulation. Otherwise, the manufacturer may use fuels other than those specified in this section only with advance approval of the Administrator.

* * * * *

(5) The Administrator may, on the basis of a written application by a manufacturer, prescribe minor test procedure variations from those set forth in paragraphs (a)(1) and (a)(2) of this section for any heavy-duty engine.

* * * * *

(d) The manufacturer shall not perform any maintenance on test vehicles or engines after selection for testing, nor shall the Administrator allow deletion of any test vehicle or engine from the test sequence, unless requested by the manufacturer and approved by the Administrator before any test vehicle or engine maintenance or deletion.

* * * * *

(f) If an engine or vehicle cannot complete the service or mileage accumulation or emission test because of a malfunction, the manufacturer may request that the Administrator authorize the repair of that engine or vehicle or its deletion from the test sequence.

(g) Whenever a manufacturer conducts testing pursuant to a test order issued under this subpart, the manufacturer shall notify the Administrator within one working day of receipt of the test order which test facility will be used to comply with the test order. If no test cells are available at a desired facility, the manufacturer must provide alternate testing capability satisfactory to the Administrator.

* * * * *

32. Section 86.1009–84 of Subpart K is amended by revising paragraphs (a), (d)(5) (v) and (vi), and (d)(6), and adding a new paragraph (d)(5)(vii) to read as follows:

§ 86.1009–84 Calculation and reporting of test results.

(a) Initial test results are calculated following the Federal Test Procedure specified in paragraph (a) of § 86.1008–84. Round these results, in accordance with ASTM E29–67, to the number of decimal places contained in the applicable emission standard expressed to one additional significant figure.

* * * * *

(d) * * *

(5) * * *

(v) Where an engine or vehicle was deleted from the test sequence by authorization of the Administrator, the reason for the deletion;

(vi) For all valid and invalid exhaust emission tests, carbon dioxide emission values for LDTs and brake-specific fuel consumption values for HDEs; and

(vii) Any other information the Administrator may request relevant to the determination as to whether the new heavy-duty engines or light-duty trucks being manufactured by the manufacturer do in fact conform with the regulations with respect to which the certificate of conformity was issued; and

(6) The following statement and endorsement:

This report is submitted pursuant to Sections 206 and 208 of the Clean Air Act. This Selective Enforcement Audit was conducted in complete conformance with all applicable regulations under 40 CFR Part 86 *et seq.*, and the conditions of the test order. No emission-related changes to production processes or quality control procedures for the vehicle or engine configuration tested have been made between receipt of the test order and conclusion of the audit. All data and information reported herein is, to the best of

(Company Name) ——————————

knowledge, true and accurate. I am aware of the penalties associated with violations of the Clean Air Act and the regulations thereunder.

——————————

(Authorized Company Representative)

33. Section 86.1010–84 of Subpart K is amended by revising paragraphs (c) and (d) to read as follows:

§ 86.1010–84 Compliance with acceptable quality level and passing and failing criteria for Selective Enforcement Audits.

* * * * *

(C) The manufacturer shall test heavy-duty engines or light-duty trucks comprising the test sample until a pass decision is reached for all pollutants, or a fail decision is reached for one pollutant. A pass decision is reached when the cumulative number of failed engines or vehicles, as defined in paragraph (b) of this section, for each pollutant is less than or equal to the pass decision number appropriate to the cumulative number of engines or vehicles tested. A fail decision is reached when the cumulative number of failed engines or vehicles for one or more pollutants is greater than or equal to the fail decision number appropriate to the cumulative number of engines or vehicles tested. The pass and fail decision numbers associated with the cumulative number of engines or vehicles tested are determined by using the tables in Appendix X of this part appropriate to the projected sales as made by the heavy-duty engine manufacturer in its Application for Certification or as made by the light-duty truck manufacturer in its report submitted under paragraph (a)(2) of § 600.207–80 of the Automobile Fuel Economy Regulations. In the tables in Appendix X to this part, sampling plan "stage" refers to the cumulative number of engines or vehicles tested. Once a pass or fail decision has been made for a particular pollutant, the number of engines or vehicles whose final deteriorated test results exceed the emission standard for that pollutant shall not be considered any further for the purposes of the audit.

(d) Passing or failing of an SEA occurs when the decision is made on the last engine or vehicle required to make a decision under paragraph (c) of this section.

* * * * *

34. Section 86.1012–84 of Subpart K is amended by revising paragraphs (i)(2) and (k) (1) and (2) to read as follows:

§ 86.1012–84 Suspension and revocation of certificates of conformity.

* * * * *

(i)* * *

(1)* * *

(2) Submit a written report to the Administrator, after successful completion of testing on the failed engine or vehicle, which contains a description of the remedy and test results for each engine or vehicle in addition to other information that may be required by this regulation.

* * * * *

(k)* * *

(1) If the Administrator determines that the proposed change(s) in engine or vehicle design may have an effect on emission performance deterioration or, in the case of light-duty trucks, on fuel economy, the Administrator shall notify the manufacturer, within five (5) working days after receipt of the report in paragraph (h) of this section, whether subsequent testing under this subpart will be sufficient to evaluate the proposed change or changes or whether additional testing will be required; and

(2) After implementing the change or changes intended to remedy the nonconformity, the manufacturer shall demonstrate that the modified engine or vehicle configuration does in fact conform with these regulations by testing engines or vehicles selected from normal production runs of that modified engine or vehicle configuration in accordance with the conditions specified in the initial test order. This testing will be considered by the Administrator to satisfy the testing requirements of § 86.078–32 or § 86.079–33 if the Administrator had so notified the manufacturer. If the subsequent audit results in passing of the audit at the level of the standards, the Administrator shall reissue or amend the certificate, as the case may be, to include that configuration: *Provided*, That the manufacturer has satisfied the testing requirements of paragraph (k)(1) of this section. If the subsequent audit is failed, a revocation remains in effect. Any design change approvals under this subpart are limited to the configuration affected by the test order.

* * * * *

35. Appendix X to Part 86 is amended by revising Table 2, to read as follows:

Appendix X—Sampling Plans for Selective Enforcement Auditing of Heavy-Duty Engines and Light-Duty Trucks

* * * * *

TABLE 2—SAMPLING PLAN FOR CODE LETTER "A"

[Sample inspection criteria]

Stage	Pass No.	Fail No.	Stage	Pass No.	Fail No.
1	([1])	([2])	16	6	11
2	([1])	([2])	17	7	12
3	([1])	([2])	18	7	12
4	0	([2])	19	8	13
5	0	([2])	20	8	13
6	1	6	21	9	14
7	1	7	22	10	14
8	2	7	23	10	15
9	2	8	24	11	15
10	3	8	25	11	16
11	3	8	26	12	16
12	4	9	27	12	17
13	5	10	28	13	17
14	5	10	29	14	17
15	6	11	30	16	17

[1] Test sample passing not permitted at this stage.
[2] Test sample failure not permitted at this stage.

* * * * *

36. Section 86.1229-85 of Subpart M is amended by revising paragraph (b)(2) to read as follows:

§ 86.1229-85 Dynamometer load determination.

* * * * *

(b) * * *

(2) The road load power used shall be determined from the following equation:

$RLP = 0.67(H - 0.75)W + 0.00125[LVW - (N \times DW)]$

Where:

RLP = Road Load Power at 50 mph (horsepower).
H = Vehicle overall maximum height (feet).
W = Vehicle overall maximum width (feet).
LVW = Loaded vehicle weight (pounds).
DW = Vehicle weight supported by the dynamometer (pounds).
N = Number of dynamometer rolls supporting a tire.

or the manufacturer may determine the road load power by an alternate procedure (including coastdown). Such alternate procedures shall exhibit good engineering judgement and shall be subject to review upon request by the Administrator. For vehicles which the manufacturer chooses to certify by the optional light-duty truck certification provision (§ 86.082-1(b)), the evaporative emission test procedure (and standard) will be that specified by the light-duty truck regulations.

37. Section 86.1230-85 of Subpart M is amended by revising the introductory text, to read as follows:

§ 86.1230-85 Test sequence; general requirements.

The test sequence shown in Figure M85-1 show the steps encountered as the test vehicle undergoes the test procedure. Ambient temperature levels encountered by the test vehicle throughout the test sequence shall not be less than 68°F (20°C) nor more than 86°F (30°C). The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.

* * * * *

38. Section 86.1233-85 of Subpart M is amended by revising paragraph (f) to read as follows:

§ 86.1233-85 Diurnal breathing loss test.

* * * * *

(f) Immediately prior to the diurnal breathing loss test, the fuel tank(s) of the prepared vehicle shall be drained and recharged with the specified test fuel as defined in § 86.1213-85 to the prescribed "tank fuel volume", as defined in § 86.078-2. The temperature of the fuel prior to its delivery to the fuel tank shall be between 45 and 60°F (7.2 and 16°C). The fuel tank cap(s) is not installed until the diurnal heat build begins.

* * * * *

39. Subpart N is revised to read as follows:

* * * * *

Subpart N—Emission Regulations for New Gasoline- and Diesel-Fueled Heavy-Duty Engines; Gaseous Exhaust Test Procedures

Sec.

Authority: Sections 202, 206, 207, 208, 301(a), Clean Air Act as amended 42 U.S.C. 7521, 7524, 7541, 7542, and 7601.

Subpart N—Emission Regulations for New Gasoline- and Diesel-Fueled Heavy-Duty Engines; Gaseous Exhaust Test Procedures

§ 86.1301-84 Scope; applicability.

This subpart contains gaseous emission test procedures for gasoline- and diesel-fueled heavy-duty engines. It applies to 1984 and later model years.

§ 86.1302-84 Definitions.

The definitions in § 86.084-2 apply to this subpart.

§ 86.1303-84 Abbreviations.

The abbreviations in § 86.084-3 apply to this subpart.

§ 86.1304-84 Section numbering; construction.

(a) The model year of initial applicability is indicated by the section number. The two digits following the hyphen designate the first model year for which a section is effective. A section remains effective until superseded.

Example: Section § 86.1311-84 applies to the 1984 and subsequent model years until superseded. If a section § 86.1311-88 is promulgated it would take effect beginning with the 1988 model year; § 86.1311-84 would apply to model years 1984 through 1987.

(b) A section reference without a model year suffix refers to the section applicable for the appropriate model year.

(c) Unless indicated, all provisions in this subpart apply to both gasoline- and diesel-fueled heavy-duty engines.

§ 86.1305-84 Introduction; structure of subpart.

(a) This subpart describes the equipment required and the procedures to follow in order to perform exhaust emission tests on gasoline- and diesel-fueled heavy-duty engines. Subpart A sets forth the testing requirements and test intervals necessary to comply with EPA certification procedures.

(b) Four topics are addressed in this subpart. Sections 86.1306-84 through 86.1315-84 set forth specifications and equipment requirements; §§ 86.1316-84 through 86.1326-84 discuss calibration methods and frequency; test procedures are listed in §§ 86.1327-84 through 86.1341-84; calculation formulae are found in § 86.1342-84; data requirements are found in § 86.1344-84.

§ 86.1306-84 Equipment required and specifications; overview.

This subpart contains procedures for exhaust emission tests on gasoline- or diesel-fueled heavy-duty engines.

Equipment required and specifications are as follows:

(a) *Exhaust emission tests.* All engines subject to this subpart are tested for exhaust emissions. Gasoline- and diesel-fueled engines are tested identically with the exception of hydrocarbon measurements; diesel-fueled engines require a heated hydrocarbon detector, § 86.1310–84. Necessary equipment and specifications appear in §§ 86.1308–84 through 86.1311–84.

(b) *Fuel, analytical gas, and engine cycle specifications.* Fuel specifications for exhaust emission testing are specified in § 86.1313–84. Analytical gases are specified in § 86.1314–84. The heavy-duty test cycles for use in exhaust testing are described in § 86.1333–84 and specified in Appendix I to this part.

§ 86.1307–84 [Reserved]

§ 86.1308–84 Dynamometer and engine equipment specifications.

(a) *Engine dynamometer.* The engine dynamometer system must be capable of controlling engine torque and rpm simultaneously over transient cycles. The transient torque and rpm schedules described in § 86.1333–84 and specified in Appendix I to this part ((f) (1) and (2)) must be followed within the accuracy requirements specified in § 86.1341–84. In addition to these general requirements, the dynamometer readout signals for speed and torque shall meet the following accuracy specifications:

(1) Engine speed readout shall be accurate to within ±2 percent of the absolute standard value, as defined in paragraph (d) of this section.

(2) Engine flywheel torque readout shall be accurate to either within ±3 percent of the NBS "true" value torque (as defined in paragraph (e) of this section), or the following accuracies:

(i) ±2.5 ft-lbs. of the NBS "true" value if the full scale value is 550 ft-lbs. or less.

(ii) ±5 ft-lbs. of the NBS "true" value if the full scale value is 1050 ft-lbs. or less.

(iii) ±10 ft-lbs. of the NBS "true" value if the full scale value is 1050 ft-lbs.

(3) *Option:* Internal dynamometer signals (i.e., armature current, etc.) may be used for torque measurement provided that it can be shown that the engine flywheel torque during the test cycle conforms to the accuracy specifications in paragraph (a) of this section. Such a measurement system must include compensation for increased or decreased flywheel torque due to the armature inertia during accelerations and decelerations in the test cycle.

(b) *Cycle verification equipment.* In order to verify that the test engine has followed the test cycle correctly, the dynamometer readout signals for speed and torque must be collected in a manner that allows a statistical correlation between the actual engine performance and the test cycle (See § 86.1341–84). Normally this collection process would involve conversion of analog dynamometer signals into digital values for storage in a computer. The conversion of dynamometer readout values into values (computer or other) that are used to evaluate the validity of engine performance in relation to the test cycle shall be performed in a manner such that:

(1) Speed values used for cycle evaluation are accurate to within ±2 percent of the dynamometer speed readout values.

(2) Engine flywheel torque values used for cycle evaluation are accurate to within ±2 percent of the dynamometer torque readout value.

(c) *Option:* For some systems it may be more convenient to combine the tolerances in paragraphs (a) and (b) of this section. This is permitted if the root mean square method (RMS) is used. The RMS values would then refer to accuracy in relationship to absolute standard or to NBS "true" values.

(1) Speed values used for cycle evaluation shall be accurate to within ±2.8 percent of the absolute standard values, as defined in paragraph (d) of this section.

(2) Engine flywheel torque values used for cycle evaluation shall be accurate to within ±3.6 percent of NBS "true" values, as determined in paragraph (e) of this section.

(d) *Speed calibration equipment.* A 60-tooth (or greater) wheel in combination with a common mode rejection frequency counter is considered an absolute standard for engine or dynamometer speed.

(e) *Torque calibration equipment.* Two techniques are allowed for torque calibration. Alternate techniques may be used if shown to yield equivalent accuracies. The NBS "true" value torque is defined as the torque calculated by taking the product of an NBS traceable weight or force and a sufficiently accurate horizontal lever arm distance, corrected for the hanging torque of the lever arm.

(1) The lever-arm dead-weight technique involves the placement of known weights at a known horizontal distance from the center of rotation of the torque measuring device. The equipment required is:

(i) *Calibration weights.* A minimum of six calibration weights for each range of torque measuring device used are required. The weights must be approximately equally spaced and each must be traceable to NBS weights. Laboratories located in foreign countries may certify calibration weights to local government bureau standards. Certification of weight by state government Bureau of Weights and Measures is acceptable. Effects of changes in gravitational constant at the test site may be accounted for if desired.

(ii) *Lever arm.* A lever arm with a minimum length of 24 inches is required. The horizontal distance from the centerline of the engine torque measurement device to the point of weight application shall be accurate to within ±0.10 inches. The arm must be balanced, or the hanging torque of the arm must be known to within ±0.1 ft-lbs.

(2) The transfer technique involves the calibration of a master load cell (i.e., dynamometer case load cell). This calibration can be done with known calibration weights at known horizontal distances, or by using a hydraulically actuated precalibrated master load cell. This calibration is then transferred to the flywheel torque measuring device. The technique involves the following steps:

(i) A master load cell shall be either precalibrated or be calibrated per paragraph (e)(1)(i) of this section with known weights traceable to NBS, and used with the lever arm(s) specified in paragraph (e)(2)(ii) of this section. The dynamometer should be either running or vibrated during this calibration to minimize static hysteresis.

(ii) A lever arm(s) with a minimum length of 24 inches is (are) required. The horizontal distances from the centerline of the master load cell, to the centerline of the dynamometer, and to the point of weight or force application shall be accurate to within ±0.10 inches. The arm(s) must be balanced or the net hanging torque of the arm(s) must be known to within ±0.1 ft.-lbs.

(iii) Transfer of calibration from the master load cell to the flywheel torque measuring device shall be performed with the dynamometer operating at a constant speed. The flywheel torque measurement device readout shall be calibrated to the master load cell torque readout at a minimum of six loads approximately equally spaced across the full useful ranges of both measurement devices. (Note that good engineering practice requires that both devices have approximately equal useful ranges of torque measurement.) The transfer calibration shall be performed in a manner such that the accuracy requirements of paragraph (a)(2) of this section for the flywheel torque measurement device readout be met or exceeded.

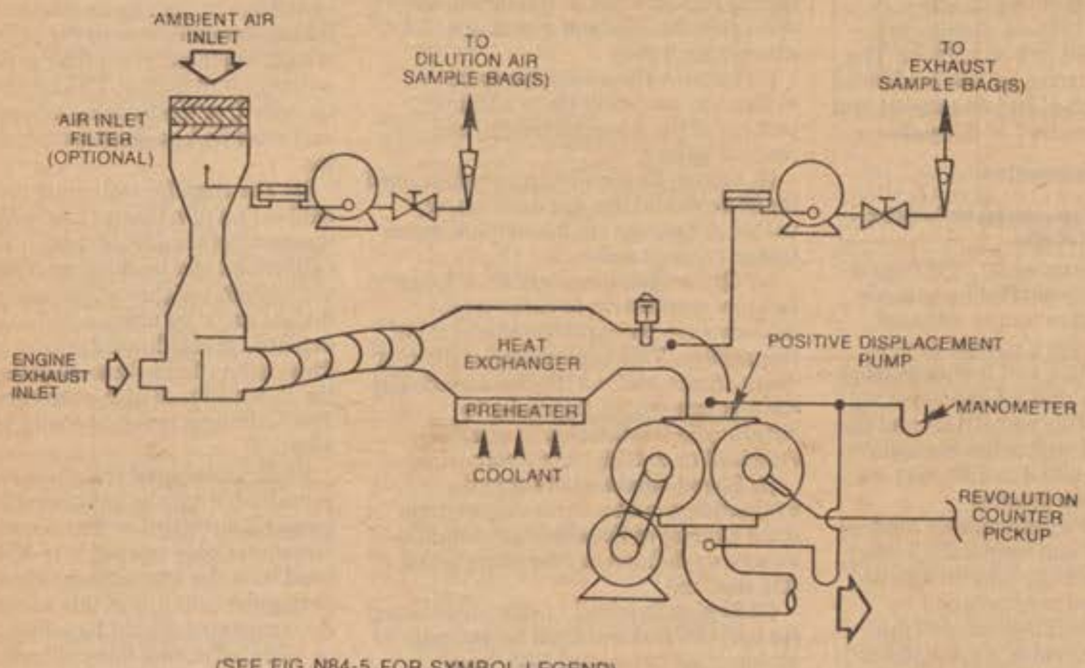
(3) Other techniques may be used if shown to yield equivalent accuracy.

(f) *Diesel engines only.* If direct measurement of mass fuel consumption is chosen as an option in lieu of dilute exhaust CO_2 measurement, the fuel measurement device shall be accurate to within ±2 percent of actual mass fuel flow.

§ 86.1309-84 Exhaust gas sampling system; gasoline-fueled engines.

(a)(1) *General.* The exhaust gas sampling system is designed to measure the true mass emissions of engine exhaust. In the CVS concept of measuring mass emissions, two conditions must be satisfied: The total volume of the mixture of exhaust and dilution air must be measured, and a continuously proportioned sample of volume must be collected for analysis. Mass emissions are determined from the sample concentration and total flow over the test period.

(2) *Positive displacement pump.* The positive displacement pump-constant volume sampler (PDP-CVS), Figure N84-1, meters total dilute exhaust flow at a constant temperature and pressure through the pump. The total volume is measured by counting the pump revolutions. The proportional sample is achieved by sampling at a constant flow rate.

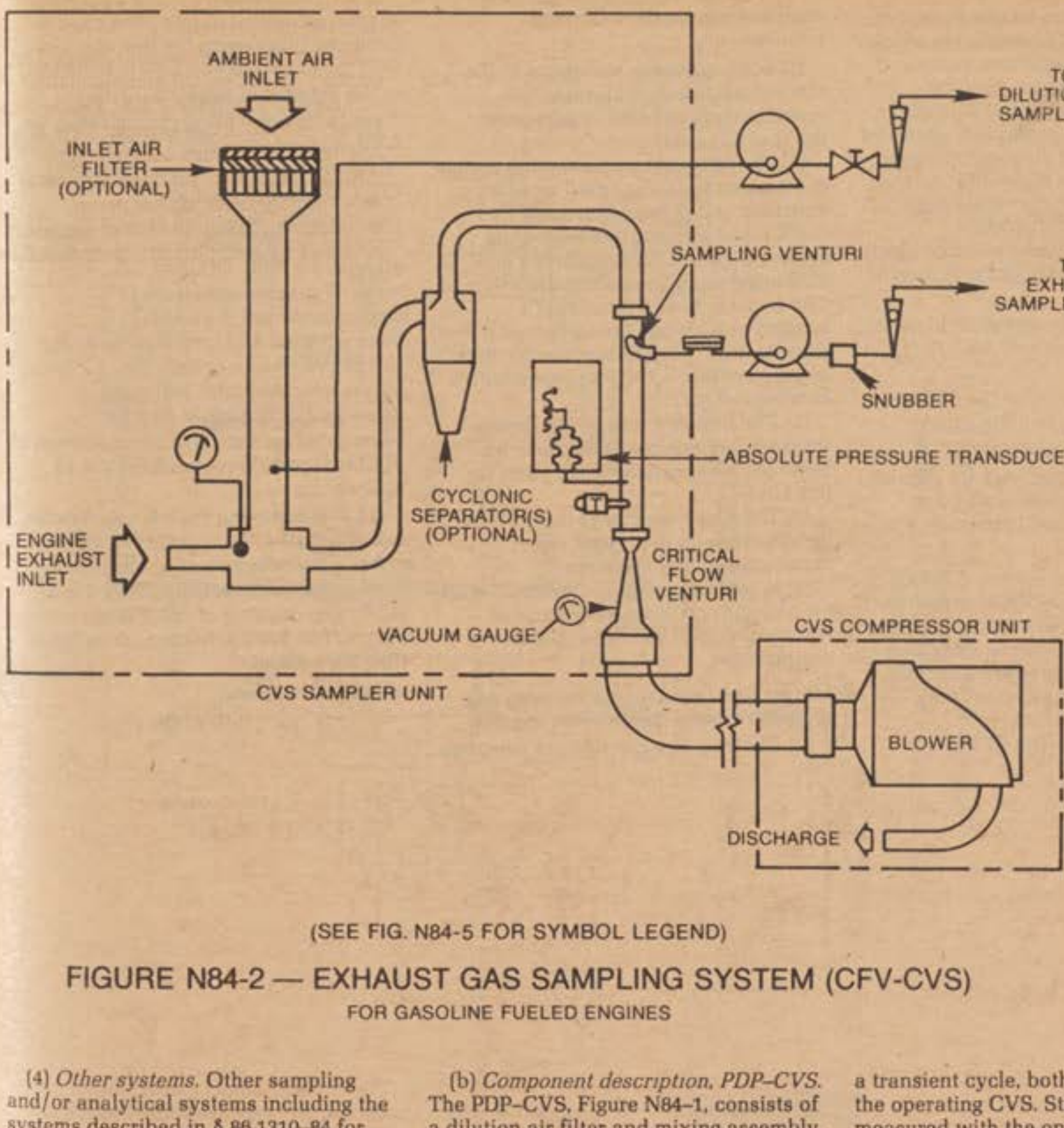


(SEE FIG. N84-5 FOR SYMBOL LEGEND)

FIGURE N84-1 — EXHAUST GAS SAMPLING SYSTEM PDP-CVS

FOR GASOLINE FUELED ENGINES

(3) *Critical flow venturi.* The operation of the critical flow venturi constant volume sampler (CFV-CVS), Figure N84-2, is based upon the principles of fluid dynamics associated with critical flow. The CFV system is commonly called a constant volume system (CVS) even though the flow varies. It would be more proper to call the critical flow venturi (CFV) system a constant proportion sampling system since proportional sampling throughout temperature excursions is maintained by use of a small CFV in the sample line. The variable mixture flow rate is maintained at choked flow, which is inversely proportional to the square root of the gas temperature, and is computed continuously. Since the pressure and temperature are the same at both venturi inlets, the sample volume is proportional to the total volume.



(SEE FIG. N84-5 FOR SYMBOL LEGEND)

FIGURE N84-2 — EXHAUST GAS SAMPLING SYSTEM (CFV-CVS)
FOR GASOLINE FUELED ENGINES

(4) *Other systems.* Other sampling and/or analytical systems including the systems described in § 86.1310-84 for diesel-fueled engines may be used if shown to yield equivalent results, and if approved in advance by the Administrator.

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

(b) *Component description, PDP-CVS.* The PDP-CVS, Figure N84-1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling system, and associated valves, pressure and temperature sensors. The PDP-CVS shall conform to the following requirements:

(1) Exhaust system backpressure must not be artificially lowered by the CVS or dilution air inlet system. Measurements to verify this should be made in the raw exhaust immediately upstream of the inlet to the CVS. (For diesels, this measurement should be made immediately upstream of the backpressure set device.) This verification requires the continuous measurement and comparison of raw exhaust static pressure observed during a transient cycle, both with and without the operating CVS. Static pressure measured with the operating CVS system shall remain within ±5 inches of water (1.2 kPa) of the static pressure measured without connection to the CVS, at identical moments in the test cycle. (Sampling systems capable of maintaining the static pressure to within ±1 inch of water (0.25 kPa) will be used by the Administrator if a written request substantiates the need for this closer tolerance.) This requirement is essentially a design specification for the CVS/dilution air inlet system, and should be performed as often as good engineering practice dictates (e.g., after installation of an uncharacterized CVS, addition of an unknown inlet restriction on the dilution air, etc.).

(2) The gas mixture temperature, measured at a point immediately ahead of the positive displacement pump and after the heat exchanger, shall be maintained within ±10°F (5.6°C) of the average operating temperature observed during the test. (The average operating temperature may be estimated from the average operating temperature from similar tests.) The temperature measuring system (sensors and readout) shall have an accuracy and precision of ±3.4°F (1.9°C).

(3) The pressure gauges shall have an accuracy and precision of ±3 mm Hg (0.4 kPa).

(4) The flow capacity of the CVS shall be large enough to eliminate water condensation in the system.

(5) Sample collection bags for dilution air and exhaust samples shall be of sufficient size so as not to impede sample flow.

(c) *Component description, CFV-CVS.* The CFV-CVS, Figure N84-2 consists of a dilution air filter (optional) and mixing assembly, optional cyclonic particulate separator(s), sampling venturi, critical flow venturi, sampling system, and assorted valves, pressure and temperature sensors. The CFV-CVS shall conform to the following requirements:

(1) Static pressure variations in the raw exhaust shall conform to the specifications detailed in paragraph (b)(1) of this section.

(2) The temperature measuring system (sensors and readout) shall have an accuracy and precision of ±3.4°F (1.9°C). The temperature measuring system used in a CVS without a heat exchanger shall have a response time of 1.50 seconds to 62.5 percent of a temperature change (as measured in hot silicone oil). There is no response time requirement for a CVS equipped with a heat exchanger.

(3) The pressure measuring system (sensors and readout) shall have an accuracy and precision of ±3 mm Hg (0.4 kPa).

(4) The flow capacity of the CVS shall be large enough to prevent water condensation in the system.

(5) Sample collection bags for dilution air and exhaust samples shall be of sufficient size so as not to impede sample flow.

§ 86.1310-84 Exhaust gas sampling and analytical system; diesel-fueled engines.

(a) *General.* The exhaust gas sampling system described in this paragraph is designed to measure the true mass of both gaseous and particulate emissions in the exhaust of heavy-duty diesel-fueled engines. This system utilizes the CVS concept (described in § 86.1309-84) of measuring mass emissions of NO_x, CO, CO_2, and particulate. A continuously integrated system is required for HC measurement, and is allowed for NO_x, CO, and CO_2. The mass of gaseous emissions is determined from the sample concentration and total flow over the test period. As an option, the measurement of total fuel mass consumed over a cycle may be substituted for the exhaust measurement of CO_2. General requirements are as follows:

(1) This sampling system requires the use of a PDP-CVS, or a CFV-CVS with either a heat exchanger or electronic flow compensation. Figure N84-3 is a schematic drawing of the PDP system. Figure N84-4 is a schematic drawing of the CFV system.

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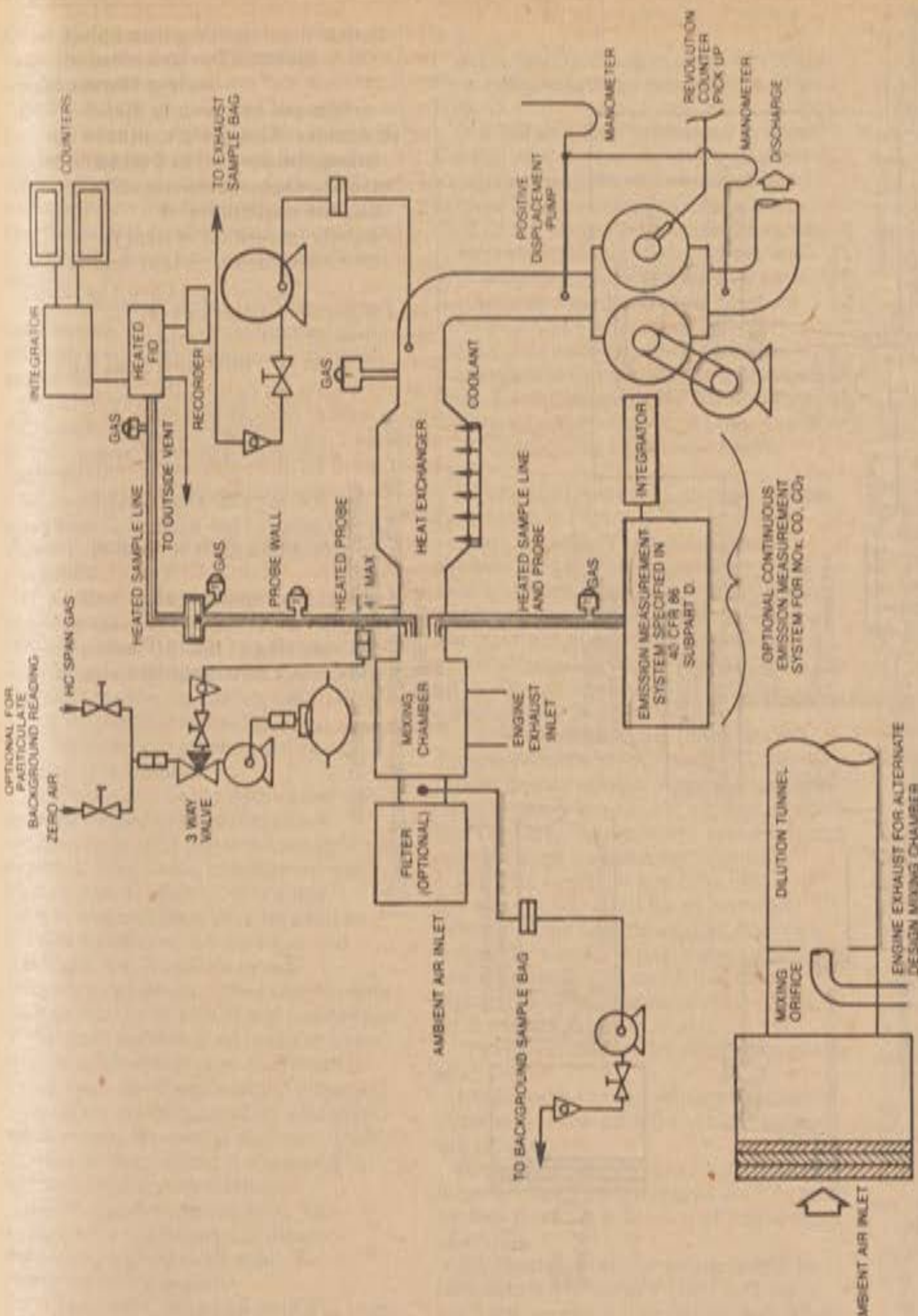


FIGURE N84-3
GASEOUS EMISSIONS SAMPLING SYSTEM (PDP-CVS)
(FOR DIESEL ENGINES ONLY)
(SEE FIGURE N84-5 FOR SYMBOL LEGEND)

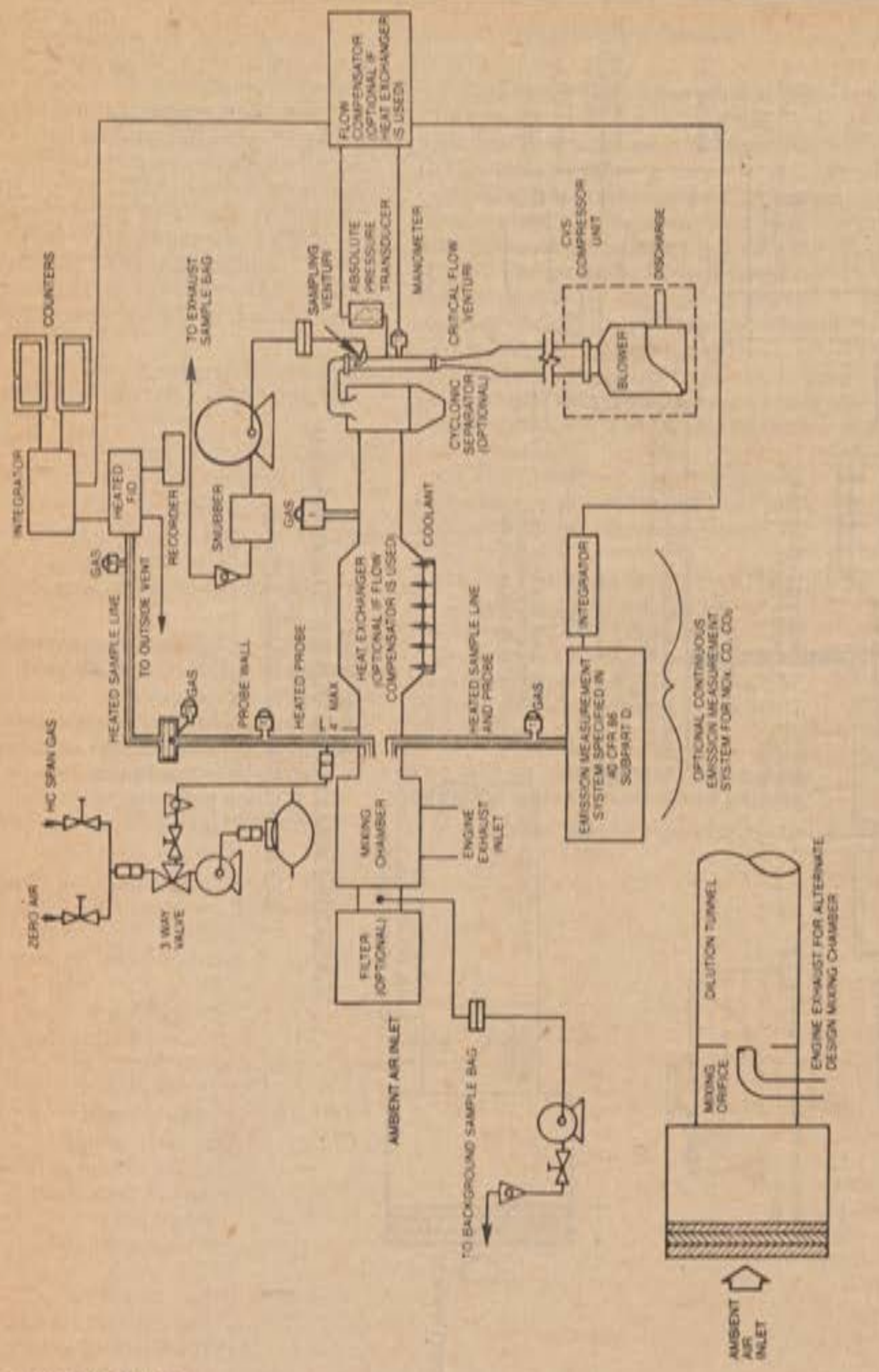


FIGURE N84-4
GASEOUS EMISSIONS SAMPLING SYSTEM (CFV-CVS)
(FOR DIESEL ENGINES ONLY)
(SEE FIGURE N84-5 FOR SYMBOL LEGEND)

BILLING CODE 6560-50-C

(2) The HC analytical system for diesel-fueled engines requires a heated flame ionization detector (HFID) and heated sample system.

(i) The HFID sample must be taken directly from the diluted exhaust stream through a heated probe and integrated continuously over the test cycle. Unless compensation for varying flow is made, the HFID must be used with a constant flow system to ensure a representative sample.

(ii) The heated probe shall be located downstream of a mixing chamber that provides a uniform sample distribution across the CVS duct.

(iii) The dilution tunnel similar to those used for diesel particulate sampling may be used as a mixing chamber.

(3) Bag sampling (§ 86.1309–84) and analytical (§ 86.1311–84) capabilities as shown in N84–3 (or Figure N84–4) are required.

(4) *Option.* Continuously integrated measurements of diluted NOx, CO, and CO_2 are permitted and can be used to determine compliance with applicable emission standards. Minimum requirements and technical specifications are given in paragraph (b)(5) of this section.

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

(6) Other sampling and/or analytical systems may be used if shown to yield equivalent results and if approved in advance by the Administrator.

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

(1) The PDP-CVS, shall conform to all of the requirements listed for the exhaust gas PDP-CVS (§ 86.1309–84(b)). The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream at a temperature of 375°F (191°C) or less at the sampling zone.

(2) The CFV-CVS shall conform to all of the requirements listed for the exhaust gas CFV-CVS (§ 86.1309–84(c)), along with the following requirements:

(i) The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream at a temperature of 375°F (191°C) or less at the sampling zone.

(ii) A heat exchanger or an electronic flow compensator is required (see Figure N84–4).

(iii) When a heat exchanger is used, the gas mixture temperature, measured at a point immediately ahead of the critical flow venturi, shall be within ±20 °F (11°C) of the average operating temperature observed during the test. The temperature measuring system (sensors and readout) shall have an accuracy and precision of ±3.4°F (1.9°C). For systems utilizing a flow compensator to maintain proportional flow, the requirement for maintaining constant temperature is not necessary.

(3) Continuous HC measurement system.

(i) The continuous HC sample system (as shown in Figure N84–3 or N84–4) uses an "overflow" zero and span system. In this type of system, excess zero or span gas spills out of the probe when zero and span checks of the analyzer are made. The "overflow" system may also be used to calibrate the HC analyzer per § 86.1321–84(b), although this is not required.

(ii) No other analyzers may draw a sample from the continuous HC sample probe, line or system, unless a common sample pump is used for all analyzers and the single sample line system design reflects good engineering practice.

(iii) The overflow gas flow rate into the sample line shall be at least 105 percent of the sample system flow rate.

(iv) The overflow gases shall enter the heated sample line no farther than 4 inches from the outside surface of the CVS duct or dilution tunnel.

(v) The continuous hydrocarbon probe shall be:

(A) Installed in the dilute stream at a point where the dilution air and exhaust are well mixed.

(B) Sufficiently distant (radially) from other probes and the tunnel wall so as to be free from the influence of any wakes of eddies.

(C) Heated over the entire length to maintain a 375° ±20°F (191°±11°C) *wall* temperature. (Insulation and other techniques may be used to maintain the temperature.)

(D) 0.19 in (0.48 cm) minimum inside diameter.

(E) Free from cold spots (i.e., free from spots where the probe wall temperature is less than 355°F (180°C)).

(vi) The dilute exhaust gas flowing in the total hydrocarbon sample system shall be:

(A) At 375° ±10°F (191°±6°C) immediately before the heated filter. This *gas* temperature will be determined by a temperature sensor located immediately upstream of the filter. The sensor and its readout shall have an accuracy and precision of ±3.4°F (1.9°C).

(B) At 375° ±10° F (191°±6°C) immediately before the HFID. This *gas* temperature will be determined by a temperature sensor located at the exit of the heated sample line. The sensor and its readout shall have an accuracy and precision of ±3.4°F (1.9°C).

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

(A) 1.5 seconds from an instantaneous step change at the port entrance to the analyzer to within 95 percent of the step change.

(B) 20.0 seconds from an instantaneous step change at the entrance to the sample probe or overflow span gas port to within 95 percent of the step change. Analysis system response time shall be coordinated with CVS flow fluctuations and sampling time/test cycle offsets if necessary.

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

(4) Mixing chamber.

(i) The mixing chamber shall be designed to fully mix the dilution air and exhaust gas while minimizing HC hang up in the system between the entrance of the exhaust gas into the system and the HC sample probe.

(ii) A dilution tunnel similar to those used for diesel particulate testing may be used as a mixing chamber (See figures N84–3 and N84–4). It shall conform to the following criteria:

(A) The tunnel shall be of small enough diameter to cause turbulent flow (Reynolds Number greater than 4000) and of sufficient length to cause complete mixing of the exhaust and dilution air.

(B) The engine exhaust shall be directed downstream at the point where it is introduced into the dilution tunnel;

(C) The tunnel shall be at least 18.0 inches (45.7 cm) in diameter;

(D) The tunnel shall be constructed of electrically conductive material which does not react with the exhaust components, and electrically grounded;

(E) The temperature of the diluted exhaust stream inside of the dilution tunnel shall be sufficient to prevent water condensation;

(F) The continuous hydrocarbon probe shall be installed in the 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 gas enters the dilution tunnel);

(G) All other factors of the continuous HC measurement system (paragraph (b)(3) of this section) shall meet the requirements specified in this subpart for diesel HC measurement systems.

(5) Optional continuously integrated NO_x, CO, and CO_2 measurement system.

(i) The sample probe shall:

(A) Be in the same plane as the continuous HC probe, but shall be sufficiently distant (radially) from other probes and the tunnel wall so as to be free from the influences of any wakes or eddies.

(B) Be heated and insulated over the entire length, to prevent water condensation, to a minimum temperature of 55°C (131°F). Sample *gas* temperature immediately before the first filter in the system shall be at least 55°C (131°F).

(ii) The continuous NO_x, CO, or CO_2 sampling and analysis system shall conform to the specifications of 40 CFR Part 86, Subpart D, with the following exceptions and revisions:

(A) The system components required to be heated by Subpart D need only be heated to prevent water condensation; the minimum component temperature shall be 55°C (131°F).

(B) The system response defined in § 86.329–79 shall be no greater than 20.0 seconds. Analysis system response time shall be coordinated with CVS flow fluctuations and sampling time/test cycle offsets if necessary.

(C) Alternative NO_x measurement techniques outlined in § 86.346–79 are not permitted for NO_x measurement in this Subpart.

(D) All analytical gases shall conform to the specifications of § 86.1314–84.

(E) Any range on a linear analyzer below 155 ppm shall have and use a calibration curve conforming to § 86.330–79.

(F) The measurement accuracy requirements specified in § 86.338–79 are superseded by those specified in § 86.1338–84.

(iii) The chart deflections of analyzers with non-linear calibration curves shall be converted to concentration values by the calibration curve(s) specified in Subpart D (§ 86.330–79) before flow correction (if used) and subsequent integration takes place.

§ 86.1311-84 Exhaust gas analytical system; CVS bag sample.

(a) *Schematic drawings.* Figure N84–5 is a schematic drawing of the exhaust gas analytical system used for analyzing CVS bag samples from either gasoline- or diesel-fueled engines. Since various configurations can produce accurate results, exact conformance with the drawing is not required. Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of the component systems. Other components such as snubbers, which are not needed to maintain accuracy in some systems, may be excluded if their exclusion is based upon good engineering judgment.

(b) *Major component description.* The analytical system, Figure N84–5, consists of a flame ionization detector (FID) for the measurement of hydrocarbons, nondispersive infrared analyzers (NDIR) for the measurement of carbon monoxide and carbon dioxide and a chemiluminescence analyzer (CL) for the measurement of oxides of nitrogen.

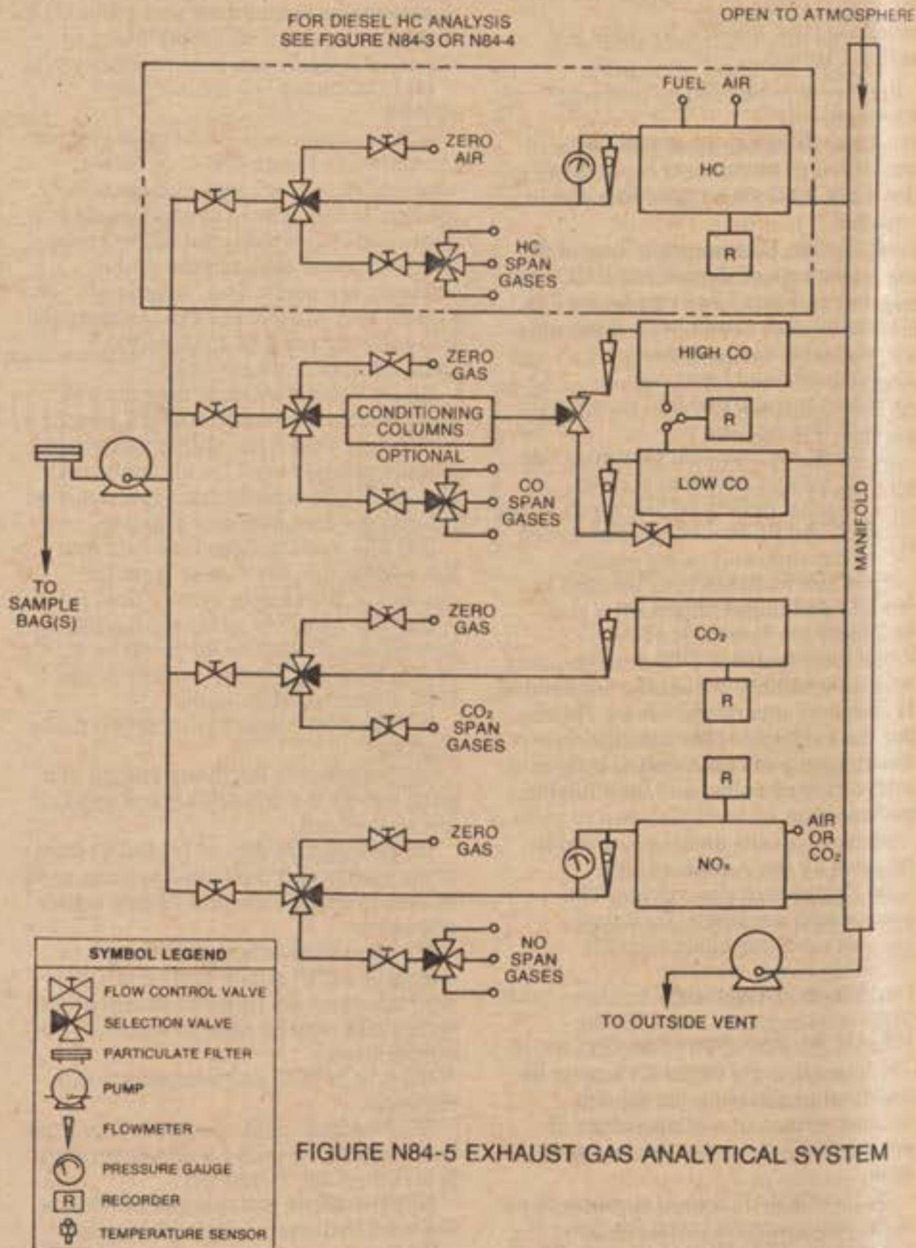


FIGURE N84-5 EXHAUST GAS ANALYTICAL SYSTEM

The exhaust gas analytical system shall conform to the following requirements:

(1) The CL requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator.

(2) The carbon monoxide (NDIR) analyzer may require a sample conditioning column containing $CaSO_4$ or dessicating silica gel to remove water vapor, and containing ascarite to remove carbon dioxide from the CO analysis stream.

(i) If CO instruments are used which are essentially free of CO_2 and water vapor interference, the use of the conditioning column may be deleted. (See §§ 86.1322–84 and 86.1342–84.)

(ii) A CO instrument will be considered to be essentially free of CO_2 and water vapor interference if its response to a mixture of 3 percent CO_2 in N_2 which has been bubbled through water at room temperature produces an equivalent CO response, as measured on the most sensitive CO range, which is less than 1 percent of full scale CO concentration on ranges above 300 ppm full scale or less than 3 ppm on ranges below 300 ppm full scale. (See § 86.1322–84.)

(c) *Alternate analytical systems.* Analysis systems meeting the specifications of 40 CFR Part 86 Subpart D may be used for testing required under this subpart, with the exception of §§ 86.346–79 and 86.347–79, provided that the Subpart D systems meet the specifications of this subpart. Heated analyzers may be used in their heated configuration.

(d) *Other analyzers and equipment.* Other types of analyzers and equipment may be used if shown to yield equivalent results and if approved in advance by the Administrator.

§ 86.1312–84 [Reserved]

§ 86.1313–84 Fuel specifications.

(a) *Gasoline.* (1) Gasoline having the specifications listed in Table N84–1 will be used by the Administrator in exhaust emission testing. Gasoline having these specifications or substantially equivalent specifications approved by the Administrator, shall be used by the manufacturer in exhaust emission testing, except that the lead and octane specifications do not apply.

TABLE N84-1

Item	ASTM	Leaded	Unleaded
Octane, research, minimum.	D2699	98	93
Sensitivity (minimum)		7.5	7.5
Pb. (organic), gm/U.S. gallon.		[1] 1.4	0.00–0.05
Distillation range:			
IBP, °F	D86	75–95	75–95
10 percent point, °F	D86	120–135	120–135
50 percent point, °F	D86	200–230	200–230
90 percent point, °F	D86	300–325	300–325
EP, °F (maximum)	D86	415	415
Sulphur, weight percent, (max).	D1266	0.10	0.10
Phosphorus, gm/U.S. gallon (max).		0.01	0.005
RVP, psi	D323	8.7–9.2	8.7–9.2
Hydrocarbon composition:			
Olefins, percent, (max).	D1319	10	10
Aeromatics, percent (max).	D1319	35	35
Saturates	D1319	([2])	([2])

[1] Minimum.
[2] Remainder.

(2) Gasoline representative of commercial gasoline which is generally available through retail outlets shall be used in service accumulation. For leaded fuel the minimum lead content shall be equal to the average lead content found in regular leaded gasoline in the fuel survey prescribed by the Administrator. Where the Administrator determines that vehicles represented by a test vehicle will be operated using gasoline of different lead content than that prescribed in this paragraph, he may consent in writing to use of gasoline with a different lead content. The octane rating of the gasoline used shall be not higher than 1.0 Research octane number above the minimum recommended by the manufacturer and have a minimum sensitivity of 7.5 octane numbers for unleaded fuel and 7.0 octane numbers for leaded fuel, where sensitivity is defined as the Research number minus the Motor octane number. The Reid Vapor Pressure of the gasoline used shall be characteristic of the motor fuel used during the season in which the service accumulation takes place.

(3) The specification range of the gasoline to be used under paragraph (a)(2) of this section shall be reported in accordance with § 86.084–21(b)(3).

(b) *Diesel fuel.* (1) The diesel fuels employed for testing shall be clean an bright, with pour and cloud points adequate for operability. The diesel fuel may contain nonmetallic additives as follows: Cetane improver, metal deactivator, antioxidant, dehazer, antirust, pour depressant, dye, and dispersant.

(2) Diesel fuel meeting the specifications in Table N84–2, or substantially equivalent specifications approved by the Administrator, shall be used in exhaust emissions testing. The grade of diesel fuel recommended by the engine manufacturer commercially designated as "Type 1–D" or "Type 2–D" grade diesel fuel shall be used.

TABLE N84-2

Item	ASTM	Type 1-D	Type 2-D
Cetane	D613	48–54	42–50
Distillation range:			
IBP °F	D86	330–390	340–400
10 percent point, °F	D86	370–430	400–460
50 percent point, °F	D86	410–480	470–540
90 percent point, °F	D86	460–520	550–610
EP, °F	D86	500–560	580–660
Gravity, API	D287	40–44	33–37
Total Surfur, percent	D129 or D2622.	0.05–0.20	0.2–0.5
Hydrocarbon composition:			
Aromatics, percent	D1319	[1] 8	[1] 27
Parafins, Naphthenes, Olefins.	D1319	([2])	([2])
Flashpoint, °F (minimum).	D93	120	130
Viscosity, Centistokes	D445	1.6–2.0	2.0–3.2

[1] Minimum.
[2] Remainder.

(3) Diesel fuel meeting the specifications in Table N84–3, or substantially equivalent specifications approved by the Administrator, shall be used in service accumulation. The grade of diesel fuel recommended by the engine manufacturer, commercially designated as "Type 1–D" or "Type 2–D" grade diesel fuel shall be used:

TABLE N84-3

Item	ASTM	Type 1-D	Type 2-D
Cetane	D613	42–56	30–58
Distillation range:			
90 percent point, °F	D86	440–530	540–630
Gravity API	D287	39–45	30–42
Total sulfur, percent (minimum).	D129 or D2622.	0.05	0.2
Flashpoint, °F (minimum).	D93	120	130
Viscosity, centistokes	D455	1.2–2.2	1.5–4.5

(4) Other petroleum distillate fuels may be used for testing and service accumulation provided that:

(i) They are commercially available;

(ii) Information, acceptable to the Administrator, is provided to show that only the designated fuel would be used in customer service;

(iii) Use of a fuel listed under paragraphs (b)(2) and (b)(3) of this section would have a detrimental effect on emissions or durability;

(iv) Written approval from the Administrator of the fuel specifications is provided prior to the start of testing.

(5) The specification range of the fuels to be used under paragraphs (b)(2), (b)(3), and (b)(4) of this section shall be reported in accordance with § 86.084–21(b)(3).

§ 86.1314–84 Analytical gases.

(a) Gases for the CO and CO_2 analyzers shall be single blends of CO and CO_2, respectively, using nitrogen as the diluent.

(b) Gases for the hydrocarbon analyzer shall be single blends of propane using air as the diluent.

(c) Gases for the NO_x analyzer shall be single blends of NO named as NO_x with a maximum NO_2 concentration of 5 percent of the nominal value using nitrogen as the diluent.

(d) Fuel for the FID shall a blend of 40 ±2 percent hydrogen with the balance being helium. The mixture shall contain less than 1 ppm equivalent carbon response; 98 to 100 percent hydrogen fuel may be used with advance approval of the Administrator.

(e) The allowable zero gas (air or nitrogen) impurity concentrations shall not exceed 1 ppm equivalent carbon response, 1 ppm carbon monoxide, 0.04 percent (400 ppm) carbon dioxide and 0.1 ppm nitric oxide.

(f)(1) "Zero-grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18 and 21 mole percent.

(2) Calibration gases shall be accurate to within ±1 percent of NBS gas standards, or other gas standards which have been approved by the Administrator.

(3) Span gases shall be accurate to within ±2 percent of NBS gas standards, or other gas standards which have been approved by the Administrator.

(g) The use of precision blending devices (gas dividers) to obtain the required calibration gas concentrations is acceptable, provided that the blended gases are accurate to within ±1.5 percent of NBS gas standards, or other gas standards which have been approved by the Administrator. This accuracy implies that primary gases used for blending must be "named" to an accuracy of at least ±1 percent, traceable to NBS or other approved gas standards.

§ 86.1315-84 [Reserved]

§ 86.1316-84 Calibrations; frequency and overview.

(a) Calibrations shall be performed as specified in §§ 86.1318-84 through 86.1326-84.

(b) At least monthly or after any maintenance which could alter calibration, the following calibrations and checks shall be performed:

(1) Calibrate the hydrocarbon analyzer, carbon dioxide analyzer, carbon monoxide analyzer, and oxides of nitrogen analyzer.

(2) Calibrate the engine dynamometer flywheel torque and speed measurement transducers, and calculate the feedback signals to the cycle verification equipment.

(c) At least weekly or after any maintenance which could alter calibration, the following checks shall be performed:

(1) Check the oxides of nitrogen converter efficiency, and;

(2) Perform a CVS system verification.

(3) Check the shaft torque feedback signal at steady-state conditions by comparing shaft torque feedback to dynamometer beam load.

(d) The CVS positive displacement pump or critical flow venturi shall be calibrated following initial installation, major maintenance or as necessary when indicated by the CVS system verification (described in § 86.1319-84).

(e) Sample conditioning columns, if used in the CO analyzer train, should be checked at a frequency consistent with observed column life or when the indicator of the column packing begins to show deterioration.

§ 86.1317-84 [Reserved]

§ 86.1318-84 Engine dynamometer system calibrations.

(a) The engine flywheel torque and engine speed measurement transducers shall be calibrated at least once each month with the calibration equipment described in § 86.1308-84.

(b) The engine flywheel torque feedback signals to the cycle verification equipment shall be electronically checked before each test, and adjusted as necessary.

(c) Other engine dynamometer system calibrations shall be performed as dictated by good engineering practice.

(d) When calibrating the engine flywheel torque transducer, any lever arm used to convert a weight or a force through a distance into a torque shall be used in a horizontal position (±5 degrees).

(e) Calibrated resistors may not be used for engine flywheel torque transducer calibration, but may be used to span the transducer prior to engine testing.

§ 86.1319-84 CVS calibration.

(a) The CVS is calibrated using an accurate flowmeter and restrictor valve. The flowmeter calibration shall be traceable to the NBS, and will serve as the reference value (NBS "true" value) for the CVS calibration. (Note: In no case should an upstream screen or other restriction which can affect the flow be used ahead of the flowmeter unless calibrated throughout the flow range with such a device.) The CVS calibration procedures are designed for use of a "metering venturi" type flowmeter. Large radius or ASME flow nozzles are considered equivalent if traceable to NBS measurements. Other measurement systems may be used if shown to be equivalent under the test conditions in this action and traceable to NBS measurements. Measurements of the various flowmeter parameters are recorded and related to flow through the CVS. Procedures used by EPA for both PDP- and CFV-CVS's are outlined below. Other procedures yielding equivalent results may be used if approved in advance by the Administrator.

(b) After the calibration curve has been obtained, verification of the entire system may be performed by injecting a known mass of gas into the system and comparing the mass indicated by the system to the true mass injected. An indicated error does not necessarily mean that the calibration is wrong, since other factors can influence the accuracy of the system (e.g. analyzer calibration, leaks, or HC hangup). A verification procedure is found in paragraph (e) of this section.

(c) *PDP calibration.* (1) The following calibration procedure outlines the equipment, the test configuration, and the various parameters which must be measured to establish the flow rate of the CVS pump.

(i) All the parameters related to the pump are simultaneously measured with the parameters related to a flowmeter which is connected in series with the pump.

(ii) The calculated flow rate, $ft^3/min.$, (at pump inlet absolute pressure and temperature) can then be plotted versus a correlation function which is the value of a specific combination of pump parameters.

(iii) The linear equation which relates the pump flow and the correlation function is then determined.

(iv) In the event that a CVS has a multiple speed drive, a calibration for each range used must be performed.

(2) This calibration procedure is based on the measurement of the absolute values of the pump and flowmeter parameters that relate the flow rate at each point. Two conditions must be maintained to assure the accuracy and integrity of the calibration curve:

(i) The temperature stability must be maintained during calibration. (Flowmeters are sensitive to inlet temperature oscillations; this can cause the data points to be scattered. Gradual changes in temperature are acceptable as long as they occur over a period of several minutes.)

(ii) All connections and ducting between the flowmeter and the CVS pump must be absolutely void of leakage.

(3) During an exhaust emission test the measurement of these same pump parameters enables the user to calculate the flow rate from the calibration equation.

(4) Connect a system as shown in Figure N84–6. Although particular types of equipment are shown, other configurations that yield equivalent results may be used if approved in advance by the Administrator. For the system indicated, the following measurements and accuracies are required:

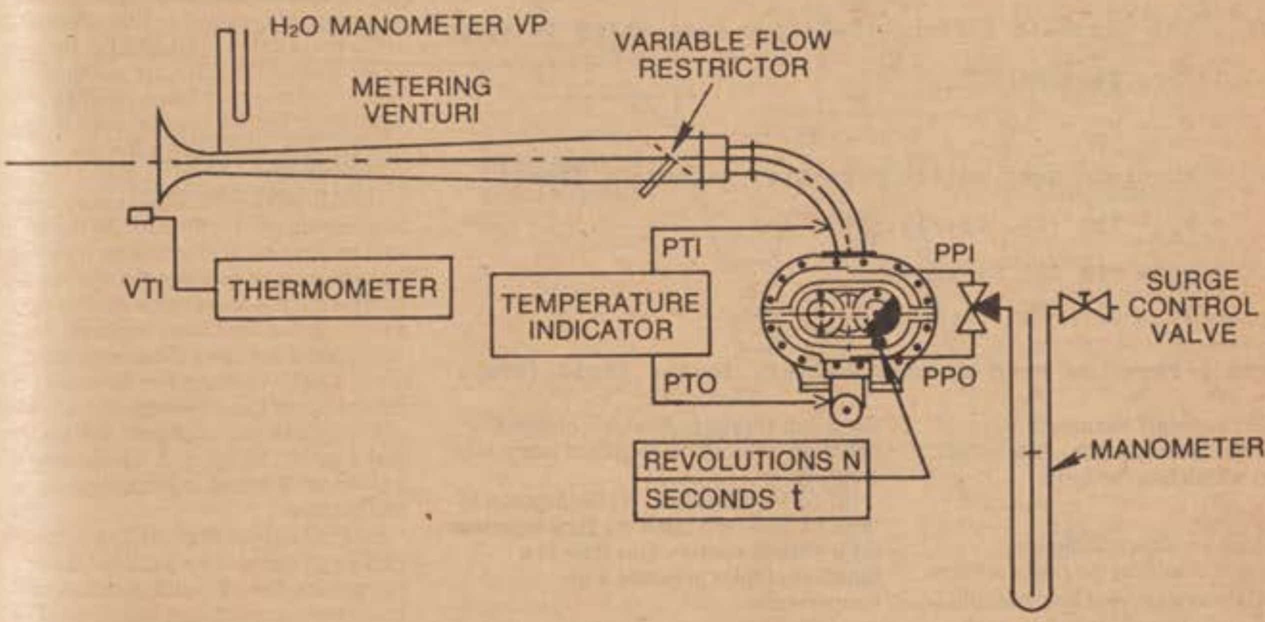


FIGURE N84-6 — PDP-CVS CALIBRATION CONFIGURATION

CALIBRATION DATA MEASUREMENTS

Parameter	Symbol	Units	Sensor-readout tolerances
Barometric pressure (corrected)	P_B	In. Hg (kPa)	±.10 in. Hg (±.340 kPa).
Ambient temperature	T_A	°F (°C)	±.5°F (±.28°C).
Air temperature into metering venturi	ETI	°F (°C)	±2.0°F (±1.11°C).
Pressure drop between the inlet and throat of metering venturi.	EDP	In. H2O (kPa)	±.05 in. H_2O (±.012 kPa).
Air flow	Q_s	Ft ^{3}/min. (m^3/min.)	±.5% of NBS "true" value.
Air temperature at CVS pump inlet	PTI	°F (°C)	±2.0 °F (±1.11°C).
Pressure depression at CVS pump inlet	PPI	In. Fluid (kPa)	±.13 in. Fluid (±.055 kPa).
Specific gravity of manometer fluid (1.75 oil)	Sp. G.		
Pressure head at CVS pump outlet	PPO	In. Fluid (kPa)	±.13 in. Fluid (±.055 kPa).
Air Temperature at CVS pump outlet (optional)	PTO	°F (°C)	±2.0°F (±1.11°C).
Pump revolutions during test period	N	Revs	±1 Rev.
Elapsed time for test period	t	s	±.5 s.

(5) After the system has been connected as shown in Figure N84–6, set the variable restrictor in the wide open position and run the CVS pump for 20 minutes. Record the calibration data.

(6) Reset the restrictor valve to a more restricted condition in an increment of pump inlet depression that will yield a minimum of six data points for the total calibration. Allow the system to stabilize for 3 minutes and repeat the data acquisition.

(7) *Data analysis:*

(i) The air flow rate, Q_s, at each test point is calculated in standard cubic feet per minute (68°F, 29.92"Hg) from the flowmeter data using the manufacturer's prescribed method.

(ii) The air flow rate is then converted to pump flow, V_o, in cubic feet per revolution at absolute pump inlet temperature and pressure:

$$V_o = \frac{Q_s}{n} \times \frac{T_p}{528} \times \frac{29.92}{P_p}$$

Where:

V_o = Pump flow, ft^3/revolution (m^3/revolution) at T_p, P_p

Q_s = Meter air flow rate in standard cubic feet per minute, standard conditions are 68°F, 29.92 inches Hg (20°C, 101.3 kPa)

n = Pump speed in revolutions per minute

T_p = Pump inlet temperature °R(°K)

= PTI + 460 (°R), or

= PTI + 273 (°K)

P_p = Absolute pump inlet pressure, inches Hg (kPa)

= P_B − PPI (Sp. Gr./13.5955) and

= P_B − PPI for SI units

Where:

P_B = barometric pressure, inches Hg (kPa)

PPI = Pump inlet depression, inches fluid (kPa)

Sp. Gr. = Specific gravity of manometer fluid

(iii) The correlation function at each test point is then calculated from the calibration data.

$$X_o = \frac{1}{n}\sqrt{\frac{\Delta P}{P_e}}$$

Where:

X_o = correlation function.

ΔP = The pressure differential from pump inlet to pump outlet, inches Hg (kPa).

$= P_e - P_p$

P_e = Absolute pump outlet pressure, inches Hg (kPa)

$= P_B$ + PPO (Sp. Gr./13.5955) and

$= P_B$ + PPO for SI units

Where:

PPO = Pressure head at pump outlet, inches fluid (kPa).

(iv) A linear least square fit is performed to generate the calibration equation which has the form:

$V_o = D_o - M(X_o)$

D_o and M are the slope and intercept constants describing the regression line.

(8) A CVS system that has multiple speeds should be calibrated on each speed used. The calibration curves generated for the ranges will be approximately parallel and the intercept values, D_o, will increase as the pump flow range decreases.

(9) If the calibration has been performed carefully, the calculated values from the equation will be within ±0.50 percent of the measured value of V_o. Values of M will vary from one pump to another, but values of D_o for pumps of the same make, model and range should agree within ±3 percent of each other. Particulate influx overtime will cause the pump slip to decrease, as reflected by lower values for M. Calibrations should be performed at pump start-up and after major maintenance to assure the stability of the pump slip rate. Analysis of mass injection data will also reflect pump slip stability.

(d) *CFV calibration.* (1) Calibration of the CFV is based upon the flow equation for a critical venturi. Gas flow is a function of inlet pressure and temperature:

$$Q_s = \frac{K_v P}{\sqrt{T}}$$

Where:

Q_s = flow,

K_v = calibration coefficient,

P = absolute pressure,

T = absolute temperature.

The calibration procedure described in paragraph (d)(3) of this section establishes the value of the calibration coefficient at measured values of pressure, temperature and air flow.

(2) The manufacturer's recommended procedure shall be followed for calibrating electronic portions of the CFV.

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

CALIBRATION DATA MEASUREMENTS

Parameter	Sym	Units	Tolerances
Barometric Pressure (corrected)	P_B	in. Hg (kPa)	±.10 in. Hg (±.34 kPa).
Air temperature, into flowmeter	ETI	°F (°C)	±.5°F (±.28°C).
Pressure drop between the inlet and throat of metering venturi.	EDP	in. H_2O (kPa)	±.05 in. H_2O (±.012 kPa).
Air flow	Q_s	ft^3/min. (m^3/min.)	±.5% of NBS "true" value.
CFV inlet depression	PPI	in. fluid (kPa)	±.13 in. fluid (±.055 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		

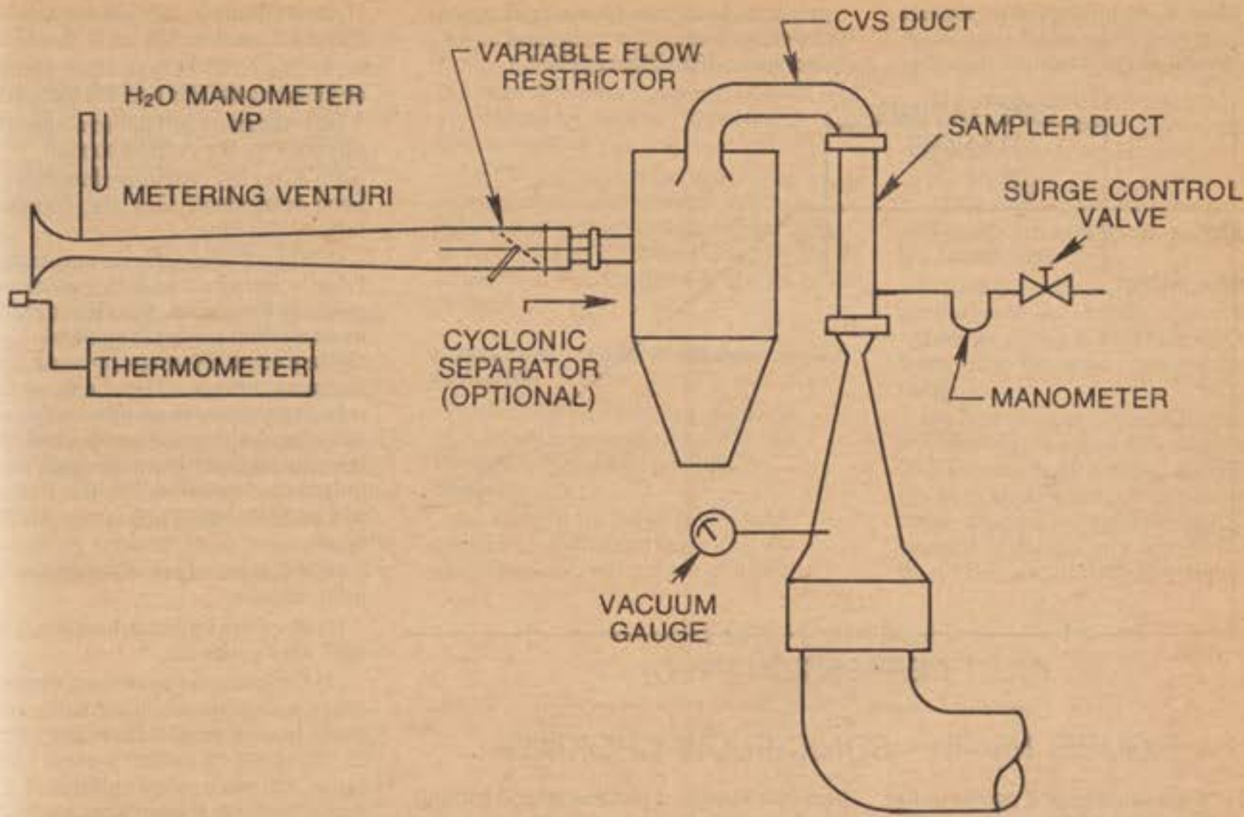


FIGURE N84-7 — CFV-CVS CALIBRATION CONFIGURATION

(4) Set up equipment as shown in Figure N84-7 and eliminate leaks. (Leaks between the flow measuring devices and the critical flow venturi will seriously affect the accuracy of the calibration.)

(5) Set the variable flow restrictor to the open position, start the blower, and allow the system to stabilize. Record data from all instruments.

(6) Vary the flow restrictor and make at least eight readings across the critical flow range of the venturi.

(7) *Data analysis.* The data recorded during the calibration are to be used in the following calculations:

(i) The air flow rate, Qs, at each test point is calculated in standard cubic feet per minute from the flow meter data using the manufacturer's prescribed method.

(ii) Calculate values of the calibration coefficient for each test point:

$$K_v = \frac{Q_s \sqrt{T_v}}{P_v}$$

Where:

Q_s = Flow rate in standard cubic feet per minute, at the standard conditions of 68°F, 29.92 inches Hg (20°C, 101.3 kPa);

T_v = Temperature at venturi inlet, °R(°K);

P_v = Pressure at venturi inlet, in Hg (kPa);

= P_B - PPI (Sp. Gr./13.5955), and

= P_B - PPI for SI units.

Where:

PPI = Venturi inlet pressure depression, inches fluid (kPa).

Sp. Gr. = Specific gravity of manometer fluid.

(iii) Plot K_v as a function of venturi inlet pressure. For choked flow, K_v will have a relatively constant value. As pressure decreases (vacuum increases), the venturi becomes unchoked and K_v decreases. (See Figure N84-8.)

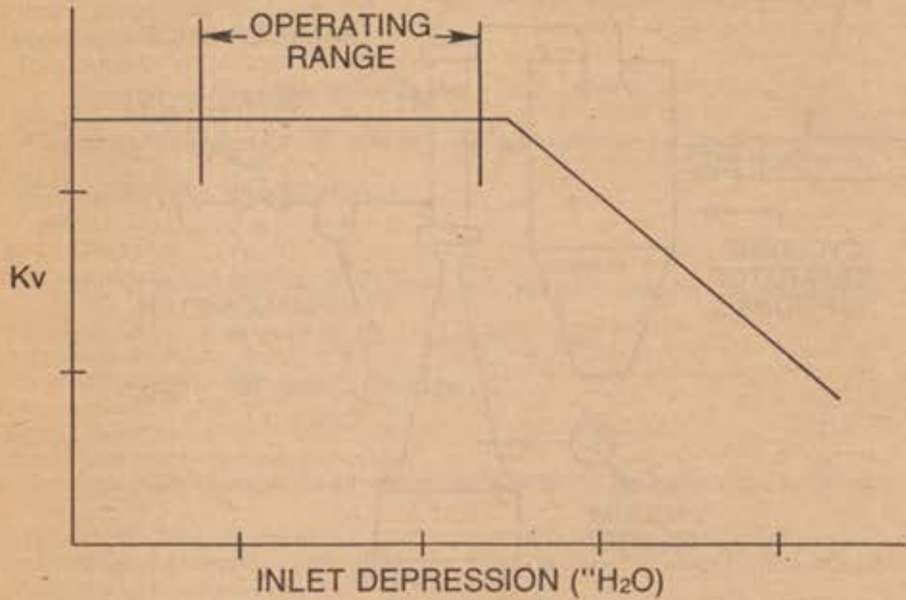


FIGURE N84-8— SONIC FLOW CHOKING

(iv) For a minimum of 8 points in the critical region calculate an average K_v and the standard deviation.

(v) If the standard deviation exceeds 0.3 percent of the average K_v, take corrective action.

(e) *CVS system verification.* The following "gravimetric" technique can be used to verify that the CVS and analytical instruments can accurately measure a mass of gas that has been injected into the system. (Verification can also be accomplished by constant flow metering using critical flow orifice devices.)

(1) Obtain a small cylinder that has been charged with pure propane.

(2) Determine a reference cylinder weight to the nearest 0.01 grams.

(3) Operate the CVS in the normal manner and release a quantity of pure propane into the system during the sampling period (approximately 5 minutes).

(4) The calculations of § 86.1342 are performed in the normal way except in the case of propane. The density of propane (17.30 g/ft³/carbon atom (0.6109 kg/m³/carbon atom)) is used in place of the density of exhaust hydrocarbons.

(5) The gravimetric mass is subtracted from the CVS measured mass and then divided by the gravimetric mass to determine the percent accuracy of the system.

(6) Good engineering practice requires that the cause for any discrepancy greater than ± 2 percent must be found and corrected.

§ 86.1320-84 [Reserved]

§ 86.1321-84 Hydrocarbon analyzer calibration.

The FID hydrocarbon analyzer shall receive the following initial and periodic calibration. The HFID shall be operated to a set point ±10°F (±5.5°C) between 365 and 385°F (185 and 197°C).

(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. Alternate methods yielding equivalent results may be used, if approved in advance by the Administrator.

(1) Follow good engineering practices for initial instrument start-up and basic operating adjustment using the appropriate fuel (see § 86.1314-84) and zero-grade air.

(2) Optimize on the most common operating range. Introduce into the analyzer a propane-in-air mixture with a propane concentration equal to approximately 90 percent of the most common operating range.

(3) One of the following procedures is required for FID or HFID optimization.

(i) 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.

(ii) The HFID optimization procedures outlined in 40 CFR Part 86, Subpart D.

(iii) Alternate procedures approved in advance by the Administrator.

(4) After the optimum flow rates have been determined, they are recorded for future reference.

(b) *Initial and periodic calibration.* Prior to introduction into service and monthly thereafter, the FID or HFID hydrocarbon analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate and pressures as when analyzing samples. Calibration gases shall be introduced directly at the analyzer, unless the "overflow" calibration option of § 86.1310-84(b)(3)(i) for the HFID is taken.

(1) Adjust analyzer to optimize performance.

(2) Zero the hydrocarbon analyzer with zero-grade air.

(3) Calibrate on each used operating range with propane-in-air calibration gases having nominal concentrations of 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 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

§ 86.1322-84 Carbon monoxide analyzer calibration.

The NDIR carbon monoxide analyzer shall receive the following initial and periodic calibration.

(a) *Initial and periodic interference check.* Prior to its introduction into service and annually thereafter, the NDIR carbon monoxide analyzer shall be checked for response to water vapor and CO_2:

(1) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance on the most sensitive range to be used.

(2) Zero the carbon monoxide analyzer with either zero-grade air or zero-grade nitrogen.

(3) Bubble a mixture of 3 percent CO_2 in N_2 through water at room temperature and record analyzer response.

(4) An analyzer response of more than 1 percent of full scale for ranges above 300 ppm full scale or more than 3 ppm on ranges below 300 ppm full scale

requires corrective action. (Use of conditioning columns is one form of corrective action which may be taken.)

(b) *Initial and periodic calibration.* Prior to its introduction into service and monthly thereafter, the NDIR carbon monoxide analyzer shall be calibrated.

(1) Adjust the analyzer to optimize performance.

(2) Zero the carbon monoxide analyzer with either zero-grade air or zero-grade nitrogen.

(3) Calibrate on each used operating range with carbon monoxide-in-N_2 calibration gases having nominal concentrations of 15, 30, 45, 60, 75, and 90 percent of that range. Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit not-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

(c) The initial and periodic interference, system check, and calibration test procedures specified in 40 CFR Part 86, Subpart D may be used in lieu of the procedures specified in this section.

§ 86.1323-84 Oxides of nitrogen analyzer calibration.

The chemiluminescent oxides of nitrogen analyzer shall receive the following initial and periodic calibration.

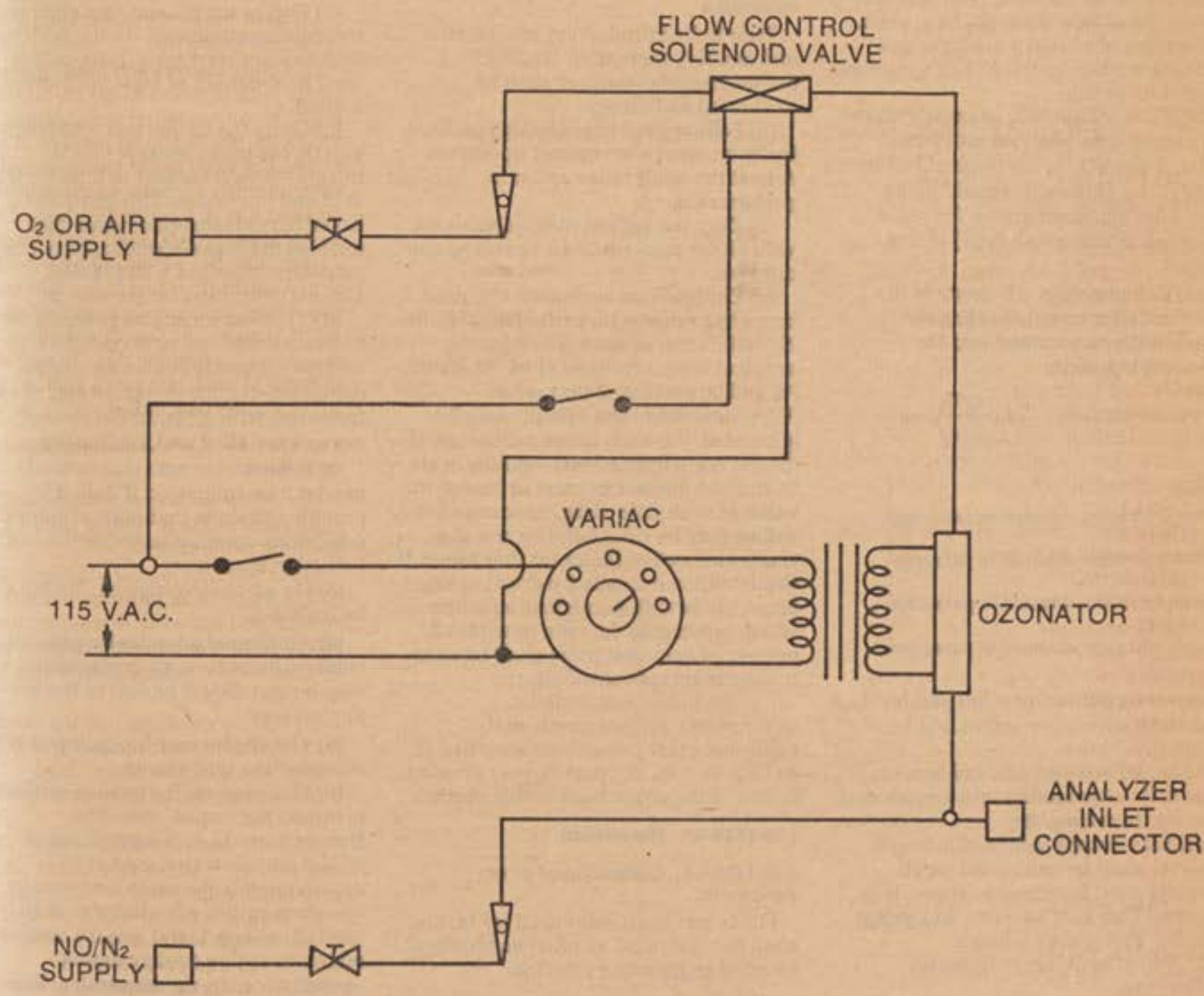
(a) Prior to its introduction into service and weekly thereafter, the chemiluminescent oxides of nitrogen analyzer shall be checked for NO_2 to NO converter efficiency. Figure N84-9 is a reference for the following paragraphs:

(1) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with zero-grade air or zero-grade nitrogen.

(3) Connect the outlet of the NO_x generator to the sample inlet of the oxides of nitrogen analyzer which has been set to the most common operating range.

(4) Introduce into the NO_x generator analyzer-system and NO-in-nitrogen (N_2) mixture with a NO concentration equal to approximately 80 percent of the most common operating range. The NO_2 content of the gas mixture shall be less than 5 percent of the NO concentration.



(SEE FIG. N84-5 FOR SYMBOL LEGEND)

FIGURE N84-9 — NO_x CONVERTER EFFICIENCY DETECTOR

(5) With the oxides of nitrogen analyzer in the NO mode, record the concentration of NO indicated by the analyzer.

(6) Turn on the NO_x generator O_2 (or air) supply and adjust the O_2 (or air) flow rate so that the NO indicated by the analyzer is about 10 percent less than indicated in paragraph (a)(5) of this section. Record the concentration of NO in this $NO+O_2$ mixture.

(7) Switch the NO_x generator to the generation mode and adjust the generation rate so that the NO measured on the analyzer is 20 percent of that measured in paragraph (a)(5) of this section. There must be at least 10 percent unreacted NO at this point. Record the concentration of residual NO.

(8) Switch the oxides of nitrogen analyzer to the NO_x mode and measure total NO_x. Record this value.

(9) Switch off the NO_x generator but maintain gas flow through the system. The oxides of nitrogen analyzer will indicate the NO_x in the $NO+O_2$ mixture. Record this value.

(10) Turn off the NO_x generator O_2 (or air) supply. The analyzer will now indicate the NO_x in the original NO-in-N_2 mixture. This value should be no more than 5 percent above the value indicated in paragraph (a)(4) of this section.

(11) Calculate the efficiency of the NO_x converter by substituting the concentrations obtained into the following equation:

$$\text{Percent efficiency} = \left(1 + \frac{a-b}{c-d}\right) \times 100$$

Where:

a = concentration obtained in paragraph (a)(8).

b = concentration obtained in paragraph (a)(9).

c = concentration obtained in paragraph (a)(6).

d = concentration obtained in paragraph (a)(7).

If converter efficiency is not greater than 90 percent corrective action will be required.

(b) *Initial and periodic calibration.* Prior to its introduction into service and monthly thereafter, the chemiluminescent oxides of nitrogen analyzer shall be calibrated on all normally used instrument ranges. Use the same flow rate as when analyzing samples. Proceed as follows:

(1) Adjust analyzer to optimize performance.

(2) Zero the oxides of nitrogen analyzer with zero-grade air or zero-grade nitrogen.

(3) Calibrate on each normally used operating range with NO-in-N_2 calibration gases with nominal concentrations of 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 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

(c) The initial and periodic interference, system check, and calibration test procedures specified in 40 CFR Part 86, Subpart D, may be used in lieu of the procedures specified in this section.

§ 86.1324–84 Carbon dioxide analyzer calibration.

Prior to its introduction into service and monthly thereafter, the NDIR carbon dioxide analyzer shall be calibrated as follows:

(a) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance.

(b) Zero the carbon dioxide analyzer with either zero-grade air or zero-grade nitrogen.

(c) Calibrate on each normally used operating range with carbon dioxide-in-N_2 calibration or span gases having nominal concentrations of 15, 30, 45, 60, 75, and 90 percent of that range. Additional calibration points may be generated. For each range calibrated, if the deviaton from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, the best-fit non-linear equation which represents the data to within 2 percent of each test point shall be used to determine concentration.

(d) The initial and periodic interference, system check, and calibration test procedures specified in 40 CFR Part 86, Subpart D, may be used in lieu of the procedures in this section.

§ 86.1325–84 [Reserved]

§ 86.1326–84 Calibration of other equipment.

Other test equipment used for testing shall be calibrated as often as required by good engineering practice.

§ 86.1327–84 Engine dynamometer test procedures; overview.

(a) The engine dynamometer test procedure is designed to determine the brake-specific emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen. The test procedure consists of a "cold" start test following either natural or forced cool-down periods described in § 86.1334–84 and § 86.1335–84, respectively. A "hot" start test follows the "cold" start test after a hot soak of 20 minutes. The idle test of Subpart P may be run after the "hot" start test. The exhaust emissions are diluted with ambient air and a continuous proportional sample is collected for analysis during the cold and hot start tests. The composite samples collected are analyzed either in bags or continuously for hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2), and oxides of nitrogen (NO_x). A bag sample of the dilution air is similarly analyzed for background levels of hydrocarbon, carbon monoxide, carbon dioxide, and oxides of nitrogen.

(b) Engine torque and rpm shall be recorded continuously during both the cold and hot start tests. Data points shall be recorded at least once every second.

(c) Using the torque and rpm feedback signals the brake horsepower is integrated with respect to time for the cold and hot cycles. This produces a brake horsepower-hour value that enables the brake-specific emissions to be determined (see § 86.1342–84, Calculations; exhaust emissions).

(d)(1) When an engine is tested for exhaust emissions or is operated for service accumulation on an engine dynamometer, the complete engine shall be tested, with all emission control devices installed and functioning.

(2) Evaporative emission controls need not be connected if data are provided to show that normal operating conditions are maintained in the engine induction system.

(3) On air cooled engines, the fan shall be installed.

(4) Additional accessories (e.g., oil cooler, alternators, air compressors, etc.) may be installed if typical of the in-use application.

(5) The engine may be equipped with a production type starter.

(e) Means of engine cooling which will maintain the engine operating temperatures (e.g., temperatures of intake air, oil, water, etc.) at approximately the same temperature as specified by the manufacturer shall be used. Auxiliary fan(s) may be used to maintain engine cooling during operation on the dynamometer. Only water is allowed as an engine coolant medium. Rust inhibitors and lubrication additives may be used, up to the levels recommended by the additive manufacturer. Antifreeze mixtures (e.g., ethylene glycol, alcohols, etc.) and other coolants that would enhance heat transfer are specifically prohibited.

(f) *Exhaust system.* The exhaust system shall meet the following requirements:

(1) *Gasoline-fueled 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.

(2) *Diesel-fueled engines.* A facility-type exhaust system shall be used, and shall meet the following requirements:

(i) Exhaust system length from the exit of the engine exhaust manifold or turbocharger outlet to the dilution tunnel is required to be not more than 32 feet. Exhaust system tubing must be composed of either stainless steel or the type of steel found in-use. This tubing shall have a maximum inside diameter of 6.0 inches (15.2 cm). If the exhaust system exceeds 20 feet in length and if particulate measurements are to be made, it is recommended that all solid tubing be insulated. If particulate measurements are to be made, it is also recommended that all solid tubing be smooth.

(ii) Short section (altogether not to exceed 20 percent of the entire exhaust system length) of flexible tubing at connection points are allowed.

(iii) If the tubing is insulated, the radial thickness of the insulation is recommended to be at least R inches, where:

$R = 16(k) - 2(r)$,

Where:

k = Thermal conductivity of the insulating material (BTU/hr-ft-°F), and

r = Outer radius of uninsulated tubing (inches).

(iv) The exhaust back pressure or restriction may be set with a valve (and muffler omitted) and restrictions shall be typical of those seen in the actual average vehicle exhaust system configuration.

§ 86.1328-84 [Reserved]

§ 86.1329-84 [Reserved]

§ 86.1330-84 Test sequence, general requirements.

(a) The test sequence shown in Figure N84-10 shows the major steps of the test procedure.

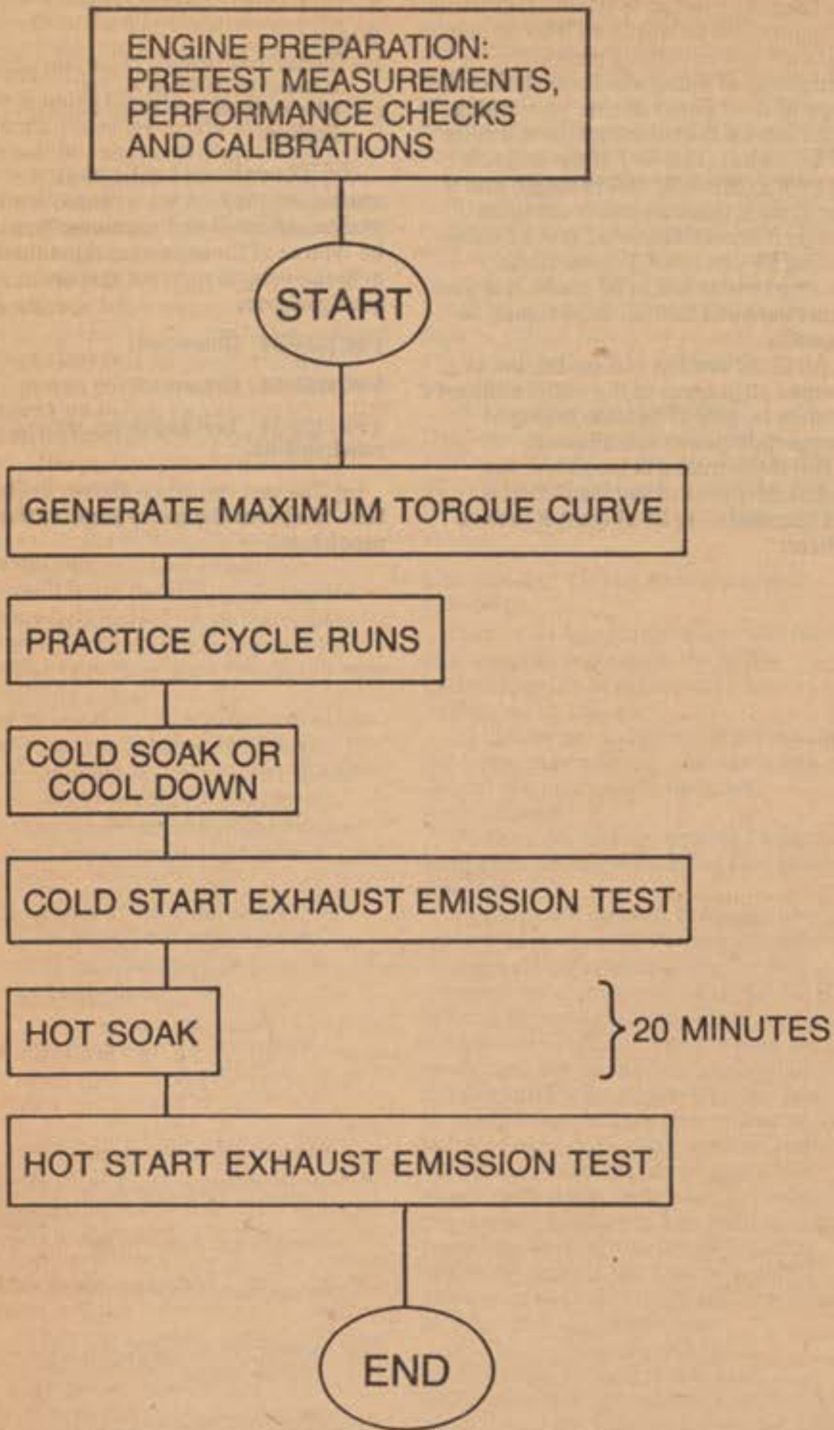


FIGURE N84-10—TEST SEQUENCE

(b) *Control of Air Temperature.*

(1) The temperature of the CVS dilution air shall be maintained at greater than 20°C (68°F) throughout the test sequence.

(2) For engines with auxiliary emission control devices which are temperature dependent (e.g., chokes, air cleaner hot air doors) the test cell ambient air temperature and the temperature of the engine intake air shall be maintained at 25°C ±5°C (77°F ±9°F) throughout the test sequence.

(3) For engines which are not equipped with temperature dependent auxiliary emission control devices, the test cell ambient air temperature and the temperature of the engine intake air shall be greater than 20°C (68°F). No corrections will be made in test results or measured engine power if 30°C (86°F) is exceeded.

(4) The only exceptions to these temperatures are as noted in § 86.1335-84.

(c) No control of ambient air, engine intake air or CVS dilution air humidity is required.

(d) The idle test of Subpart P may be run after completion of the hot start exhaust emission test, if applicable.

(e) The barometric pressure observed during the generation of the maximum torque curve shall not deviate more than 1 inch Hg from the value measured at the beginning of the map. The average barometric pressure observed during the exhaust emission test must be within 1 inch Hg of the average observed during the maximum torque curve generation.

(f) *Diesel-Fueled Engines only.* Air inlet and exhaust restrictions shall be set to represent the average restrictions which would be seen in use in a representative application. Inlet depression and exhaust backpressure shall be set with the engine operating at rated speed and wide open throttle, except for the case of inlet depression for naturally aspirated engines, which shall be set at maximum engine speed (high idle). The settings shall take place during the final mode of the preconditioning prior to determining the maximum torque curve.

(g) Pre-test engine measurements (e.g., governed diesel-fueled engine high idle speed, diesel-fueled engine fuel flows, etc.), pre-test engine performance checks (e.g., verification of actual rated rpm, etc.) and pre-test system calibrations (e.g., inlet and exhaust restrictions, etc.) shall be made prior to generation of the maximum torque curve. This can be done during engine preconditioning, or at the manufacturer's convenience subject to the requirements of good engineering practice.

§ 86.1331-84 [Reserved]

§ 86.1332-84 Engine mapping procedures.

(a) Mount test engine on the engine dynamometer.

(b) Determine minimum mapping speed. The minimum speed is defined as the warm engine curb idle rpm.

(c) Determine maximum mapping speed per the following methodologies. (Note paragraph (d)(1) of this section.)

(1) *Gasoline-fueled engines.* (i) For ungoverned engines the maximum mapping speed shall be calculated from the following equation:

$$\text{Maximum speed} = \text{curb idle rpm} + \frac{115\ (\text{Measured rated rpm} \quad \text{curb idle rpm})}{100}$$

(ii) For governed engines the maximum mapped speed shall be either that speed at which the wide-open throttle torque drops off to zero, or the maximum speed as calculated for ungoverned engines, whichever is smaller.

(2) *Diesel-fueled engines.* (i) For ungoverned engines the maximum mapping speed shall be calculated from the following equation:

$$\text{Maximum speed} = \text{curb idle rpm} + \frac{113\ (\text{measured rated rpm} - \text{curb idle rpm})}{100}$$

(ii) For governed engines the maximum mapping speed shall be either that speed at which wide-open throttle torque drops off to zero, or the maximum speed as calculated for ungoverned engines, whichever is smaller.

(d) Perform an engine power map.

(1) During engine preparation or warm-up, the engine may be operated such that a preliminary estimate of measured rated rpm can be made.

(2) *Gasoline-fueled engines.* (i) For a cold engine, start the engine and operate at zero load in accordance with the manufacturer's start-up and warm-up procedures for 1 minute ±30 seconds.

(ii) Operate the engine at a torque equivalent to 10 ±3 percent of the most recent determination of maximum torque for 4 minutes ±30 seconds at 2,000 rpm.

(iii) Operate the engine at a torque equivalent to 55 ±5 percent of the most recent determination of maximum torque for 35 minutes ±1 minute at 2,000 rpm.

(iv) Operate the engine at idle (minimum speed).

(v) Open the throttle fully.

(vi) While maintaining wide-open throttle and full-load, maintain minimum engine speed for at least 15 seconds. Record the average torque during the last 5 seconds.

(vii) In no greater than 100 ±20 rpm increments, determine the maximum torque curve from minimum speed to maximum speed. Hold each test point for 15 seconds and record the average torque over the last 5 seconds.

(viii) *Alternate mapping technique.* In place of paragraph (d)(2) (vi) and (vii) of this section a continual sweep of rpm is allowed. While operating at wide-open throttle, the engine speed is increased at an average rate of 8 rpm/second (±1 rpm/second) from minimum speed to maximum speed. Speed and torque points shall be recorded at a sample rate of at least one point per second.

(ix) Recalculate the maximum speed per paragraph (c)(1) (i) or (ii) of this section using the measured rated speed derived from the new maximum torque curve. If the new maximum speed lies outside the range of speeds encompassed by the actual map, then the map shall be considered void, and another map will need to be run using the newly derived measured rated speed in all calculations.

(x) For warm engines, the entire warm-up procedure specified in paragraphs (d)(2) (i) through (iii) of this section need not be repeated. It is sufficient for an engine already at normal operating temperatures to be operated at the conditions specified in paragraph (d)(2)(iii) of this section until oil and water temperatures are stabilized, after which the procedures of paragraphs (d)(2) (iv) through (vii) of this section may be performed. The oil and water temperatures are defined as stabilized if they are maintained within 2 percent of point for 2 minutes.

(3) *Diesel-fueled engines.* (i) If the engine is cold, start and operate at free idle for 2 to 3 minutes.

(ii) Operate the engine at approximately 50 percent power at the peak torque speed for 5 to 7 minutes.

(iii) Operate the engine at rated speed and wide open throttle for 25 to 30 minutes.

(iv) *Option.* The engine may be preconditioned by operating at rated speed and maximum horsepower until the oil and water temperatures are stabilized. The temperatures are defined as stabilized if they are maintained within 2 percent of point for 2 minutes. This optional procedure may be substituted for paragraph (d)(3)(iii) of this section.

(v) Unload the engine and operate at the curb idle speed.

(vi) Operate the engine at wide open throttle and minimum engine speed. Increase the engine speed at an average rate of 8 rpm/second (±1 rpm/second) from minimum to maximum speed. Engine speed and torque points shall be recorded at a sample rate of at least one point per second.

(vii) Recalculate the maximum speed per paragraph (c)(2) (i) or (ii) of this section using the measured rated speed derived from the new maximum torque curve. If the new maximum speed lies outside the range of speeds encompassed by the actual map, then the map shall be considered void. The entire mapping procedure shall be repeated, using the newly derived measured rated speed in all calculations.

(viii) For warm engines, the entire warm-up procedure specified in paragraphs (d)(3) (i) through (iv) of this section need not be repeated. It is sufficient for an engine already at normal operating temperatures to be operated per the requirements of paragraph (d)(3)(iv) of this section, after which the procedures of paragraphs (d)(3) (v) and (vi) of this section may be performed.

(e) Mapping curve generation.

(1) *Gasoline-fueled engines.* (i) Fit all data points recorded under paragraphs (d)(2) (vi) and (vii) of this section (100 rpm increments) with a cubic spline technique. The cubic spline curve shall be accurate to within ±1.0 ft-lbs. of all recorded engine torques.

(ii) All points generated under the continuous rpm sweep by paragraphs (d)(2) (vi) and (viii) of this section shall be connected by linear interpolation between points.

(iii) For governed engines, all points above the maximum speed (see paragraph (c)(1)(ii) of this section) shall be assigned maximum torque values of zero for purposes of cycle generation.

(iv) For all engines, all speed points below the minimum speed shall be assigned a maximum torque value equal to that observed at minimum speed for purposes of cycle generation.

(v) The torque curve resulting from paragraphs (e)(1) (i) through (iv) of this section is the mapping curve and will be used to convert the normalized torque values in the engine cycle (see Appendix I(f)(1) to this part) to actual torque values for the test cycle.

(2) *Diesel-fueled engines.*

(i) Connect all data points recorded under paragraph (d)(3(vi) of this section using linear interpolation between points.

(ii) For governed engines, all points above the maximum speed (see paragraph (c)(2)(ii) of this section) shall be assigned maximum torque values of zero for purposes of cycle generation.

(iii) For all engines, all speed points below the minimum speed shall be assigned a maximum torque value equal to that observed at the minimum speed for purposes of cycle generation.

(iv) The torque curve resulting from paragraphs (e)(2)(i) through (e)(2)(iii) of this section is the mapping curve and will be used to convert the normalized torque values in the engine cycle (see Appendix I(f)(2) to this part) into actual torque value for the test cycle.

(f) *Alternate mapping.* If a manufacturer believes that the above mapping techniques are unsafe or unrepresentative for any given engine or engine family, alternate mapping techniques may be used. These alternate techniques must satisfy the intent of the specified mapping procedures to determine the maximum available torque at all engine speeds achieved during the test cycles. Deviations from the mapping techniques specified in this section for reasons of safety or representativeness shall be reported per § 86.1344-84(e)(6), along with the justification for their use. In no case, however, shall descending continual sweeps of rpm be used for governed or turbocharged engines.

(g) *Replicate Tests.* An engine need not be mapped before each and every cold cycle test. An engine shall be remapped prior to a cold cycle test if:

(1) An unreasonable amount of time has transpired since the last map, as determined by engineering judgement, or

(2) The barometric pressure prior to the start of the cold cycle test has changed more than 1 inch Hg from the average barometric pressure observed during the map, or

(3) Physical changes or recalibrations have been made to the engine which may potentially affect engine performance.

§ 86.1333-84 Transient test cycle generation.

(a) The heavy-duty transient engine cycles for gasoline- and diesel-fueled engines are listed in Appendix I ((f) (1) and (2) to this part). These second-by-second listings represent torque and rpm maneuvers characteristic of heavy-duty engines. Both rpm and torque are normalized (expressed as a percentage of maximum) in these listings.

(1) To unnormalize rpm use the following equation:

$$\text{Actual rpm} = \frac{\%\ \text{rpm (Measured rated rpm} - \text{curb idle rpm)}}{100} + \text{Curb idle rpm}$$

The method of calculating measured rated rpm is detailed in paragraph (g) of this section.

(2) Torque is normalized to the maximum torque at the rpm listed with it. Therefore, to unnormalize the torque values in the cycle, the maximum torque curve for the engine in question must be used. The generation of the maximum torque curve is described in § 86.1332-84.

(b) *Example of the unnormalization procedure.* The following test point shall be unnormalized:

% RPM	% Torque
43	82

Given the following values:
Measured Rated rpm=3800
Curb Idle rpm=600
Calculate actual rpm:

$$\text{Actual rpm} = \frac{\%\ \text{rpm (Measured rated rpm} - \text{curb idle rpm)}}{100} + \text{Curb idle rpm}$$

$$\text{Actual rpm} = \frac{43\ (3800-600)}{100} + 600$$

Actual rpm=1976

Determine actual torque: Determine the maximum observed torque at 1976 rpm from the maximum torque curve. Then multiply this value (e.g., 358 ft-lbs.) by 0.82. This results in an actual torque of 284 ft-lbs.

(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 electronically filtered.

(d) *Automatic chokes.* The zero percent speed specified in the gasoline-fueled engine cycle (Appendix I(f)(1) to this part) shall be superseded by proper operation of the engine's automatic choke.

(1) During automatic choke operation a manual transmission engine shall be allowed to idle at whatever speed is required to produce a feedback torque of 0 ft-lbs. ±10 ft-lbs. (using, for example, clutch disengagement, speed to torque control switching, software overrides, etc.) at those points in Appendix I(f)(1) to this part where both reference speed and reference torque are zero percent values.

(2) During automatic choke operation an automatic transmission engine shall be allowed to idle at whatever speed is required to produce a feedback torque of CITT ft-lbs. ±10 ft-lbs. (see (e)(2) of this section for definition of CITT) at those points in Appendix I(f)(1) to this part where both reference speed and reference torque are zero percent values.

(3) For engines tested without an operating clutch, modification to the cycle validation criteria for this automatic choke high idle allowance is permitted only for the first 150 seconds of the cold cycle and the first 30 seconds of the hot cycle. After this, the cycles shall be run as specified in Appendix I (f)(1) to this part. (See § 86.1341-84 for allowances in the cycle validation criteria.)

(e) *Automatic Transmissions.* The reference cycles in Appendix I(f) (1) and (2) to this part shall be altered for test engines intended primarily for use with automatic transmissions.

(1) Zero percent speed for automatic transmission engines is defined as curb idle rpm (i.e., in-vehicle, coupled with automatic transmission in gear).

(2) All zero-percent speed, zero-percent torque points (idle points) shall be modified to zero percent speed, x percent torque except as permitted in § 86.1337–84(a)(8). Using the manufacturers' specified curb idle transmission torque (CITT), the maximum torque available at the curb idle (i.e., with transmission) rpm as determined from the maximum torque curve generated in § 86.1332–84, X percent torque is defined per the following equation:

$$x\ \% = \frac{\text{CITT} \times 100}{\text{Maximum torque at curb idle rpm}}$$

The manufacturer's specified CITT shall be based upon those observed in typical applications.

(f) *Clutch operation.* Manual transmission engines may be tested with a clutch. If used, the clutch shall be disengaged at all zero percent speeds, zero percent torque points, but may be engaged up to two points preceding a non-zero point, and may be engaged for time segments with zero percent speed and torque points of durations less than four seconds. (See § 86.1341–84 for allowances in the cycle validation criteria.)

(g) *Measured rated rpm.* The measured rated rpm corresponds to the 100 percent rpm values specified in the reference cycles of Appendix I(f) (1) and (2) to this part. It is generally intended to represent the rpm at which maximum brake horsepower occurs. For the purposes of this test sequence, it shall either be defined as the manufacturer's specified rated speed, or calculated in the following way, whichever yields the higher speed:

(1) From the maximum torque curve generated per § 86.1332–84, find the maximum observed brake horsepower of the engine.

(2) Calculate 98 percent of the observed maximum brake horsepower, and determine from the maximum torque curve the highest and lowest engine rpms at which this brake horsepower is observed.

(3) The highest and lowest of the 98 percent power rpms represent the endpoints of an rpm range. The midpoint of this range shall be considered the measured rated rpm for cycle generation purposes.

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

(a) *Control system calibration.*

(1) Before the cold soak or cool down, final calibration of the dynamometer and throttle control systems may be performed. These calibrations may consist of steady-state operations and/or actual practice cycle runs.

(2) Following any practice runs or calibration procedures, the engine shall be turned off and allowed to either cold soak at 68° to 86°F until the oil temperature reaches 24°C, or until 12 hours have elapsed, whichever time is shorter, or be cooled per §86.1335–84.

§ 86.1335–84 Optional forced cool-down procedure.

(a) This forced cool-down procedure applies to both gasoline and diesel-fueled engines.

(b) 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 cooling water 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 forced cool-down.

(iii) Only water, including the use of a building's standard water supply, or the coolant that is already in the engine (per § 86.1327–84(e)) is permitted for forced cool-down purposes.

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

(i) Air shall be directed uniformly over the entire exterior surface of the engine at any desired flow rate.

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

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

(e) The cold cycle exhaust emission test may begin after a forced cool down only when the engine oil temperature is stabilized between 20°C and 24°C (68°F and 75°F). This temperature measurement is to be made by a temperature measurement device immersed in the sump oil, the sensor part of which is not in contact with any engine surface. No engine oil change is permitted during the test sequence. Direct forced cooling of engine oil through the use of oil coolers, heat exchangers, etc., is permitted only with engines of displacements greater than 500 cubic inches; forced cooling of engine oil for all other engines can only be accomplished by natural conduction and convection associated with the procedures in paragraphs (c) and (d) of this section. In addition, the cold cycle emission test for engines subjected to direct forced cooling of engine oil may only begin when the circulating water temperature has stabilized to within ±2.8°C (5°F) of the stabilized oil temperature.

(f)(1) The cold cycle exhaust emission test for gasoline engines equipped with catalytic converters may begin after a forced cool down only when the catalyst bed temperature at the catalyst outlet is 25°C ±5°C (77°F ±9°F), in addition to the temperature restrictions in paragraph (e) of this section.

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

(g) At the completion of the forced cool down, all general requirements specified in § 86.1330–84, 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.

§ 86.1336–84 Engine starting and restarting.

(a) The engine shall be started according to the manufacturer's recommended starting procedure in the owner's manual, using either a production starter motor or the dynamometer. The speed at which the engine is cranked (motored) with the dynamometer shall be equal to the cranking speed (nominal speed ±10 percent) in the vehicle with a fully charged battery. The time taken to accelerate the engine to cranking speed by the dynamometer shall be equal (nominal ±0.5 seconds) to the time required with a starter motor. Motoring by the dynamometer shall be terminated not more than one second after the engine starts. The 24 ±1-second free idle period, and declutching if applicable, shall begin when the engine is determined to have started.

(1) Engines equipped with automatic chokes shall be operated according to the manufacturer's operating instructions in the owner's manual, including choke setting and "kick-down" from cold fast idle.

(2) Engines equipped with manual chokes shall be operated according to the manufacturer's operating instructions in the owner's manual.

(3) The operator may use the choke, throttle, etc. where necessary to keep the engine running.

(4) If the manufacturer's operating instructions in the owner's manual do not specify a warm engine starting procedure, the engine (automatic and manual choke engines) shall be started by depressing the throttle half way and cranking the engine until it starts.

(b)(1) If the engine does not start after 15 seconds of cranking, cranking shall cease and the reason for failure to start shall be determined. The gas flow measuring device (or revolution counter) on the constant volume sampler (and the hydrocarbon integrator when testing diesel-fueled engines) shall be turned off during this diagnostic period. In addition, either the CVS should be turned off or the exhaust tube disconnected from the tailpipe during the diagnostic period. If failure to start is an operational error, the engine shall be rescheduled for testing from a cold start.

(2) If longer cranking times are necessary and recommended to the ultimate purchaser, such cranking times may be used in lieu of the 15-second limit, provided the owner's manual and the service repair manual indicate that the longer cranking times are normal.

(3) If a failure to start occurs during the cold portion of the test and is caused by an engine malfunction, corrective action of less than 30 minutes duration may be taken (according to § 86.084–25), and the test continued. The sampling system shall be reactivated at the same time cranking begins. When the engine starts, the timing sequence shall begin. If failure to start is caused by engine malfunction and the engine cannot be started, the test shall be voided and corrective action may be taken according to § 86.084–25.

(4) If a failure to start occurs during the hot start portion of the test and is caused by engine malfunction, the engine must be started within one minute of key on. The sampling system shall be reactivated at the same time cranking begins. When the engine starts, the transient engine cycle timing sequence shall begin. If the engine cannot be started within one minute of key on, the test shall be voided, corrective action taken (according to § 86.084–25), and the engine rescheduled for testing.

(c) *Engine stalling.* (1) If the engine stalls during the initial idle period of either the cold or hot start test, the engine shall be restarted immediately using the appropriate cold or hot starting procedure and the test continued.

(2) If the engine stalls anywhere in the cold cycle, except in the initial idle period, the test shall be voided.

(3) If the engine stalls on the hot cycle portion of the test at any time other than the initial idle, the engine may be shut off and resoaked for 20 minutes. The hot cycle may then be rerun. Only one hot start resoak and restart is permitted.

§ 86.1337–84 Engine dynamometer test run.

(a) The following steps shall be taken for each test:

(1) Prepare the engine, dynamometer, and sampling system for the cold start test. Change filters, etc. and leak check as necessary.

(2) Connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(3) Attach the CVS to the engine exhaust system anytime prior to starting the CVS.

(4) Start the CVS (if not already on), the sample pumps, the engine cooling fan(s) and the data collection system. The heat exchanger of the constant volume sampler (if used) and the heated components of any continuous sampling systems(s) (if applicable) shall be preheated to their designated operating temperatures before the test begins. (See § 86.1340–84(e) for continuous sampling procedures.)

(5) Adjust the sample flow rates to the desired flow rates and set the CVS gas flow measuring devices to zero.

Note.—CFV-CVS sample flow rate is fixed by the venturi design.

(6) Follow the manufacturer's choke and throttle instructions for cold starting. Simultaneously start the engine and begin exhaust and dilution air sampling. For diesel engines, turn on the hydrocarbon, continuous NOx, CO, or CO_2 (if used) analyzer(s) system integrator(s) and indicate the start of the test on the data collection medium (i.e., mark the chart on a chart recorder, set a byte on a computer or data logger, etc.).

(7) As soon as it is determined that the engine is started, start a "free idle" timer.

(8) 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.

(9) 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.

(10) On the last record of the cycle cease sampling, immediately turn the engine off, and start a hot soak timer. Sampling systems should continue to sample after the end of the test cycle until system response times have elapsed.

(11) 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 § 83.1340–84. A stablized reading of the exhaust sample on all analyzers shall be made within 20 minutes of the end of the sample collection phase of the test.

(12) Allow the engine to soak for 20±1 minutes.

(13) Prepare the engine and dynamometer for the hot start test.

(14) Connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(15) Start the CVS (if not already on) or connect the exhaust system to the CVS (if disconnected). Start the sample pumps, the engine cooling fan(s) and the data collection system. The heat exchanger of the constant volume sampler (if used) and the heated components of any continuous sampling system(s) (if applicable) shall be preheated to their designated operating temperatures before the test begins. See § 86.1340–84(e) for continuous sampling procedures.

(16) Adjust the sample flow rates to the desired flow rate and set the CVS gas flow measuring devices to zero.

Note.—CFV-CVS sample flow rate is fixed by the venturi design.

(17) Follow the manufacturer's choke and throttle instruction for hot starting. Simultaneously start the engine and begin exhaust and dilution air sampling.

(18) As soon as it is determined that the engine is started, start a "free idle" timer.

(19) Allow the engine to idle freely with no-load for 24±1 seconds. The provisions and interpretations of paragraph (a)(8) of this section apply.

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

(21) Beginning at the last record of the cycle, allow sampling system response times to elapse and cease sampling.

(22) 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 § 86.1340-84. 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.

(23) The CVS and the engine may be turned off, if desired.

(b) The procedure in paragraph (a) of this section is designed for one sample bag for the cold start portion and one for the hot start portion. It is also permissible to use more than one sample bag per test portion.

(c) If a dynamometer test run is determined to be void, corrective action may be taken. The engine may then be allowed to cool (naturally or forced) and the dynamometer test rerun per paragraphs (a) or (b) of this section.

§ 86.1338-84 Emission measurement accuracy.

(a) *Measurement accuracy—Bag sampling.* (1) Good engineering practice dictates that 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 are made to ensure the accuracy of the calibration curves. The following procedure for calibration below 15 percent of full scale may be used:

(i) If a 16-point gas divider is used, 50 percent of the calibration points shall be below 10 percent of full scale. The gas divider shall conform to the accuracy requirements specified in § 86.1314-84(g).

(ii) If a 7- or 9-point 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 following procedure:

(A) Span the full analyzer range using a top range calibration gas meeting the accuracy requirements of § 86.1314-84(f)(2).

(B) Generate a calibration curve according to, and meeting the requirements of, § 86.1321-84 through § 86.1324-84.

(C) Select a calibration gas (a span gas may be used for calibrating the CO_2 analyzer) with a concentration between the two lowest non-zero gas divider increments. This gas must be "named" to an accuracy of ±1.0 percent (±2.0 percent for CO_2 span gas) of NBS gas standards, or other standards approved by the Administrator.

(D) Using the calibration curve fitted to the points generated in paragraphs (a)(2)(ii) (A) and (B) of this section, check the concentration of the gas selected in paragraph (a)(2)(ii)(C) of this section. The concentration derived from the curve shall be within ±2.3 percent (±2.8 percent for CO_2 span gas) of the gas' original named concentration.

(E) Provided the requirments of paragraph (a)(2)(ii)(D) of this section are met, use the gas divider with the gas selected in paragraph (a)(2)(ii)(C) of this section and determine the remainder of the calibration points. Fit a calibration curve per §§ 86.1321-84 through 86.1324-84 for the entire analyzer range.

(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) The analyzer's response may be less than 15 percent or more than 100 percent of full scale 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) The analyzer's response may be less than 15 percent of full scale if:

(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; or

(C) The emissions from the engine are erratic and the integrated chart deflection value for the cycle is greater than 15 percent of full scale; or

(D) The contribution of all data read below the 15 percent level is less than 10 percent by mass of the final test results.

(iii) During the engine start-up, the HC analyzer is allowed to "spike" off-scale for a maximum of 5 seconds.

§ 86.1339-84 [Reserved]

§ 86.1340-84 Exhaust sample analysis.

(a) The analyzer response may be read by automatic data collection (ADC) equipment such as computers, data loggers, etc. If ADC equipment is used the following is required:

(1) For bag analysis the analyzer response must be stable at greater than 99 percent of the final reading for the dilute exhaust sample bag. A single value representing the average chart deflection over a 10-second stabilized period shall be stored. For the background bag, all readings taken during the 10-second interval must be stable at the final value to within ±1 percent of full scale.

(2) For continuous analysis systems, the ADC system must read at least two analyzer readings per second. A single value representing the average integrated concentration over a cycle shall be stored.

(3) The chart deflections or average integrated concentrations required in paragraphs (a) (1) and (2) of this section may be stored on long-term computer storage devices such as computer tapes, storage discs, punch cards, or they may be printed in a listing for storage. In either case a chart recorder is not required and records from a chart recorder, if they exist, need not be stored.

(4) If the data from ADC equipment is used as permanent records, the ADC equipment and the analyzer values as interpreted by the ADC equipment are subject to the calibration specifications in §§ 86.1316-84 through 86.1326-84, as if the ADC equipment were part of the analyzer.

(b) Data records from any one or a combination of analyzers may be stored as chart recorder records.

(c) Software zero and span.

(i) The use of "software" zero and span is permitted. The process of software zero and span refers to the technique of initially adjusting the analyzer zero and span responses to the calibration curve values, but for subsequent zero and span checks the analyzer response is simply recorded without adjusting the analyzer gain. The observed analyzer response recorded from the subsequent check is mathematically corrected back to the calibration curve values for zero and span. The same mathematical correction is then applied to the analyzer's response to a sample of exhaust gas in order to compute the true sample concentration.

(ii) The maximum amount of software zero and span mathematical correction is ±10 percent of full scale chart deflection.

(iii) Software zero and span may be used to switch between ranges without adjusting the gain of the analyzer.

(iv) The software zero and span technique may not be used to mask analyzer drift. The observed chart deflection before and after a given time period or event shall be used for computing the drift. Software zero and span may be used after the drift has been computed to mathematically adjust any span drift so that the "after" span check may be transformed into the "before" span check for the next segment.

(d) For bag sample analysis perform the following sequence:

(1) Warm-up and stabilize the analyzers; clean and/or replace filter elements, conditioning columns (if used), etc., as necessary.

(2) Obtain a stable zero reading.

(3) Zero and span the analyzers with zero and span gases. The span gases shall have concentrations between 75 and 100 percent of full-scale chart deflection. The flow rates and system pressures during spanning shall be approximately the same as those encountered during sampling. A sample bag may be used to identify the required analyzer range.

(4) Re-check zero response. If this zero response differs from the zero response recorded in paragraph (d)(3) of this section by more than 1 percent of full scale, then paragraphs (d)(2), (d)(3), and (d)(4) of this section should be repeated.

(5) If a chart recorder is used, identify and record the most recent zero and span response as the pre-analysis values.

(6) If ADC equipment is used, electronically record the most recent zero and span response as the pre-analysis values.

(7) Measure HC (except diesels), CO, CO_2, and NO_x sample and background concentrations in the sample bag(s) with approximately the same flow rates and pressures used in paragraph (d)(3) of this section. (Constituents measured continuously do not require bag analysis.)

(8) A post-analysis zero and span check of each range must be performed and the values recorded. The number of events that may occur between the pre and post checks is not specified. However, the difference between pre-analysis zero and span values (recorded in paragraph (d) (5) or (6)) of this section versus those recorded for the post-analysis check may not exceed the zero drift limit or the span drift limit of 2 percent of full scale chart deflection for any range used, otherwise the test is void.

(e) For continuous sample analysis perform the following sequence:

(1) Warm-up and stabilize the analyzers; clean and/or replace filter elements, conditioning columns (if used) etc., as necessary.

(2) Leak check portions of the sampling system that operate at negative guage pressures when sampling, and allow heated sample lines, filters, pumps, etc., to stabilize at operating temperature.

(3) [Optional] Perform a hang-up check for the HFID sampling system:

(i) Zero the analyzer using zero air introduced at the analyzer port.

(ii) Flow zero air through the overflow sampling system. Check the analyzer response.

(iii) If the overflow zero response exceeds the analyzer zero response by 2 percent or more of the HFID full-scale deflection, hang-up is indicated and corrective action must be taken.

(iv) The complete system hang-up check specified in paragraph (f) of this section is recommended as a periodic check.

(4) Obtain a stable zero reading.

(5) Zero and span each range to be used on each analyzer used prior to the beginning of the cold cycle. The span gases shall have a concentration between 75 and 100 percent of full scale chart deflection. The flow rates and system pressures shall be approximately the same as those encountered during sampling. The HFID analyzer shall be zeroed and spanned through the overflow sampling system.

(6) Re-check zero response. If this zero response differs from the zero response recorded in paragraph (e)(5) of this section by more than 1 percent of full scale, then paragraphs (e)(4), (e)(5), and (e)(6) of this section should be repeated.

(7) If a chart recorder is used, identify and record the most recent zero and span response as the pre-analysis values.

(8) If ADC equipment is used, electronically record the most recent zero and span response as the pre-analysis values.

(9) Measure the emissions (HC required for diesels, NO_x, CO, CO_2 optional) continuously during the cold start cycle. Indicate the start of the test, the range(s) used, and the end of the test on the recording medium (chart paper or ADC equipment). Maintain approximately the same flow rates and system pressures used in paragraph (e)(5) of this section.

(10) Collect background HC, CO, CO_2, and NO_x, in a sample bag.

(11) Perform a post-analysis zero and span check for each range used at the conditions specified in paragraph (e)(5) of this section. Record these responses as the post-analysis values.

(12) Neither the zero drift nor the span drift between the pre-analysis and post-analysis checks on any range used may exceed 3 percent for HC or 2 percent for NO_x, CO, and CO_2 of full scale chart deflection, or the test is void. (If the HC drift is greater than 3 percent of full-scale chart deflection, hydrocarbon hang-up is likely.)

(13) Determine HC background levels for the cold start cycle by introducing the background sample into the overflow sample system.

(14) Determine background levels of NO_x, CO, or CO_2 (if necessary) by the bag technique outlined in paragraph (d) of this section.

(15) Repeat paragraphs (e) (4) through (14) of this section for the hot cycle. The post-analysis zero and span check for the cold start (or previous hot start) cycle may be used for the pre-analysis zero and span for the following hot start cycle.

(f) HC hang-up. If HC hang-up is indicated, the following sequence may be performed.

(1) Fill a clean sample bag with background air.

(2) Zero and span the HFID at the analyzer ports.

(3) Analyze the background air sample bag through the analyzer ports.

(4) Analyze the background air through the entire sample probe system.

(5) If the difference between the readings obtained is 2 percent or more of the HFID full scale deflection, clean the sample probe and the sample line.

(6) Reassemble the sample system, heat to specified temperature, and repeat the procedure in paragraphs (f) (1) through (6) of this section.

§ 86.1341-84 Test cycle validation criteria.

(a) To minimize the biasing effect of the time lag between the feedback and reference cycle values, the entire engine speed and torque feedback signal sequence may be advanced or delayed in time with respect to the reference speed and torque sequence. If the feedback signals are shifted, both speed and torque must be shifted the same amount in the same direction.

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

(c) Linear regressions of feedback value on reference value shall be performed for speed, torque and brake horsepower. 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 (in rpm), torque (in 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

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

(e) For a test to be considered valid, the criteria in Figure N84–11 must be met for both cold and hot cycles individually. Point deletions from the regression analyses are permitted where noted in Figure N84–11.

(f) 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. All torque and speed data points must be used to calculate the integrated brake horsepower-hour. For the purposes of this calculation, negative or closed rack torque values (i.e., motoring horsepower) shall be set equal to zero and included.

(g) 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 § 86.1337–84.

(h) For diesel engines, all reference torque values specified in Appendix I, f(2) to this part as "closed rack" shall be deleted from the calculation of cycle torque and power validation statistics. Associated reference and feedback brake horsepower points shall be set equal to zero for purposes of calculating integrated power-hour for diesel engines, and also for gasoline engines whenever the reference torque is less than zero percent. (Note the regression deletions specified in Figure N84–11.)

FIGURE N84–11

	Regression line tolerances		BHP
	Speed (rpm)	Torque	
Standard Error of Estimate (SE) of Y on X.	100	13% of Power Map Maximum Engine Torque.	8% of Power Map Maximum BHP.
Slope of the Regression Line, m.	.970–1.030	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	0.9700[1]	0.8800 (hot) [1]; 0.8500 (cold) [1]	0.9100 [1].
Y Intercept of the Regression Line, b.	±50	±15 ft. lbs.	±5.0 BHP

Permitted point deletions from regression analysis	
Condition	Points to be deleted
First 24 Seconds (±1) of Free Idle of Hot and Cold Cycles.	Speed, Torque, BHP
Wide-Open Throttle, and Speed Control, and Torque Feedback < Torque Reference.	Torque, BHP
Wide-Open Throttle, and Torque Control, and Speed Feedback < Speed Reference.	Speed, BHP
Speed Control, and Gasoline-fueled Engine, and Closed Throttle, and Torque Reference < Torque Feedback, and: A. Manual Transmission, and Reference Torque Not Equal to Zero, or B. Automatic Transmission, and Reference Torque Not Equal to Curb Idle Transmission Torque.	Torque, BHP
Speed Control, and Diesel Engine, and Reference Torque Equals "Closed Rack"	Torque, BHP
Gasoline-fueled Engine, and Equipped With Automatic Choke, and First 150 Seconds of Cold Cycle or First 30 Seconds of Hot Cycle, and Closed Throttle, and No Clutch (or with clutch engaged during idle periods), and:	
A. Manual Transmission, and Torque Feedback is Equal To Zero (±10 ft. lbs.), or	Speed, BHP.
B. Automatic Transmission, and Torque Feedback is Equal To Curb Idle Transmission Torque (±10 ft. lbs.).	Speed, BHP
Engine Equipped with an Operating Clutch, and Clutch Disengaged.	Speed, BHP

[1] Minimum.

§ 86.1342–84 Calculations; exhaust emissions.

(a) The final reported transient emission test results shall be computed by use of the following formula:

$$A_{wm} = \frac{\frac{1}{7}(g_C) + \frac{6}{7}(g_H)}{\frac{1}{7}(BHP\text{-}hr_C) + \frac{6}{7}(BHP\text{-}hr_H)}$$

Where:

A_{wm} = Weighted mass emission level (HC, CO, CO_2, or NO_x) in grams per brake horsepower-hour.

g_C = Mass emission level in grams, measured during the cold start test.

g_H = Mass emission level in grams, measured during the hot start test.

$BHP\text{-}hr_C$ = Total brake horsepower-hour (brake horsepower integrated over time) for the cold start test.

$BHP\text{-}hr_H$ = Total brake horsepower-hour (brake horsepower integrated over time) for the hot start test.

(b) The mass of each pollutant for the cold start test and the hot start test for bag measurements and diesel heat exchanger sample system measurements is determined from the following equations:

(1) Hydrocarbon mass:

$$HC_{mass} = V_{mix} \times Density_{HC} \times (HC_{conc}/10^6)$$

(2) Oxides of nitrogen mass:

$$NOx_{mass} = V_{mix} \times Density_{NO_2} \times K_H \times (NOx_{conc}/10^6)$$

(3) Carbon monoxide mass:

$$CO_{mass} = V_{mix} \times Density_{CO} \times (CO_{conc}/10^6).$$

(4) Carbon dioxide mass:

$$CO_{2\,mass} = V_{mix} \times Density_{CO_2} \times (CO_{2\,conc}/10^2)$$

(c) The mass of each pollutant for the cold start test and the hot start test for flow compensated sample systems is determined from the following equations:

(1) $$HC_{mass} = \sum_{i=1}^{n} \left[\left(\frac{HC_e}{10^6}\right)_i \times (V_{mix})_i \times (Density_{HC}) \times \Delta T/T \right] - \frac{HC_d}{10^6}\left(1 - \frac{1}{DF}\right) \times V_{mix} \times Density_{HC}$$

(2) $$NOx_{mass} = K_H \times \sum_{i=1}^{n} \left[\left(\frac{NOx_e}{10^6}\right)_i \times (V_{mix})_i \times (Density_{NO_2}) \times \Delta T/T \right] - K_H \times \frac{NOx_d}{10^6}\left(1 - \frac{1}{DF}\right) \times V_{mix} \times Density_{NO_2}$$

(3) $$CO_{mass} = \sum_{i=1}^{n} \left[\left(\frac{CO_e}{10^6}\right)_i \times (V_{mix})_i \times (Density_{CO}) \times \Delta T/T \right] - \frac{CO_d}{10^6}\left(1 - \frac{1}{DF}\right) \times V_{mix} \times Density_{CO}$$

(4) $$CO_{2\,mass} = \sum_{i=1}^{n} \left[\left(\frac{CO_{2e}}{10^2}\right)_i \times (V_{mix})_i \times (Density_{CO_2}) \times \Delta T/T \right] - \frac{CO_{2d}}{10^2}\left(1 - \frac{1}{DF}\right) \times V_{mix} \times Density_{CO_2}$$

(d) Meaning of symbols:

(1) HC_{mass} = Hydrocarbon emissions, in grams per test phase

$Density_{HC}$ = Density of hydrocarbons is 16.33 g/ft³ (.5768 kg/m³), assuming an average carbon to hydrogen ratio of 1:1.85, at 68°F (20°C) and 760 mm Hg (101.3 kPa) pressure

HC_{conc} = Hydrocarbon concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent (i.e., equivalent propane X3)

$HC_{conc} = HC_e - HC_d[1-(1/DF)]$

Where:

HC_e = Hydrocarbon concentration of the dilute exhaust bag sample or, for diesel heat exchanger systems, average hydrocarbon concentration of the dilute exhaust sample as calculated from the integrated HC traces, in ppm carbon equivalent. For flow compensated sample systems $(HC_e)_i$ is the instantaneous concentration

HC_d = Hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent

(2) NOx_{mass} = Oxides of nitrogen emissions, in grams per test phase

$Density_{NO_2}$ = Density of oxides of nitrogen is 54.16 g/ft³ (1.913 kg/m³), assuming they are in the form of nitrogen dioxide, at 68°F (20°C) and 760 mm Hg (101.3 kPa) pressure

NOx_{conc} = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in ppm:

$NOx_{conc} = NOx_e - NOx_d[1-(1/DF)]$

Where:

NOx_e = Oxides of nitrogen concentration of the dilute exhaust bag sample as measured, in ppm. For flow compensated sample systems $(NOx_e)_i$ is the instantaneous concentration.

NOx_d = Oxides of nitrogen concentration of the dilute air as measured, in ppm

(3) CO_{mass} = Carbon monoxide emissions, in grams per test phase

$Density_{CO}$ = Density of carbon monoxide is 32.97 g/ft³ (1.164 kg/m³), at 68°F (20°C) and 760 mm Hg (101.3 kPa) pressure

CO_{conc} = Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor, and CO_2 extraction, in ppm

$CO_{conc} = CO_e - CO_d[1-(1/DF)]$

Where:

CO_e = Carbon monoxide concentration of the dilute exhaust bag sample volume corrected for water vapor and carbon dioxide extraction, in ppm. For flow compensated sample systems $(CO_e)_i$ is the instantaneous concentration. (The calculation assumes the carbon to hydrogen ratio of the fuel is 1:1.85.)

$CO_e = [1 - 0.01925CO_{2e} - 0.000323R]CO_{em}$

Where:

CO_{em} = Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm

CO_{2e} = Carbon dioxide concentration of the dilute exhaust bag sample, in percent, if measured. For flow compensated sample systems $(CO_{2e})_i$ is the instantaneous concentration. For cases where exhaust sampling of CO_2 is not performed, the following approximation is permitted:

$$CO_{2e} = \left(\frac{44.010}{12.011 + (1.008)}\right)\left(\frac{M' (453.6)}{Density_{CO_2}}\right)\frac{100}{V_{mix}}$$

M′ = Fuel mass consumed during the test cycle

R = Relative humidity of the dilution air, in percent

CO_d = Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in ppm

$CO_d = (1 - 0.000323R)CO_{dm}$

Where:

CO_{dm} = Carbon monoxide concentration of the dilution air sample as measured, in ppm

Note.—If a CO instrument which meets the criteria specified in § 86.1311-84 is used and the conditioning column has been deleted, CO_{em} can be substituted directly for CO_e and CO_{dm} can be substituted directly for CO_d

(4) $CO_{2\,mass}$ = Carbon dioxide emissions, in grams per test phase

Density CO_2 = Density of carbon dioxide is 51.81 g/ft³ (1.843 kg/m³), at 68°F (20°C) and 760 mm Hg (101.3 kPa) pressure

CO_{2conc} = Carbon dioxide concentration of the dilute exhaust sample corrected for background, in percent

$CO_{2conc} = CO_{2e} - CO_{2d}[1-(1/DF)]$

Where:

CO_{2d} = Carbon dioxide concentration of the dilution air as measured, in percent

(5) $DF = 13.4/[CO_{2e} + (HC_e + CO_e) \times 10^{-4}]$, or
$DF = 13.4/CO_{2e}$.

(6) K_H = Humidity correction factor

For gasoline engines:

$K_H = 1/[1 - 0.0047 (H - 75)]$

(or for SI units $= 1/[1 - 0.0329 (H - 10.71)]$)

For diesel engines:

$K_H = 1/[1 - 0.0026 (H - 75)]$

(or for SI units $= 1/[1 - 0.0182 (H - 10.71)]$)

Where:

H = Absolute humidity of the engine intake air in grains (grams) of water per pound (kilogram) of dry air

$H = [(43.518)R_i \times P_d]/[P_B - (P_d \times R_i/100)]$, and
$= [(6.217)R_i \times P_d]/[P_B - (P_d \times R_i/100)]$ for SI units

R_i = Relative humidity of the engine intake air, in percent

P_d = Saturated vapor pressure, in mm Hg (kPa) at the engine intake air dry bulb temperature

P_B = Barometric pressure, in mm Hg (kPa)

(7) V_{mix} = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528°R) (293°K) and 760 mm Hg (101.3 kPa).

$(V_{mix})_i$ = Instantaneous dilute exhaust volumetric flow rate (for compensated flow systems), in cubic feet per second

ΔT = Time interval (seconds) between samples in flow compensated systems

T = Total sampling time (seconds)

For PDP–CVS:

$$V_{mix} = V_o \times \frac{N(P_B - P_4)\ (528°R)}{(760\ \text{mm Hg})\ (T_p)}\ \text{and}$$

$$= V_o \times \frac{N(P_B - P_4)\ (293.15°K)}{(101.3\ \text{kPa})\ (T_p)}\ \text{, for SI units}$$

Where:

V_o = Volume of gas pumped by the positive displacement pump, in cubic feet (cubic metres) per revolution. This volume is dependent on the pressure differential across the positive displacement pump

N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected

P_B = Barometric pressure, in mm Hg (kPa)

P_4 = Pressure depressions below atmospheric measured at the inlet to the positive displacement pump, in mm Hg (kPa) (during an idle mode)

T_p = Average temperature of dilute exhaust entering positive displacement pump during test, °R(°K)

(e) Sample calculation of mass values of exhaust emissions:

(1) Assume the following test results for a gasoline engine:

	Cold start cycle test results	Hot start cycle test results
V_{mix}	6924 ft³	6873 ft³
R_a	30.2%	30.2%
R_i	30.2%	30.2%
P_B	735 mm Hg	735 mm Hg
P_d	22.676 mm Hg	22.676 mm Hg
HC_e	132.07 ppm C equiv.	86.13 ppm C equiv.
NOx_e	7.86 ppm	10.98 ppm
COe_m	171.22 ppm	114.28 ppm
CO_{2e}	.178%	.381%
HC_d	3.60 ppm C equiv.	8.70 ppm C equiv.
NOx_d	0.0 ppm	0.10 ppm

	Cold start cycle test results	Hot start cycle test results
CO_{dm}	0.89 ppm	0.89 ppm
CO_{2d}	0.0%	0.036%
BHP–hr	0.259	0.347

Then:

Cold Start Test

$H = [(43.478) (30.2) (22.676)] / [735 - (22.676) (30.2)/100] = 41$ grains of water per pound of dry air

$K_H = 1/[1 - 0.0047(41 - 75)] = 0.862$

$CO_e = [1 - 0.01925(.178) - 0.000323(30.2)]\ 171.22 = 169.0$ ppm

$CO_d = [1 - 0.000323(30.2)]0.89 = .881$ ppm

$DF = 13.4/[.178 + (132.07 + 169.0)(10^{-4})] = 64.390$

$HC_{conc} = 132.1 - 3.6[1 - (1/64.390)] = 128.6$ ppm

$HC_{mass} = 6924(16.33)(128.6/1{,}000{,}000) = 14.53$ grams

$NOx_{conc} = 7.86 - 0.0[1 - (1/64.390)] = 7.86$ ppm

$NOx_{mass} = 6924(54.16)(.862)(7.86/1{,}000{,}000) = 2.54$ grams

$CO_{conc} = 169.0 - .881[1 - 1/64.390)] = 168.0$ ppm

$CO_{mass} = 6924(32.97)(168.0/1{,}000{,}000) = 38.35$ grams

$CO_{2\ conc} = .178 - 0[1 - 1/64.390)] = .178\%$

$CO_{2\ mass} = 6924(51.81)(.178/100) = 639$ grams

Hot Start Test

Similar calculations result in the following:

$HC_{mass} = 8.72$ grams

$NOx_{mass} = 3.49$ grams

$CO_{mass} = 25.70$ grams

$CO_{2\ mass} = 1226$ grams

(2) Weighted mass emission results:

$$HC_{wm}=\frac{1/7(14.53)+6/7(8.72)}{1/7(0.259)+6/7(0.347)}=28.8 \text{ grams/BHP-hr}$$

$$NOx_{wm}=\frac{1/7(2.54)+6/7(3.49)}{1/7(0.259)+6/7(0.347)}=10.0 \text{ grams/BHP-hr}$$

$$CO_{wm}=\frac{1/7(38.35)+6/7(25.70)}{1/7(0.259)+6/7(0.347)}=82.2 \text{ grams/BHP-hr}$$

$$CO_{2\ wm}=\frac{1/7(639)+6/7(1226)}{1/7(0.259)+6/7(0.347)}=3415 \text{ grams/BHP-hr}$$

(f) The final reported brake-specific fuel consumption (BSFC) shall be computed by use of the following formula:

$$BSFC=\frac{1/7(M_C)+6/7(M_H)}{1/7(\text{BHP-hr}_C)+6/7(\text{BHP-hr}_H)}$$

Where:

BSFC = brake-specific fuel consumption in pounds of fuel per brake horsepower-hour (lbs/BHP-hr)

M_C = mass of fuel, in pounds, used by the engine during the cold start test

M_H = mass of fuel, in pounds, used by the engine during the hot start test

BHP-hr_C = total brake horsepower-hours (brake horsepower integrated with respect to time) for the cold start test

BHP-hr_H = total brake horsepower-hours (brake horsepower integrated with respect to time) for the hot start test

(g) The mass of fuel for the cold start and hot start test is determined from mass fuel flow measurements made during the tests, or from the following equation:

$M=(G_s/R_2)(1/453.6)$

(1) Meaning of symbols:

M = Mass of fuel, in pounds, used by the engine during the cold or hot start test

G_s = Grams of carbon measured during the cold or hot start test:

$G_s=[12.011/(12.011+\alpha(1.008))]HC_{mass}+0.429CO_{mass}+0.273CO_{2\ mass}$

Where:

HC_{mass} = Hydrocarbon emissions, in grams for cold or hot start test

$CO_{2\ mass}$ = carbon monoxide emissions, in grams for cold or hot start test

$CO_{2\ mass}$ = Carbon dioxide emissions, in grams for cold or hot start test

α = The atomic hydrogen to carbon ratio of the fuel

R_2 = The grams of carbon in the fuel per gram of fuel

$R_2=12.011/[12.011+\alpha(1.008)]$

(h) Sample calculation of brake-specific fuel consumption:

(1) Assume the following test results:

	Cold start cycle test results	Hot start cycle test results
BHP-hr	6.945	7.078
	1.85	1.85
HC_{mass} (grams)	37.08	28.82
CO_{mass} (grams)	357.69	350.33
$CO_{2\ mass}$ (grams)	5,419.62	5,361.32

Then:

G_s for cold start test = [12.011/(12.011 + (1.85)(1.008))](37.08) + 0.429(357.69) + 0.273(5419.62) = 1665.10 grams

G_s for hot start test = [12.011/(12.011 + (1.85)(1.008))](28.82) + 0.429(350.33) + 0.273(5361.32) = 1638.88 grams

R_2 = 12.011/[12.011 + 1.85(1.008)] = .866

M_c = (1665.10/.866)(1/453.6) = 4.24 lbs. (calculated), or

= 4.42 lbs. (directly measured).

M_H = (1638.88/.866)(1/453.6) = 4.17 lbs. (calculated), or

= 4.17 lbs. (directly measured).

(2) Brake-specific fuel consumption results:

$$BSFC=\frac{1/7(4.24)+6/7(4.17)}{1/7(6.945)+6/7(7.078)}=.592 \text{ lbs. of fuel/BHP-hr}$$

(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 x dry concentration.

Where:

$$K_w=1-.00925CO_{2e}(')-\frac{1.608\times H'}{7000+H'}, \text{ or}$$

$$=1-.00925CO_{2e}(')-\frac{1.608\times H'}{1000+H'} \quad \text{for SI units}$$

$CO_{2e}(')$ = either CO_{2e} or CO'_{2e}, as applicable

H' = Absolute humidity of the CVS dilution air in grains (grams) of water per pound (kilogram) of dry air

$H'=[(43.518)R_i'\times P_d']/[P_B-(P_d'\times R_i'/100)]$, and

$=[(6.217)R_i'\times P_d']/[P_B-(P_d'\times R_i'/100)]$ for SI units

R_i' = Relative humidity of the CVS dilution air, in percent

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

P_B = Barometric pressure, in mm Hg (kPa)

§ 86.1343-84 [Reserved]

§ 86.1344-84 Required information.

(a) The required test data shall be grouped into the following three general categories:

(1) *Engine set-up and descriptive data.* This data must be provided to the EPA supervisor of engine testing for each engine sent to the Administrator for confirmatory testing prior to the initiation of engine set-up. This data is necessary to ensure that EPA test personnel have the correct data in order

to set up and test the engine in a timely and proper manner. This data is not required for tests performed by the manufacturers.

(2) *Pre-test data.* This data is general test data that must be recorded for each test. The data is of a more descriptive nature such as identification of the test engine, test site number, etc. As such, this data can be recorded at any time within 24 hours of the test.

(3) *Test-data.* This data is physical test data that must be recorded at the time of testing.

(b) All data may be supplied to the Administrator by punch cards, magnetic tape, or other electronic data processing means. Acceptable data formats and transmission techniques will be provided in the Application Format for Certification of the applicable Model Year.

(c) *Engine set-up data.* Because specific test facilities may change with time, the specific data parameters and number of items may vary. The Application Format for Certification for the applicable Model Year will specify exact requirements. In general, the following type of data will be required:

(1) Engine manufacturer.

(2) Engine system combination.

(3) Engine code and CID.

(4) Engine identification number.

(5) Applicable engine model year.

(6) Engine fuel type.

(7) Recommended oil type.

(8) Exhaust pipe configuration, pipe sizes, etc.

(9) Curb idle speed.

(10) Dynamometer idle speed. (Automatic transmission engines only.)

(11) Engine parameter specification such as spark timing, operating temperature, advance curves, etc.

(12) Engine performance data such as maximum BHP, previously measured rated rpm, fuel consumption, governed speed, etc.

(13) Recommended start-up procedure.

(14) Maximum safe engine operating speed.

(15) Number of hours of operation accumulated on engine.

(16) Manufacturer's recommended inlet depression limit and typical in-use inlet depression level.

(17) Exhaust system.

(i) *Diesel engines.*

(A) Header pipe inside diameter.

(B) Tailpipe inside diameter.

(C) Minimum distance in-use between the exhaust manifold flange and the exit of the chassis exhaust system.

(D) Manufacturer's recommended maximum exhaust backpressure limit for the engine.

(E) Typical backpressure, as determined by typical application of the engine.

(F) Minimum backpressure required to meet applicable noise regulations.

(ii) *Gasoline-fueled engines.* Typical in-use backpressure in vehicle exhaust system.

(d) *Pre-test data.* The following data shall be recorded, and reported to the Administrator for each test conducted for Compliance with the provisions of 40 CFR 86, Subpart A:

(1) Engine-system combination.

(2) Engine identification.

(3) Instrument operator(s).

(4) Engine operator(s).

(5) Number of hours of operation accumulated on the engine prior to beginning the test sequence (Figure N84-10).

(6) Fuel identification, fuel specifications of test fuel used.

(7) Date of most recent analytical assembly calibration.

(8) All pertinent instrument information such as tuning, gain, serial numbers, detector number, calibration curve number, etc. As long as this information is traceable, it may be summarized by system number or analyzer identification numbers.

(e) *Test data.* The physical parameters necessary to compute the test results and ensure accuracy of the results shall be recorded for each test conducted for compliance with the provisions of 40 CFR Part 86, Subpart A. Additional test data may be recorded at the discretion of the manufacturer. Extreme details of the test measurements such as analyzer chart deflections will generally not be required on a routine basis to be reported to the Administrator for each test, unless a dispute about the accuracy of the data arises. The following type of data shall be required to be reported to the Administrator. The Application Format for Certification for the applicable Model Year will specify the exact requirements which may change slightly from year to year with the addition or deletion of certain items.

(1) Date and time of day.

(2) Test number.

(3) Engine intake air or test cell temperature.

(4) Barometric pressure.

Note.— A central laboratory barometer may be used: *Provided,* that individual test cell barometric pressure are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(5) Engine intake or test cell and CVS dilution air humidity.

(6) Maximum torque versus speed curve as determined in § 86.1332-84, with minimum and maximum engine speeds, and a description of the mapping technique used.

(7) Measured maximum horsepower and maximum torque speeds.

(8) Measured maximum horsepower and torque.

(9) Measured high idle engine speed (governed diesel engines only).

(10) Measured fuel consumption at maximum power and torque (diesel engines only).

(11) Cold soak time interval and cool down procedures.

(12) Temperature set point of the heated continuous analysis system components (if applicable).

(13) Test cycle validation statistics as specified in § 86.1341-84 for each test phase (cold-hot).

(14) Total CVS flow rate with dilution factor for each test phase (cold-hot).

(15) Sample concentrations (background corrected) for HC, CO, CO2, and NOx for each test phase (cold-hot).

(16) Brake specific emissions (g/BHP-hr) for HC, CO and NOx for each test phase (cold-hot).

(17) The weighted (cold-hot) brake specific emissions (g/BHP-hr) for the total test.

(18) The weighted (cold-hot) carbon balance or mass-measured brake specific fuel consumption for the total test.

(19) The number of hours of operation accumulated on the engine after completing the test sequences described in Figure N84-10.

40. Paragraph (f) to Appendix I of Part 86 is revised to read as follows:

Appendix I—Urban Dynamometer Schedules

* * * * *

(f) (1) EPA Engine Dynamometer Schedule for Heavy-Duty Gasoline-Fueled Engines.

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	7.00	44.40
26	16.00	85.40
27	27.00	97.80
28	38.00	100.00
29	45.00	100.00
30	51.00	100.00
31	54.00	97.50
32	53.00	90.00
33	49.00	75.20
34	45.00	50.00
35	40.00	70.00
36	34.00	2.30
37	27.00	0.0
38	21.00	2.30
39	16.00	12.00
40	12.00	35.30
41	8.50	4.90
42	5.00	−10.00
43	3.00	−10.00
44	0.0	−10.00
45	0.0	−10.00
46	0.0	−10.00
47	0.0	−10.00
48	0.0	−7.00
49	0.0	−4.00
50	0.0	0.0
51	3.00	10.00
52	11.00	40.20
53	20.00	53.00
54	27.50	64.80
55	32.00	78.00
56	32.00	78.00
57	27.50	56.00
58	26.00	24.40
59	24.00	−6.40
60	23.00	−10.00
61	24.00	−10.00
62	27.00	−10.00
63	34.00	−10.00
64	44.00	28.00
65	57.00	74.40
66	60.00	74.40
67	53.00	33.60
68	45.00	−10.00
69	44.00	−10.00
70	40.00	−10.00
71	40.00	7.00
72	44.00	22.70
73	46.00	30.00
74	46.00	32.00
75	44.00	25.00
76	40.00	18.00
77	37.00	14.00
78	36.00	10.00
79	34.00	0.0
80	34.00	−10.00
81	32.00	−10.00
82	31.00	−10.00
83	36.00	39.90
84	42.00	84.70
85	48.00	90.00
86	50.00	90.00
87	50.00	90.00
88	47.00	85.00
89	43.00	75.00
90	38.00	60.00
91	36.00	36.00
92	36.00	7.50
93	36.30	−10.00
94	45.00	64.50
95	53.00	67.00
96	58.00	64.50
97	62.00	60.30
98	63.00	55.50
99	62.00	52.30
100	61.00	47.00
101	55.00	44.00
102	50.00	39.00
103	45.00	36.00
104	40.00	34.00
105	36.00	30.00
106	34.00	25.80
107	32.00	20.00
108	30.00	14.60
109	26.00	10.00
110	23.00	0.0
111	18.00	−8.00
112	16.00	−10.00
113	16.00	−8.00
114	20.00	27.60
115	17.00	4.00
116	14.00	−8.00
117	12.00	−10.00
118	9.00	−10.00
119	7.00	−10.00
120	7.00	−10.00
121	5.00	−10.00
122	4.00	−10.00
123	3.00	−10.00
124	2.00	−8.00
125	0.0	−3.80
126	0.0	−0.70
127	0.0	0.0
128	0.0	0.0
129	0.0	0.0
130	5.00	8.00
131	8.00	16.30
132	10.00	27.50
133	8.00	27.50
134	5.00	9.00
135	2.00	1.80
136	0.0	0.0
137	0.0	0.0
138	0.0	0.0
139	0.0	0.0
140	0.0	0.0
141	0.0	0.0
142	0.0	0.0
143	0.0	0.0
144	0.0	0.0
145	0.0	0.0
146	0.0	0.0
147	0.0	0.0
148	0.0	0.0
149	2.00	4.80
150	1.00	4.50
151	0.0	0.0
152	0.0	0.0
153	0.0	0.0
154	0.0	0.0
155	0.0	0.0
156	0.0	0.0
157	0.0	0.0
158	0.0	0.0
159	0.0	0.0
160	0.0	0.0
161	0.0	0.0
162	0.0	0.0
163	0.0	0.0
164	0.0	0.0
165	0.0	0.0
166	0.0	0.0
167	8.00	27.00
168	18.00	65.00
169	23.00	82.50
170	23.00	88.00
171	21.00	88.00
172	18.00	81.30
173	17.00	32.00
174	15.00	−10.00
175	13.00	−10.00
176	11.00	−10.00
177	8.00	−10.00
178	6.00	−10.00
179	4.00	−10.00
180	2.00	−10.00
181	0.0	0.0
182	0.0	0.0
183	0.0	0.0
184	0.0	0.0
185	0.0	0.0
186	0.0	0.0
187	0.0	0.0
188	0.0	0.0
189	0.0	0.0
190	0.0	0.0
191	0.0	0.0
192	0.0	0.0
193	0.0	0.0
194	0.0	0.0
195	0.0	0.0
196	0.0	0.0
197	0.0	0.0
198	0.0	0.0
199	0.0	0.0
200	0.0	0.0
201	0.0	0.0
202	0.0	0.0
203	0.0	0.0
204	0.0	4.00
205	0.50	7.70
206	5.00	14.00
207	11.00	24.70
208	15.00	42.30
209	16.00	70.00
210	17.00	70.00
211	17.00	50.00
212	16.00	26.30
213	14.00	5.00
214	10.00	−10.00
215	10.00	−10.00
216	14.00	73.30
217	18.00	83.00
218	19.00	84.80
219	18.00	84.80
220	16.00	82.80
221	11.00	74.00
222	7.00	8.50
223	4.00	0.0
224	0.0	0.0
225	0.0	0.0
226	0.0	0.0
227	0.0	0.0
228	0.0	0.0
229	0.0	0.0
230	0.0	0.0
231	0.0	0.0
232	0.0	0.0
233	6.00	17.60
234	6.00	19.60
235	5.00	14.00
236	3.00	9.80
237	1.00	5.50
238	0.0	3.00
239	0.0	0.0
240	0.0	0.0
241	0.0	0.0
242	0.0	0.0
243	0.0	0.0
244	0.0	0.0
245	0.0	0.0
246	0.0	0.0
247	0.0	0.0
248	0.0	0.0
249	0.0	0.0
250	0.0	0.0
251	0.0	0.0
252	0.0	0.0
253	0.0	0.0
254	0.0	0.0
255	0.0	0.0
256	0.0	0.0
257	0.0	0.0
258	0.0	0.0
259	0.0	0.0
260	0.0	0.0
261	0.0	0.0
262	0.0	0.0
263	0.0	0.0
264	0.0	0.0
265	0.0	0.0
266	0.0	0.0
267	0.0	0.0
268	0.0	0.0
269	0.0	0.0
270	0.0	0.0
271	0.0	0.0
272	0.0	0.0
273	0.0	0.0
274	0.0	0.0
275	0.0	0.0
276	0.0	0.0
277	0.0	0.0
278	0.0	0.0
279	0.0	0.0
280	0.0	0.0
281	0.0	7.00
282	1.00	10.00
283	2.00	11.50
284	1.00	10.00
285	0.0	0.0
286	0.0	0.0
287	0.0	0.0
288	0.0	0.0
289	0.0	0.0
290	0.0	0.0
291	0.0	0.0
292	0.0	0.0
293	0.0	0.0
294	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
295	0.0	0.0
296	0.0	0.0
297	0.0	0.0
298	0.0	0.0
299	0.0	28.00
300	0.0	30.00
301	2.00	32.00
302	6.00	34.00
303	14.00	36.00
304	19.00	38.00
305	24.50	38.00
306	24.50	36.00
307	24.00	30.00
308	19.00	24.00
309	13.00	18.00
310	9.00	14.00
311	7.00	8.00
312	6.00	0.0
313	4.00	3.00
314	3.00	6.80
315	0.0	0.0
316	0.0	0.0
317	0.0	0.0
318	0.0	0.0
319	0.0	0.0
320	0.0	0.0
321	0.0	0.0
322	0.0	0.0
323	0.0	18.00
324	3.00	40.00
325	8.00	86.00
326	18.00	97.00
327	38.00	100.00
328	45.50	100.00
329	45.00	96.00
330	44.00	84.40
331	43.00	53.50
332	41.00	5.00
333	43.00	47.60
334	44.00	90.00
335	45.00	90.00
336	44.00	73.00
337	40.00	54.00
338	38.00	34.70
339	36.00	10.00
340	35.00	10.00
341	35.00	10.00
342	35.50	60.00
343	36.00	57.90
344	37.00	53.00
345	39.00	50.00
346	40.50	50.00
347	43.00	50.00
348	45.00	50.00
349	48.00	50.00
350	51.00	52.00
351	56.00	58.70
352	64.00	70.00
353	68.00	70.00
354	70.00	70.00
355	65.50	64.60
356	61.00	28.90
357	55.00	−5.00
358	50.00	−10.00
359	45.00	−10.00
360	38.00	−10.00
361	28.00	−10.00
362	19.00	−10.00
363	14.00	−10.00
364	7.00	−10.00
365	2.00	−5.00
366	3.00	5.00
367	7.00	25.00
368	9.00	38.00
369	7.00	17.00
370	4.00	2.00
371	3.00	−9.00
372	3.00	−10.00
373	11.00	70.00
374	15.00	97.60
375	16.00	100.00
376	19.00	100.00
377	26.00	100.00
378	29.00	95.00
379	25.00	63.00
380	19.00	−10.00
381	12.00	−10.00
382	8.00	−10.00
383	5.00	−10.00
384	2.00	−10.00
385	1.00	−10.00
386	0.0	−5.00
387	0.0	0.0
388	0.0	0.0
389	0.0	0.0
390	0.0	0.0
391	0.0	0.0
392	0.0	0.0
393	0.0	0.0
394	0.0	0.0
395	0.0	0.0
396	0.0	0.0
397	0.0	0.0
398	0.0	0.0
399	0.0	0.0
400	0.0	0.0
401	0.0	0.0
402	0.0	0.0
403	0.0	0.0
404	0.0	0.0
405	0.0	0.0
406	0.0	0.0
407	0.0	0.0
408	0.0	0.0
409	0.0	0.0
410	0.0	0.0
411	0.0	0.0
412	0.0	0.0
413	0.0	0.0
414	0.0	0.0
415	0.0	0.0
416	0.0	0.0
417	0.0	0.0
418	0.0	0.0
419	4.00	20.00
420	4.00	20.00
421	0.0	0.0
422	0.0	0.0
423	0.0	0.0
424	0.0	0.0
425	0.0	0.0
426	0.0	0.0
427	0.0	0.0
428	0.0	0.0
429	0.0	0.0
430	2.00	0.0
431	6.00	2.00
432	14.00	28.80
433	20.00	30.00
434	24.40	11.00
435	24.00	10.00
436	24.00	12.00
437	28.00	52.00
438	32.00	52.00
439	34.00	46.00
440	34.00	30.00
441	34.50	30.00
442	35.00	30.00
443	36.00	35.00
444	39.00	40.00
445	45.00	50.00
446	49.00	56.00
447	50.00	−8.00
448	45.00	−10.00
449	39.00	−10.00
450	34.00	−10.00
451	28.00	−10.00
452	25.00	−10.00
453	21.00	−10.00
454	18.00	−10.00
455	15.00	−10.00
456	12.00	−10.00
457	18.00	−8.00
458	29.00	19.80
459	40.00	54.00
460	52.00	82.00
461	64.00	95.00
462	71.00	99.00
463	77.00	100.00
464	84.00	100.00
465	85.00	99.00
466	85.00	95.00
467	84.00	90.00
468	82.00	84.60
469	80.00	78.50
470	78.00	78.50
471	77.00	70.00
472	76.00	65.50
473	74.00	61.50
474	72.00	56.00
475	70.00	52.00
476	68.00	46.00
477	66.50	40.00
478	65.00	32.00
479	63.00	26.00
480	61.00	25.60
481	61.00	72.00
482	61.00	78.00
483	58.00	72.00
484	50.00	64.00
485	44.00	55.00
486	35.00	40.00
487	26.00	20.00
488	21.00	−4.00
489	18.00	−10.00
490	16.00	−10.00
491	19.00	−8.00
492	24.00	2.00
493	32.00	68.50
494	45.00	78.00
495	51.00	86.00
496	58.00	92.00
497	64.00	97.00
498	71.00	100.00
499	73.00	98.00
500	73.00	94.00
501	73.00	86.00
502	73.00	82.00
503	76.00	84.00
504	80.00	98.00
505	84.00	100.00
506	85.00	100.00
507	84.00	100.00
508	81.00	92.00
509	75.00	80.00
510	73.00	70.00
511	70.00	60.00
512	67.00	53.00
513	65.00	45.00
514	63.00	36.50
515	62.00	28.00
516	61.00	22.50
517	60.00	23.00
518	60.00	24.00
519	60.00	24.00
520	60.00	26.00
521	61.00	60.00
522	62.00	64.00
523	63.00	64.00
524	64.00	64.00
525	62.00	64.00
526	56.00	60.00
527	53.00	−7.00
528	49.00	−10.00
529	47.00	−10.00
530	46.00	−10.00
531	45.00	−7.00
532	45.00	30.00
533	46.00	50.00
534	46.00	50.00
535	47.00	50.00
536	47.00	50.00
537	47.00	30.00
538	46.00	12.00
539	45.00	10.50
540	44.00	10.00
541	41.00	10.00
542	37.00	9.00
543	36.00	2.00
544	35.00	−10.00
545	38.00	67.00
546	35.00	−10.00
547	31.00	15.00
548	28.00	55.00
549	34.00	44.00
550	35.00	38.50
551	36.00	38.50
552	36.00	38.50
553	37.00	39.50
554	39.00	36.00
555	42.00	27.00
556	45.00	62.00
557	48.00	45.00
558	51.00	15.00
559	51.00	8.00
560	51.00	6.00
561	48.00	10.00
562	46.00	11.00
563	44.00	13.00
564	41.00	17.00
565	37.00	20.00
566	34.00	20.00
567	30.00	17.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
568	26.00	14.00
569	23.00	7.00
570	19.00	2.00
571	15.00	−5.00
572	11.00	−10.00
573	8.00	−10.00
574	5.00	−8.00
575	2.00	−5.00
576	0.0	0.0
577	0.0	0.0
578	0.0	0.0
579	0.0	0.0
580	0.0	0.0
581	0.0	0.0
582	0.0	0.0
583	4.00	15.00
584	19.00	31.00
585	30.00	46.00
586	37.00	68.00
587	40.00	76.00
588	41.00	77.00
589	40.50	78.00
590	40.00	77.00
591	40.00	64.00
592	38.00	10.00
593	38.00	25.00
594	40.00	50.00
595	40.00	36.00
596	40.00	31.00
597	40.00	31.00
598	41.00	37.00
599	42.00	97.00
600	43.00	100.00
601	45.00	100.00
602	47.00	100.00
603	48.00	100.00
604	49.00	100.00
605	51.00	97.00
606	52.00	94.00
607	53.00	90.00
608	54.00	87.00
609	56.00	86.00
610	56.00	85.00
611	55.50	85.00
612	55.00	81.00
613	54.00	77.00
614	53.00	72.00
615	52.00	67.00
616	49.00	60.00
617	46.00	45.00
618	45.00	12.00
619	44.00	10.00
620	44.00	10.00
621	45.00	12.00
622	46.00	14.00
623	47.00	24.00
624	49.00	88.00
625	50.00	90.00
626	51.00	90.00
627	52.00	90.00
628	53.00	90.00
629	54.00	90.00
630	54.00	90.00
631	54.00	87.00
632	54.00	84.00
633	54.00	80.00
634	53.50	77.00
635	53.00	76.00
636	53.00	75.00
637	52.00	73.00
638	51.00	69.00
639	50.00	65.00
640	50.00	60.00
641	49.00	55.00
642	49.00	50.00
643	49.00	50.00
644	49.50	60.00
645	49.50	65.00
646	50.00	70.00
647	50.50	75.00
648	51.00	80.00
649	52.00	85.00
650	53.00	90.00
651	54.00	90.00
652	55.00	90.00
653	55.00	88.00
654	55.00	84.00
655	55.00	79.00
656	55.00	74.00
657	55.00	69.00
658	55.00	64.00
659	55.00	59.00
660	55.00	54.00
661	55.00	49.00
662	55.00	44.50
663	55.00	39.00
664	55.00	34.00
665	55.00	27.00
666	55.00	18.00
667	55.00	8.00
668	55.00	6.00
669	55.00	13.00
670	55.00	27.00
671	55.50	30.00
672	56.00	30.00
673	57.00	30.00
674	58.00	34.00
675	59.00	46.00
676	59.00	89.00
677	59.00	90.00
678	59.00	91.00
679	59.00	91.00
680	60.00	91.00
681	60.00	91.00
682	60.50	90.00
683	61.00	89.00
684	61.50	88.00
685	62.00	83.00
686	63.00	73.00
687	65.00	70.00
688	66.00	71.00
689	67.00	74.00
690	67.50	79.00
691	68.00	85.00
692	68.50	90.00
693	69.00	94.00
694	69.50	96.00
695	70.00	98.00
696	70.50	100.00
697	71.00	100.00
698	72.00	100.00
699	72.00	100.00
700	72.00	100.00
701	72.00	100.00
702	72.00	100.00
703	72.00	100.00
704	72.00	100.00
705	72.00	100.00
706	72.00	100.00
707	72.50	100.00
708	73.00	100.00
709	73.50	100.00
710	74.00	100.00
711	74.00	100.00
712	74.50	100.00
713	75.00	100.00
714	75.00	100.00
715	75.00	100.00
716	75.00	100.00
717	75.00	100.00
718	75.00	100.00
719	75.00	100.00
720	75.00	100.00
721	75.00	100.00
722	75.00	100.00
723	75.00	98.00
724	75.00	90.00
725	75.00	34.00
726	74.00	15.00
727	72.00	3.00
728	70.00	−7.00
729	69.00	−10.00
730	68.00	−10.00
731	70.50	53.00
732	73.00	80.00
733	75.00	88.00
734	77.00	94.00
735	79.00	97.00
736	82.00	97.00
737	85.00	98.00
738	85.00	98.00
739	87.00	97.00
740	90.00	95.00
741	92.00	90.00
742	93.00	88.00
743	94.00	86.00
744	95.00	83.00
745	96.00	79.00
746	97.00	74.00
747	98.00	68.00
748	99.00	62.00
749	100.00	54.00
750	100.00	30.00
751	100.00	22.00
752	100.00	20.00
753	100.00	22.00
754	100.00	30.00
755	100.00	65.00
756	100.00	76.00
757	100.00	80.00
758	100.00	76.00
759	100.00	72.00
760	100.00	54.00
761	95.00	30.00
762	85.00	12.00
763	68.00	−5.00
764	57.00	−8.00
765	56.00	−10.00
766	57.00	−9.00
767	57.00	−5.00
768	57.00	22.00
769	58.00	40.00
770	59.00	45.00
771	59.00	48.00
772	59.50	45.00
773	60.00	33.00
774	60.00	0.0
775	60.00	−10.00
776	60.00	−10.00
777	60.00	34.00
778	60.00	50.00
779	60.00	60.00
780	60.00	69.00
781	60.00	75.00
782	60.00	79.00
783	61.00	83.00
784	61.00	84.00
785	61.00	85.00
786	62.00	85.00
787	62.00	85.00
788	62.00	85.00
789	63.00	85.00
790	63.00	85.00
791	64.00	85.00
792	64.00	85.00
793	64.00	85.00
794	64.00	85.00
795	64.00	85.00
796	64.00	84.50
797	64.00	84.00
798	64.00	83.00
799	64.00	82.00
800	64.00	81.00
801	64.00	77.00
802	64.00	72.00
803	65.00	67.00
804	66.00	64.00
805	67.00	60.00
806	69.00	62.30
807	72.00	84.00
808	73.00	90.50
809	74.00	91.00
810	74.00	90.00
811	74.00	84.50
812	73.00	74.00
813	72.00	66.00
814	71.00	60.00
815	70.00	54.00
816	69.00	50.00
817	68.00	49.00
818	68.00	48.00
819	68.00	48.00
820	68.00	48.50
821	68.00	49.00
822	68.00	51.00
823	68.00	53.50
824	68.00	55.00
825	68.00	58.00
826	68.00	60.00
827	68.00	62.00
828	68.00	64.00
829	68.00	67.00
830	69.00	68.50
831	70.00	70.00
832	70.00	70.00
833	70.00	70.00
834	70.00	70.00
835	70.00	70.00
836	70.00	70.00
837	71.00	66.00
838	73.00	64.00
839	75.00	64.00
840	77.00	98.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
841	79.00	100.00
842	81.00	100.00
843	82.00	100.00
844	83.00	100.00
845	84.00	98.00
846	84.00	94.00
847	85.00	93.00
848	86.00	94.00
849	87.00	98.00
850	89.00	100.00
851	92.00	100.00
852	95.00	100.00
853	97.50	100.00
854	100.00	100.00
855	100.00	100.00
856	100.00	100.00
857	100.00	100.00
858	100.00	97.00
859	96.00	−6.00
860	94.00	−10.00
861	91.00	−10.00
862	88.00	−10.00
863	86.00	−10.00
864	84.00	−10.00
865	82.00	−10.00
866	79.00	−10.00
867	77.00	−10.00
868	75.00	−10.00
869	73.00	−10.00
870	72.00	−10.00
871	72.00	−10.00
872	72.00	−8.00
873	71.00	8.00
874	68.00	9.00
875	64.00	−9.00
876	58.00	−8.00
877	56.00	53.00
878	56.00	67.00
879	56.00	70.00
880	56.00	67.00
881	55.00	60.00
882	54.00	60.00
883	49.00	75.00
884	38.00	80.00
885	30.00	78.00
886	25.00	53.00
887	18.00	32.00
888	14.00	16.00
889	9.00	3.00
890	5.00	−6.00
891	1.00	−10.00
892	0.0	−7.00
893	0.0	0.0
894	0.0	0.0
895	0.0	0.0
896	0.0	0.0
897	0.0	0.0
898	0.0	0.0
899	0.0	0.0
900	0.0	0.0
901	0.0	0.0
902	0.0	0.0
903	0.0	0.0
904	0.0	0.0
905	0.0	0.0
906	0.0	0.0
907	0.0	0.0
908	0.0	0.0
909	0.0	0.0
910	0.0	0.0
911	0.0	0.0
912	0.0	0.0
913	0.0	0.0
914	0.0	0.0
915	0.0	0.0
916	0.0	0.0
917	0.0	0.0
918	0.0	0.0
919	0.0	0.0
920	4.50	47.00
921	12.00	85.00
922	30.00	97.00
923	42.00	100.00
924	51.00	100.00
925	54.00	100.00
926	54.00	97.00
927	52.00	90.00
928	48.00	75.00
929	44.00	57.00
930	37.00	17.00
931	29.00	40.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
932	24.00	34.00
933	21.00	27.00
934	22.00	24.00
935	22.50	22.00
936	20.00	16.00
937	15.00	7.00
938	10.00	0.0
939	5.00	−7.00
940	2.00	−10.00
941	1.00	−10.00
942	0.0	−10.00
943	0.0	0.0
944	0.0	0.0
945	1.00	0.0
946	5.00	20.00
947	15.00	43.00
948	28.00	52.00
949	34.00	64.00
950	37.00	74.00
951	37.50	90.00
952	37.00	56.00
953	36.00	27.00
954	35.00	−2.00
955	33.00	−8.00
956	29.00	−10.00
957	29.00	−8.00
958	29.00	−2.00
959	34.00	30.00
960	38.00	75.00
961	34.00	70.00
962	31.00	25.00
963	28.00	−7.00
964	26.00	−10.00
965	24.00	−7.00
966	23.00	4.00
967	23.00	22.00
968	24.00	30.00
969	23.00	32.00
970	22.00	25.00
971	18.00	18.00
972	16.00	14.00
973	15.00	10.00
974	15.00	0.0
975	15.00	−7.00
976	15.00	−10.00
977	18.00	−8.00
978	25.00	40.00
979	37.00	90.00
980	46.00	90.00
981	49.00	90.00
982	49.00	90.00
983	49.00	85.00
984	47.00	77.00
985	44.00	59.00
986	43.00	36.00
987	42.00	13.00
988	40.00	−10.00
989	41.00	65.00
990	44.00	65.00
991	45.00	65.00
992	45.00	62.00
993	44.00	56.00
994	42.00	46.00
995	41.00	36.00
996	39.00	20.00
997	38.00	4.00
998	37.00	33.00
999	38.00	39.00
1,000	36.00	40.00
1,001	35.00	40.00
1,002	33.00	39.00
1,003	30.00	36.00
1,004	27.00	33.00
1,005	22.00	24.00
1,006	21.00	−5.00
1,007	20.00	−10.00
1,008	18.00	−6.00
1,009	17.00	28.00
1,010	16.00	5.00
1,011	14.00	−5.00
1,012	12.00	−9.00
1,013	9.00	−10.00
1,014	7.00	−10.00
1,015	5.00	−10.00
1,016	4.00	−10.00
1,017	3.00	−10.00
1,018	2.00	−10.00
1,019	0.0	−7.00
1,020	0.0	−4.00
1,021	0.0	0.0
1,022	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1,023	0.0	0.0
1,024	0.0	0.0
1,025	2.00	7.00
1,026	6.00	15.00
1,027	10.00	28.00
1,028	11.00	26.00
1,029	10.00	10.00
1,030	8.00	3.00
1,031	5.00	0.0
1,032	2.00	0.0
1,033	0.0	0.0
1,034	0.0	0.0
1,035	0.0	0.0
1,036	0.0	0.0
1,037	0.0	0.0
1,038	0.0	0.0
1,039	0.0	0.0
1,040	0.0	0.0
1,041	0.0	0.0
1,042	0.0	0.0
1,043	0.0	0.0
1,044	0.0	0.0
1,045	0.0	0.0
1,046	0.0	0.0
1,047	0.0	0.0
1,048	0.0	0.0
1,049	0.0	0.0
1,050	0.0	0.0
1,051	0.0	0.0
1,052	0.0	0.0
1,053	0.0	0.0
1,054	0.0	0.0
1,055	0.0	0.0
1,056	0.0	0.0
1,057	0.0	0.0
1,058	0.0	0.0
1,059	0.0	0.0
1,060	0.0	0.0
1,061	4.00	05.00
1,062	11.00	35.00
1,063	21.00	73.00
1,064	25.00	86.00
1,065	26.00	90.00
1,066	25.00	90.00
1,067	23.00	83.00
1,068	20.00	32.00
1,069	16.00	−6.00
1,070	14.00	−10.00
1,071	10.00	−10.00
1,072	7.00	−10.00
1,073	3.00	−10.00
1,074	1.00	−10.00
1,075	0.0	−7.00
1,076	0.0	−3.00
1,077	0.0	0.0
1,078	0.0	0.0
1,079	0.0	0.0
1,080	0.0	0.0
1,081	0.0	0.0
1,082	0.0	0.0
1,083	0.0	0.0
1,084	0.0	0.0
1,085	0.0	0.0
1,086	0.0	0.0
1,087	0.0	0.0
1,088	0.0	0.0
1,089	0.0	0.0
1,090	0.0	0.0
1,091	0.0	0.0
1,092	0.0	0.0
1,093	0.0	0.0
1,094	0.0	0.0
1,095	0.0	0.0
1,096	0.0	0.0
1,097	0.0	0.0
1,098	1.00	3.00
1,099	3.00	6.00
1,100	6.00	13.00
1,101	9.00	14.00
1,102	12.00	16.00
1,103	15.00	28.00
1,104	18.00	60.00
1,105	20.00	47.00
1,106	21.00	31.00
1,107	21.00	15.00
1,108	20.00	−2.00
1,109	20.00	−10.00
1,110	20.00	−2.00
1,111	20.00	70.00
1,112	21.00	83.00
1,113	22.00	84.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1,114	22.00	83.00
1,115	18.00	76.00
1,116	14.00	68.00
1,117	8.00	10.00
1,118	4.00	4.00
1,119	1.00	0.0
1,120	0.0	0.0
1,121	0.0	0.0
1,122	0.0	0.0
1,123	0.0	0.0
1,124	0.0	0.0
1,125	0.0	1.00
1,126	1.00	5.00
1,127	5.00	18.00
1,128	9.00	19.00
1,129	12.00	18.00
1,130	12.00	15.00
1,131	9.00	10.00
1,132	5.00	5.00
1,133	2.00	2.00
1,134	0.0	0.0
1,135	0.0	0.0
1,136	0.0	0.0
1,137	0.0	0.0
1,138	0.0	0.0
1,139	0.0	0.0
1,140	0.0	0.0
1,141	0.0	0.0
1,142	0.0	0.0
1,143	0.0	0.0
1,144	0.0	0.0
1,145	0.0	0.0
1,146	0.0	0.0
1,147	0.0	0.0
1,148	0.0	0.0
1,149	0.0	0.0
1,150	0.0	0.0
1,151	0.0	0.0
1,152	0.0	0.0
1,153	0.0	0.0
1,154	0.0	0.0
1,155	0.0	0.0
1,156	0.0	0.0
1,157	0.0	0.0
1,158	0.0	0.0
1,159	0.0	0.0
1,160	0.0	0.0
1,161	0.0	0.0
1,162	0.0	0.0
1,163	0.0	0.0
1,164	0.0	0.0
1,165	0.0	0.0
1,166	0.0	0.0
1,167	0.0	0.0

(2) EPA Engine Dynamometer Schedule for Heavy-Duty Diesel Engines.

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	0.0	3.67
26	0.0	47.69
27	3.11	59.41
28	9.09	84.54
29	15.62	80.00
30	33.49	80.00
31	37.93	79.29
32	31.20	38.25
33	21.99	26.67
34	30.00	15.10
35	22.22	16.47
36	19.61	28.05
37	20.00	20.38
38	18.33	(1)
39	6.55	(1)
40	15.82	(1)
41	23.63	(1)
42	17.51	(1)
43	14.19	62.52
44	16.64	69.36
45	27.77	60.00
46	37.03	63.79
47	47.36	75.36
48	54.77	80.00
49	57.70	80.00
50	54.03	79.92
51	58.00	65.03
52	58.65	43.23
53	62.88	50.00
54	69.83	50.00
55	72.00	42.05
56	75.81	40.00
57	84.22	42.20
58	83.86	41.28
59	80.55	(1)
60	80.51	(1)
61	78.00	(1)
62	79.79	(1)
63	80.33	30.54
64	85.58	42.12
65	81.78	50.00
66	78.00	50.00
67	80.74	43.16
68	92.10	73.65
69	88.01	(1)
70	84.00	(1)
71	84.00	(1)
72	81.17	(1)
73	70.46	(1)
74	66.00	13.57
75	62.23	29.43
76	64.00	20.00
77	63.48	17.42
78	60.34	10.00
79	56.85	10.00
80	56.00	(1)
81	52.45	(1)
82	39.91	10.00
83	36.38	10.00
84	30.00	10.00
85	27.93	10.00
86	26.00	16.74
87	27.66	3.36
88	28.00	(1)
89	27.41	(1)
90	20.96	(1)
91	12.15	(1)
92	3.61	(1)
93	0.0	0.0
94	0.0	0.0
95	0.0	0.91
96	0.0	7.52
97	0.0	0.0
98	0.0	0.0
99	0.0	0.0
100	0.0	0.0
101	0.0	0.0
102	0.0	0.0
103	0.0	0.0
104	0.0	0.0
105	0.0	0.0
106	0.0	0.0
107	0.0	0.0
108	0.0	0.0
109	0.0	0.0
110	0.0	0.0
111	0.0	0.0
112	0.0	0.0
113	0.0	0.0
114	0.0	0.0
115	0.0	0.0
116	0.0	0.0
117	0.0	0.0
118	0.0	0.0
119	0.0	0.0
120	0.0	0.0
121	0.0	0.0
122	0.0	0.0
123	0.0	0.0
124	0.0	0.0
125	0.0	0.0
126	0.0	0.0
127	0.0	0.0
128	0.0	0.0
129	1.77	(1)
130	1.60	(1)
131	0.0	0.0
132	0.0	0.0
133	2.14	9.26
134	3.08	0.0
135	0.0	0.0
136	0.0	0.0
137	0.0	0.0
138	0.0	0.0
139	0.0	0.0
140	0.0	0.0
141	0.0	0.0
142	0.0	0.0
143	0.0	0.0
144	0.0	0.0
145	0.0	0.0
146	0.0	0.0
147	0.0	5.51
148	0.0	11.34
149	0.0	0.0
150	0.0	0.0
151	0.0	0.0
152	0.0	0.0
153	0.0	0.0
154	0.0	0.0
155	0.0	0.0
156	0.0	0.0
157	0.0	0.0
158	0.0	0.21
159	0.0	30.00
160	0.0	26.79
161	0.0	20.00
162	0.0	20.00
163	0.0	4.12
164	0.0	0.0
165	0.0	0.0
166	0.0	0.0
167	0.0	0.0
168	0.0	0.0
169	0.0	0.0
170	0.0	0.0
171	0.0	0.0
172	0.0	0.0
173	0.0	0.0
174	0.0	0.0
175	0.0	0.0
176	0.0	0.0
177	0.0	0.0
178	0.0	0.0
179	0.0	0.0
180	0.0	0.0
181	0.0	0.0
182	0.0	0.0
183	0.0	0.0
184	0.0	20.00
185	0.0	20.00
186	0.0	11.73
187	0.0	0.0
188	0.0	0.0
189	0.0	0.0
190	0.0	0.0
191	0.0	0.0
192	0.0	0.0
193	0.0	0.0
194	0.0	0.0
195	0.0	0.0
196	0.0	0.0
197	0.0	0.0
198	0.0	0.0
199	0.0	0.0
200	0.0	0.0
201	0.0	0.0
202	0.0	0.0
203	0.0	0.0
204	0.0	0.0
205	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
206	0.0	0.0
207	0.0	0.0
208	0.0	0.0
209	0.0	0.0
210	0.0	0.0
211	0.0	0.0
212	0.0	0.0
213	0.0	0.0
214	0.0	73.41
215	0.0	90.00
216	31.30	81.30
217	41.15	90.00
218	44.00	90.00
219	46.41	90.00
220	51.04	82.41
221	66.66	80.00
222	75.03	90.00
223	89.85	90.00
224	96.78	93.88
225	96.91	50.94
226	94.60	17.02
227	99.16	28.60
228	100.00	39.83
229	100.00	30.00
230	100.00	26.69
231	100.00	20.00
232	100.71	20.00
233	100.00	36.06
234	96.16	40.00
235	95.77	30.00
236	94.55	32.75
237	96.86	35.68
238	99.18	30.00
239	100.00	44.93
240	101.81	50.00
241	86.54	(1)
242	63.56	(1)
243	56.00	(1)
244	46.00	(1)
245	41.86	45.18
246	38.31	78.47
247	35.96	80.00
248	31.03	80.00
249	25.36	80.00
250	23.05	60.97
251	18.20	27.34
252	12.64	43.71
253	10.10	68.95
254	3.79	66.95
255	1.48	44.28
256	0.0	0.0
257	0.0	0.0
258	0.0	0.0
259	0.0	0.0
260	0.0	0.0
261	0.0	0.0
262	0.0	0.0
263	0.0	24.97
264	0.0	17.16
265	0.0	6.20
266	0.0	10.00
267	0.0	10.00
268	0.0	0.0
269	0.0	0.0
270	0.0	0.0
271	0.0	0.0
272	0.0	0.0
273	0.0	0.0
274	0.0	0.0
275	0.0	0.0
276	0.0	0.0
277	0.0	0.0
278	0.0	0.0
279	0.0	0.0
280	0.0	0.0
281	0.0	0.0
282	0.0	0.0
283	0.0	0.0
284	0.0	0.0
285	0.0	0.0
286	0.0	0.0
287	0.0	0.0
288	0.0	0.0
289	0.0	0.0
290	0.0	0.0
291	0.0	0.0
292	0.0	0.0
293	0.0	0.0
294	0.0	0.0
295	0.0	0.0
296	0.0	0.0
297	0.0	0.0
298	0.0	0.0
299	0.0	0.0
300	0.0	0.0
301	0.0	0.0
302	0.0	0.0
303	0.0	0.0
304	0.0	0.0
305	0.0	0.0
306	0.0	0.0
307	0.0	0.0
308	0.0	0.0
309	0.0	0.0
310	0.0	0.0
311	0.0	0.0
312	0.0	0.0
313	0.0	0.0
314	0.0	0.0
315	0.0	0.0
316	0.0	0.0
317	0.0	0.0
318	0.0	0.0
319	0.0	0.0
320	0.0	0.0
321	0.0	15.55
322	0.0	20.00
323	24.18	19.08
324	23.00	10.00
325	11.56	1.86
326	6.87	(1)
327	6.00	(1)
328	0.72	(1)
329	0.0	0.0
330	0.0	0.0
331	0.0	0.0
332	0.0	0.0
333	0.0	0.0
334	0.0	0.0
335	0.0	0.0
336	0.0	0.0
337	0.0	0.0
338	0.0	0.0
339	0.0	0.0
340	0.0	0.0
341	0.0	0.0
342	0.0	0.0
343	0.0	0.0
344	0.0	0.0
345	0.0	0.0
346	0.0	0.0
347	0.0	0.0
348	0.0	0.0
349	0.0	0.0
350	0.0	0.0
351	0.0	0.0
352	0.0	0.0
353	0.0	0.0
354	0.0	0.0
355	0.0	0.0
356	0.0	0.0
357	0.0	0.0
358	0.0	0.0
359	0.0	0.0
360	0.0	0.0
361	0.0	0.0
362	0.0	0.0
363	0.0	0.0
364	0.0	0.0
365	0.0	0.0
366	0.0	0.0
367	0.0	0.0
368	0.0	0.0
369	0.0	0.0
370	0.0	0.0
371	0.0	0.0
372	0.0	0.0
373	0.0	0.0
374	0.0	0.0
375	0.0	0.0
376	0.0	0.0
377	0.0	29.59
378	−1.50	67.46
379	8.88	100.00
380	46.04	100.00
381	76.89	100.00
382	80.00	100.00
383	82.14	94.64
384	85.39	83.07
385	87.70	88.51
386	92.00	79.83
387	92.00	61.66
388	94.58	66.77
389	102.88	60.00
390	106.00	72.76
391	109.18	8.43
392	111.91	(1)
393	82.00	(1)
394	79.33	(1)
395	71.15	(1)
396	68.84	(1)
397	78.35	49.17
398	82.00	70.00
399	80.65	69.46
400	92.85	60.00
401	97.48	60.00
402	98.95	60.00
403	100.74	60.00
404	103.68	43.17
405	104.00	10.04
406	80.62	20.00
407	83.37	20.00
408	81.06	15.29
409	80.00	10.00
410	76.86	(1)
411	74.11	(1)
412	71.60	(1)
413	70.58	(1)
414	78.00	(1)
415	80.29	1.45
416	80.54	17.30
417	78.23	11.13
418	78.45	19.55
419	84.36	24.16
420	72.16	80.00
421	79.10	74.83
422	90.09	16.04
423	74.04	(1)
424	68.02	(1)
425	68.53	(1)
426	59.39	(1)
427	63.54	(1)
428	70.00	2.38
429	73.10	17.76
430	72.13	(1)
431	67.27	(1)
432	36.03	(1)
433	20.75	(1)
434	11.49	(1)
435	−2.09	0.0
436	−0.73	0.0
437	8.57	60.00
438	30.55	61.93
439	67.10	63.00
440	86.03	39.85
441	89.33	30.00
442	91.64	30.00
443	97.88	10.40
444	97.73	1.37
445	96.00	10.00
446	96.00	0.96
447	96.00	(1)
448	85.27	28.34
449	87.54	30.76
450	86.16	29.18
451	88.00	20.00
452	87.21	20.00
453	86.00	20.00
454	87.42	20.00
455	88.00	11.32
456	77.84	(1)
457	72.00	(1)
458	71.32	(1)
459	70.00	0.04
460	70.00	(1)
461	74.88	(1)
462	74.06	(1)
463	67.74	(1)
464	66.00	(1)
465	64.23	(1)
466	62.00	(1)
467	55.94	(1)
468	54.00	(1)
469	66.43	(1)
470	75.21	70.00
471	86.00	54.53
472	86.00	24.56
473	88.81	(1)
474	90.00	(1)
475	105.48	(1)
476	74.00	(1)
477	73.34	(1)
478	71.02	10.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
479	76.46	29.38
480	81.61	40.00
481	78.16	30.39
482	74.13	26.46
483	90.00	0.0
484	90.87	0.0
485	92.00	(1)
486	93.50	(1)
487	94.00	(1)
488	94.13	(1)
489	88.96	(1)
490	63.25	(1)
491	62.00	(1)
492	49.54	45.37
493	52.49	86.99
494	64.00	90.00
495	64.99	90.00
496	17.93	93.22
497	78.87	95.21
498	82.00	83.64
499	86.76	80.00
500	93.71	80.00
501	94.87	80.00
502	103.60	80.00
503	101.23	41.89
504	95.48	24.85
505	98.00	50.00
506	99.79	50.00
507	106.21	46.82
508	110.84	(1)
509	98.55	(1)
510	70.95	(1)
511	67.27	(1)
512	60.96	(1)
513	48.03	(1)
514	52.31	(1)
515	54.00	(1)
516	65.27	(1)
517	78.00	(1)
518	57.61	(1)
519	42.58	(1)
520	38.81	(1)
521	22.37	(1)
522	3.52	(1)
523	0.0	0.0
524	−1.46	36.39
525	−0.23	5.75
526	0.0	0.0
527	0.0	0.0
528	0.0	0.0
529	0.0	0.0
530	0.0	0.0
531	0.0	0.0
532	0.0	0.0
533	0.0	0.0
534	0.0	0.0
535	0.0	0.0
536	0.0	0.0
537	0.0	0.0
538	0.0	0.0
539	0.0	0.0
540	0.0	0.0
541	0.0	0.0
542	0.0	0.0
543	0.0	0.0
544	0.0	(1)
545	0.0	0.0
546	−0.75	0.0
547	−0.56	0.0
548	4.00	(1)
549	0.68	(1)
550	0.0	0.0
551	0.0	0.0
552	0.0	2.60
553	0.0	20.00
554	0.0	20.00
555	0.0	7.98
556	0.0	0.0
557	0.0	0.0
558	0.0	78.53
559	1.85	60.00
560	11.10	63.88
561	16.00	70.00
562	30.05	70.00
563	42.88	70.00
564	56.10	70.00
565	63.39	66.52
566	70.66	59.94
567	72.98	80.00
568	77.87	86.46
569	88.03	90.00
570	90.00	90.00
571	92.23	100.00
572	94.00	100.00
573	94.86	100.00
574	96.00	100.00
575	97.49	100.00
576	108.84	100.00
577	110.00	83.92
578	104.77	(1)
579	87.50	(1)
580	90.00	0.0
581	91.38	(1)
582	81.84	(1)
583	65.99	(1)
584	63.68	(1)
585	60.73	(1)
586	57.05	(1)
587	53.47	(1)
588	50.42	(1)
589	44.31	(1)
590	37.58	37.91
591	33.48	20.00
592	31.16	20.00
593	28.65	20.00
594	22.13	20.00
595	9.31	(1)
596	0.0	0.0
597	0.0	0.0
598	0.0	0.0
599	0.0	0.0
600	0.0	0.0
601	0.0	0.0
602	0.0	0.0
603	0.0	0.0
604	0.0	0.0
605	0.0	0.0
606	2.52	6.30
607	10.30	17.87
608	13.89	20.00
609	20.20	20.00
610	24.07	22.59
611	33.33	17.50
612	40.30	(1)
613	47.85	(1)
614	66.00	7.78
615	68.00	10.93
616	67.59	32.04
617	66.00	40.00
618	67.04	40.00
619	68.00	40.00
620	68.00	48.33
621	75.93	99.53
622	78.00	100.00
623	78.00	100.00
624	77.07	100.00
625	76.00	100.00
626	76.00	100.00
627	76.00	100.00
628	75.63	100.00
629	73.00	97.50
630	76.81	90.00
631	80.26	90.00
632	83.44	90.00
633	84.00	98.79
634	84.00	100.00
635	83.61	100.00
636	82.00	100.00
637	83.02	94.91
638	86.67	90.00
639	89.65	90.00
640	90.00	99.81
641	89.45	100.00
642	86.00	100.00
643	86.00	95.47
644	87.22	90.00
645	88.00	90.00
646	88.00	80.74
647	88.00	79.17
648	88.00	77.21
649	88.00	100.00
650	88.00	94.45
651	88.00	90.00
652	88.00	90.00
653	90.00	90.00
654	89.63	90.00
655	88.66	90.00
656	90.00	90.00
657	90.00	90.00
658	91.63	81.86
659	92.00	80.00
660	90.00	81.29
661	89.43	92.86
662	87.11	100.00
663	86.00	100.00
664	86.00	100.00
665	89.66	100.00
666	90.00	99.27
667	90.46	90.00
668	92.78	90.00
669	95.09	90.00
670	100.22	82.97
671	102.00	80.00
672	102.00	70.18
673	102.00	80.00
674	97.34	50.07
675	87.02	(1)
676	86.00	(1)
677	73.12	22.19
678	75.77	39.62
679	75.76	48.80
680	75.11	37.23
681	78.00	34.34
682	80.37	40.00
683	77.51	47.49
684	81.44	50.00
685	82.13	39.36
686	84.00	27.79
687	84.00	16.21
688	84.00	15.36
689	85.39	26.93
690	86.00	30.00
691	86.00	30.08
692	85.67	40.00
693	84.65	40.00
694	86.00	35.20
695	87.28	30.00
696	88.00	22.05
697	86.09	(1)
698	83.78	(1)
699	81.47	(1)
700	81.70	(1)
701	85.16	(1)
702	84.52	(1)
703	82.21	(1)
704	79.89	(1)
705	77.58	(1)
706	76.00	6.31
707	79.16	0.0
708	75.16	27.36
709	72.00	40.00
710	72.00	40.00
711	74.00	38.44
712	74.00	30.00
713	74.00	30.00
714	74.00	36.28
715	72.43	47.86
716	68.23	59.43
717	73.80	50.00
718	72.52	50.00
719	74.00	45.85
720	72.85	57.18
721	76.38	62.70
722	81.55	60.00
723	80.18	60.00
724	83.60	60.00
725	83.44	56.40
726	86.00	50.00
727	87.35	50.00
728	86.34	50.00
729	86.00	40.11
730	88.29	61.47
731	88.78	63.92
732	86.92	50.00
733	86.76	50.00
734	87.55	42.24
735	88.00	49.34
736	86.00	50.91
737	86.00	67.45
738	86.00	81.88
739	87.13	70.00
740	89.44	77.21
741	91.76	88.78
742	90.07	89.65
743	92.00	80.00
744	92.70	80.00
745	94.00	80.00
746	94.00	80.00
747	94.00	80.00
748	94.00	80.00
749	94.00	81.37
750	94.59	87.05
751	96.00	57.40

Record (section)	Percent		Record (section)	Percent		Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque		Normalized revolutions per minute	Normalized torque		Normalized revolutions per minute	Normalized torque
752	96.00	42.19	843	104.00	69.29	934	31.20	38.25
753	96.00	42.33	844	106.00	70.00	935	21.99	26.67
754	96.00	40.00	845	106.00	62.70	936	30.00	15.10
755	96.00	38.37	846	106.00	40.00	937	22.23	16.47
756	96.00	12.83	847	104.88	40.00	938	19.61	28.05
757	96.00	(1)	848	104.00	32.85	939	20.00	20.38
758	96.00	(1)	849	104.00	30.00	940	18.33	(1)
759	96.00	(1)	850	104.00	0.30	941	6.55	(1)
760	97.74	7.37	851	103.63	11.87	942	15.82	(1)
761	100.05	19.74	852	100.62	13.12	943	23.63	(1)
762	102.00	11.83	853	98.00	5.01	944	17.51	(1)
763	102.00	26.81	854	96.68	10.00	945	14.19	62.52
764	103.00	49.96	855	96.00	(1)	946	16.64	69.36
765	104.00	60.00	856	96.00	(1)	947	27.77	60.00
766	102.97	60.00	857	96.00	(1)	948	37.03	63.79
767	103.94	60.00	858	95.43	(1)	949	47.36	75.36
768	104.00	40.00	859	94.00	(1)	950	54.77	80.00
769	104.00	25.75	860	94.00	(1)	951	57.70	60.00
770	103.12	(1)	861	95.52	5.18	952	54.03	79.92
771	100.80	(1)	862	97.83	(1)	953	58.00	65.03
772	100.00	(1)	863	98.00	(1)	954	58.65	43.23
773	101.63	44.88	864	98.00	(1)	955	62.88	50.00
774	102.00	36.40	865	97.22	(1)	956	69.83	50.00
775	102.00	(1)	866	96.00	6.35	957	72.00	42.05
776	102.00	(1)	867	96.00	12.98	958	75.81	40.00
777	100.91	(1)	868	96.00	10.00	959	84.22	42.20
778	101.40	(1)	869	95.53	10.00	960	83.86	41.28
779	100.28	(1)	870	92.00	10.00	961	80.55	(1)
780	97.97	(1)	871	92.00	10.00	962	80.51	(1)
781	96.00	(1)	872	92.98	14.89	963	78.00	(1)
782	96.00	10.00	873	94.00	13.54	964	79.79	(1)
783	96.00	0.23	874	90.79	42.12	965	80.33	30.54
784	96.00	(1)	875	88.08	40.40	966	85.58	42.12
785	96.00	(1)	876	86.23	30.00	967	81.78	50.00
786	94.08	(1)	877	88.00	32.75	968	78.00	50.00
787	78.00	(1)	878	87.14	44.32	969	80.74	43.16
788	77.45	(1)	879	84.82	50.00	970	92.10	73.65
789	71.67	28.96	880	82.51	50.00	971	88.01	(1)
790	67.18	80.00	881	82.00	50.00	972	84.00	(1)
791	66.50	87.48	882	82.12	40.00	973	84.00	(1)
792	71.43	90.00	883	83.13	35.64	974	81.17	(1)
793	74.13	90.00	884	80.00	20.00	975	70.46	(1)
794	75.56	92.20	885	84.26	51.95	976	66.00	13.57
795	74.75	100.00	886	86.62	66.21	977	62.23	29.43
796	77.07	94.65	887	84.31	60.00	978	64.00	20.00
797	79.38	83.08	888	81.99	9.96	979	63.48	17.42
798	80.00	71.51	889	79.35	1.61	980	60.34	10.00
799	80.01	69.93	890	75.36	19.56	981	56.85	10.00
800	82.33	56.36	891	73.05	40.00	982	56.00	(1)
801	84.00	50.00	892	70.73	8.35	983	52.45	(1)
802	84.00	59.58	893	68.42	(1)	984	39.91	10.00
803	84.00	76.36	894	47.15	8.95	985	36.38	10.00
804	84.00	60.00	895	35.79	10.00	986	30.00	10.00
805	84.00	70.49	896	32.95	7.38	987	27.93	10.00
806	82.00	80.00	897	29.16	(1)	988	26.00	16.74
807	81.47	82.66	898	16.47	(1)	989	27.66	3.36
808	80.00	90.00	899	2.13	(1)	990	28.00	(1)
809	77.68	90.00	900	0.0	0.0	991	27.41	(1)
810	74.52	75.24	901	0.0	0.0	992	20.96	(1)
811	77.58	76.96	902	0.0	0.0	993	12.15	(1)
812	81.89	80.00	903	0.0	0.0	994	3.81	(1)
813	80.42	80.00	904	0.0	0.0	995	0.0	0.0
814	82.00	83.88	905	0.0	0.0	996	0.0	0.0
815	83.05	79.50	906	0.0	0.0	977	0.0	0.91
816	84.00	70.00	907	0.0	0.0	988	0.0	7.52
817	84.00	61.60	908	0.0	0.0	999	0.0	0.0
818	84.00	50.03	909	0.0	0.0	1,000	0.0	0.0
819	86.00	60.00	910	0.0	0.0	1,001	0.0	0.0
820	86.00	60.00	911	0.0	0.0	1,002	0.0	0.0
821	86.00	69.39	912	0.0	0.0	1,003	0.0	0.0
822	88.51	73.73	913	0.0	0.0	1,004	0.0	0.0
823	88.43	70.00	914	0.0	0.0	1,005	0.0	0.0
824	88.00	70.00	915	0.0	0.0	1,006	0.0	0.0
825	94.00	70.99	916	0.0	0.0	1,007	0.0	0.0
826	94.51	80.00	917	0.0	0.0	1,008	0.0	0.0
827	95.17	80.00	918	0.0	0.0	1,009	0.0	0.0
828	95.14	80.00	919	0.0	0.0	1,010	0.0	0.0
829	94.54	80.00	920	0.0	0.0	1,011	0.0	0.0
830	94.00	80.00	921	0.0	0.0	1,012	0.0	0.0
831	94.00	77.89	922	0.0	0.0	1,013	0.0	0.0
832	94.00	31.99	923	0.0	0.0	1,014	0.0	0.0
833	94.00	43.57	924	0.0	0.0	1,015	0.0	0.0
834	94.00	60.28	925	0.0	0.0	1,016	0.0	0.0
835	94.00	63.29	926	0.0	0.0	1,017	0.0	0.0
836	94.00	76.57	927	0.0	3.67	1,018	0.0	0.0
837	94.00	89.86	928	0.0	47.69	1,019	0.0	0.0
838	94.29	90.00	929	3.11	59.41	1,020	0.0	0.0
839	97.80	87.00	930	9.09	84.54	1,021	0.0	0.0
840	102.91	80.00	931	15.62	80.00	1,022	0.0	0.0
841	104.00	73.85	932	33.49	80.00	1,023	0.0	0.0
842	104.00	62.28	933	37.93	79.29	1,024	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1,025	0.0	0.0
1,026	0.0	0.0
1,027	0.0	0.0
1,028	0.0	0.0
1,029	0.0	0.0
1,030	0.0	0.0
1,031	1.77	(1)
1,032	1.60	(1)
1,033	0.0	0.0
1,034	0.0	0.0
1,035	2.14	9.28
1,036	3.08	0.0
1,037	0.0	0.0
1,038	0.0	0.0
1,039	0.0	0.0
1,040	0.0	0.0
1,041	0.0	0.0
1,042	0.0	0.0
1,043	0.0	0.0
1,044	0.0	0.0
1,045	0.0	0.0
1,046	0.0	0.0
1,047	0.0	0.0
1,048	0.0	0.0
1,049	0.0	5.51
1,050	0.0	11.34
1,051	0.0	0.0
1,052	0.0	0.0
1,053	0.0	0.0
1,054	0.0	0.0
1,055	0.0	0.0
1,056	0.0	0.0
1,057	0.0	0.0
1,058	0.0	0.0
1,059	0.0	0.0
1,060	0.0	0.21
1,061	0.0	30.00
1,062	0.0	26.78
1,063	0.0	20.00
1,064	0.0	20.00
1,065	0.0	4.12
1,066	0.0	0.0
1,067	0.0	0.0
1,068	0.0	0.0
1,069	0.0	0.0
1,070	0.0	0.0
1,071	0.0	0.0
1,072	0.0	0.0
1,073	0.0	0.0
1,074	0.0	0.0
1,075	0.0	0.0
1,076	0.0	0.0
1,077	0.0	0.0
1,078	0.0	0.0
1,079	0.0	0.0
1,080	0.0	0.0
1,081	0.0	0.0
1,082	0.0	0.0
1,083	0.0	0.0
1,084	0.0	0.0
1,085	0.0	0.0
1,086	0.0	20.00
1,087	0.0	20.00
1,088	0.0	11.73
1,089	0.0	0.0
1,090	0.0	0.0
1,091	0.0	0.0
1,092	0.0	0.0
1,093	0.0	0.0
1,094	0.0	0.0
1,095	0.0	0.0
1,096	0.0	0.0
1,097	0.0	0.0
1,098	0.0	0.0
1,099	0.0	0.0
1,100	0.0	0.0
1,101	0.0	0.0
1,102	0.0	0.0
1,103	0.0	0.0
1,104	0.0	0.0
1,105	0.0	0.0
1,106	0.0	0.0
1,107	0.0	0.0
1,108	0.0	0.0
1,109	0.0	0.0
1,110	0.0	0.0
1,111	0.0	0.0
1,112	0.0	0.0
1,113	0.0	0.0
1,114	0.0	0.0
1,115	0.0	0.0
1,116	0.0	73.41
1,117	0.0	90.00
1,118	31.30	81.30
1,119	41.15	90.00
1,120	44.00	90.00
1,121	46.41	90.00
1,122	51.04	82.41
1,123	66.66	80.00
1,124	75.03	90.00
1,125	89.85	90.00
1,126	96.78	93.88
1,127	96.91	50.94
1,128	94.60	17.02
1,129	99.16	28.60
1,130	100.00	39.83
1,131	100.00	30.00
1,132	100.00	26.69
1,133	100.98	20.00
1,134	100.71	20.00
1,135	100.00	36.06
1,136	96.16	40.00
1,137	95.77	30.00
1,138	94.55	32.75
1,139	96.86	35.68
1,140	99.18	30.00
1,141	100.00	44.93
1,142	101.81	50.00
1,143	66.54	(1)
1,144	63.56	(1)
1,145	56.00	(1)
1,146	46.00	(1)
1,147	41.86	45.18
1,148	38.31	78.47
1,149	35.98	80.00
1,150	31.03	80.00
1,151	25.36	80.00
1,152	23.05	60.97
1,153	18.20	27.34
1,154	12.84	43.71
1,155	10.10	68.95
1,156	3.79	68.95
1,157	1.48	44.28
1,158	0.0	0.0
1,159	0.0	0.0
1,160	0.0	0.0
1,161	0.0	0.0
1,162	0.0	0.0
1,163	0.0	0.0
1,164	0.0	0.0
1,165	0.0	24.97
1,166	0.0	17.16
1,167	0.0	6.20
1,168	0.0	10.00
1,169	0.0	10.00
1,170	0.0	0.0
1,171	0.0	0.0
1,172	0.0	0.0
1,173	0.0	0.0
1,174	0.0	0.0
1,175	0.0	0.0
1,176	0.0	0.0
1,177	0.0	0.0
1,178	0.0	0.0
1,179	0.0	0.0
1,180	0.0	0.0
1,181	0.0	0.0
1,182	0.0	0.0
1,183	0.0	0.0
1,184	0.0	0.0
1,185	0.0	0.0
1,186	0.0	0.0
1,187	0.0	0.0
1,188	0.0	0.0
1,189	0.0	0.0
1,190	0.0	0.0
1,191	0.0	0.0
1,192	0.0	0.0
1,193	0.0	0.0
1,194	0.0	0.0
1,195	0.0	0.0
1,196	0.0	0.0
1,197	0.0	0.0
1,198	0.0	0.0
1,199	0.0	0.0

[1] Closed rack.

(3) Optional EPA Engine Dynamometer Schedule for Heavy-Duty Gasoline-Fueled Engines.

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	−1.78	44.40
26	0.0	85.35
27	4.25	100.00
28	27.47	100.00
29	42.96	100.00
30	45.79	100.00
31	48.11	99.46
32	50.42	90.00
33	52.74	75.23
34	54.00	50.00
35	44.42	8.96
36	45.05	−10.00
37	46.00	9.99
38	37.69	−10.00
39	31.61	5.68
40	22.94	35.29
41	24.00	4.87
42	20.86	−10.00
43	12.45	−10.00
44	6.00	−10.00
45	6.52	−10.00
46	7.17	−10.00
47	2.56	−10.00
48	0.0	0.0
49	0.0	0.0
50	0.0	0.0
51	0.0	10.11
52	4.32	46.40
53	8.90	45.17
54	1.95	50.00
55	3.33	41.68
56	4.00	89.46
57	13.76	55.60
58	26.43	26.98
59	33.85	6.16
60	36.00	−10.00
61	34.45	−10.00
62	34.00	−10.00
63	35.64	−10.00
64	32.99	27.39
65	36.00	80.00
66	41.63	74.37
67	60.41	26.76
68	48.44	−10.00
69	43.86	−10.00
70	40.39	−10.00
71	36.50	4.01
72	35.05	30.00
73	40.66	16.70
74	43.64	26.45
75	45.96	−10.00
76	47.10	−10.00
77	49.29	−10.00
78	37.10	−10.00
79	36.00	−10.00
80	34.47	−10.00
81	32.15	−10.00
82	31.67	−10.00
83	28.48	13.89
84	32.38	90.00
85	36.00	90.00
86	41.69	90.00
87	45.74	90.00
88	49.95	80.00
89	49.10	80.00
90	50.59	62.97
91	45.99	34.98

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
92	42.76	7.23
93	35.12	−10.00
94	32.06	67.92
95	35.53	62.55
96	46.57	68.60
97	49.77	48.85
98	52.00	60.00
99	58.06	60.00
100	63.66	23.42
101	64.14	17.84
102	59.58	3.76
103	38.00	42.26
104	39.09	30.00
105	40.00	30.00
106	34.85	47.18
107	32.03	10.33
108	34.00	33.48
109	34.00	50.00
110	33.02	20.69
111	25.54	−10.00
112	15.57	−10.00
113	14.00	−10.00
114	14.47	27.64
115	16.00	4.49
116	17.13	−10.00
117	16.00	−10.00
118	10.02	−10.00
119	8.81	−10.00
120	5.88	−10.00
121	4.00	−10.00
122	4.00	−10.00
123	2.93	−10.00
124	0.62	−10.00
125	0.0	0.0
126	0.0	0.0
127	0.0	0.0
128	0.0	0.0
129	0.0	0.0
130	0.0	10.00
131	0.0	10.00
132	0.0	29.02
133	0.0	27.83
134	0.0	7.34
135	0.0	0.0
136	0.0	0.0
137	0.0	0.0
138	0.0	0.0
139	0.0	0.0
140	0.0	0.0
141	0.0	0.0
142	0.0	0.0
143	0.0	0.0
144	0.0	0.0
145	0.0	0.0
146	2.00	0.0
147	1.38	0.0
148	0.0	0.0
149	0.0	6.27
150	0.0	2.16
151	0.0	0.0
152	0.0	0.0
153	0.0	0.0
154	0.83	−10.00
155	2.00	−10.00
156	0.54	−10.00
157	0.0	0.0
158	0.0	0.0
159	0.0	0.0
160	0.0	0.0
161	0.0	0.0
162	0.0	0.0
163	0.0	0.0
164	0.0	0.0
165	0.0	0.0
166	0.0	0.0
167	0.0	22.01
168	1.23	72.29
169	6.63	80.00
170	17.29	89.29
171	22.17	90.00
172	24.00	82.70
173	24.00	31.96
174	24.00	−10.00
175	22.57	−10.00
176	22.00	−10.00
177	13.88	−10.00
178	10.00	−10.00
179	9.31	−10.00
180	3.99	−10.00
181	0.0	0.0
182	0.0	0.0
183	0.0	0.0
184	0.0	0.0
185	0.0	0.0
186	0.0	0.0
187	0.0	0.0
188	0.0	0.0
189	0.0	0.0
190	0.0	0.0
191	0.0	0.0
192	0.0	0.0
193	0.0	0.0
194	0.0	0.0
195	0.0	0.0
196	0.0	0.0
197	0.0	0.0
198	0.0	0.0
199	0.0	0.0
200	0.0	0.0
201	0.0	0.0
202	0.0	0.0
203	0.0	0.0
204	−2.52	6.30
205	−4.22	15.26
206	0.0	10.00
207	0.0	10.00
208	0.0	10.00
209	0.0	75.93
210	0.0	32.22
211	1.67	35.00
212	15.48	29.82
213	25.46	−10.00
214	24.22	−10.00
215	23.44	−10.00
216	12.41	80.00
217	8.94	83.61
218	7.26	84.82
219	16.70	80.00
220	24.67	63.33
221	0.24	79.81
222	0.0	8.52
223	0.0	0.0
224	0.0	0.0
225	0.0	0.0
226	0.0	0.0
227	0.0	0.0
228	0.0	0.0
229	0.0	0.0
230	0.0	0.0
231	0.0	0.0
232	0.0	0.0
233	0.0	17.59
234	0.0	19.63
235	0.0	10.00
236	0.0	10.00
237	0.0	10.00
238	0.0	3.34
239	0.0	0.0
240	0.0	0.0
241	0.0	0.0
242	0.0	0.0
243	0.0	0.0
244	0.0	0.0
245	0.0	0.0
246	0.0	0.0
247	0.0	0.0
248	0.0	0.0
249	0.0	0.0
250	0.0	0.0
251	0.0	0.0
252	0.0	0.0
253	0.0	0.0
254	0.0	0.0
255	0.0	0.0
256	0.0	0.0
257	0.0	0.0
258	0.0	0.0
259	0.0	0.0
260	0.0	0.0
261	0.0	0.0
262	0.0	0.0
263	0.0	0.0
264	0.0	0.0
265	0.0	0.0
266	0.0	0.0
267	0.0	0.0
268	0.0	0.0
269	0.0	0.0
270	0.0	0.0
271	0.0	0.0
272	0.0	0.0
273	0.0	0.0
274	0.0	0.0
275	0.0	0.0
276	0.0	0.0
277	0.0	0.0
278	0.0	0.0
279	0.0	0.0
280	0.0	0.0
281	0.0	4.17
282	1.15	10.00
283	2.00	10.00
284	0.22	10.00
285	0.0	0.0
286	0.0	0.0
287	0.0	0.0
288	0.0	0.0
289	0.0	0.0
290	0.0	0.0
291	0.0	0.0
292	0.0	0.0
293	0.0	0.0
294	0.0	0.0
295	0.0	0.0
296	0.0	0.0
297	0.0	0.0
298	0.0	0.0
299	0.0	0.0
300	0.0	4.07
301	0.0	10.00
302	0.0	17.22
303	0.0	20.00
304	0.0	20.37
305	2.33	31.94
306	16.22	36.48
307	24.00	24.91
308	24.00	13.34
309	19.06	10.00
310	18.00	−10.00
311	17.17	−10.00
312	9.04	−10.00
313	1.09	−10.00
314	0.0	0.0
315	0.0	0.0
316	0.0	0.0
317	0.0	0.0
318	0.0	0.0
319	0.0	0.0
320	0.0	0.0
321	0.0	0.0
322	0.0	0.0
323	0.0	0.62
324	0.37	41.08
325	2.68	90.00
326	6.00	94.99
327	11.94	100.00
328	15.63	100.00
329	41.26	90.28
330	46.26	90.00
331	44.56	67.08
332	36.00	1.12
333	27.58	50.12
334	23.52	90.00
335	24.00	90.00
336	26.29	70.00
337	30.00	85.38
338	30.00	34.47
339	30.00	10.00
340	30.00	10.00
341	30.00	10.00
342	30.18	60.00
343	40.00	58.25
344	40.67	50.00
345	41.02	50.00
346	40.00	50.00
347	41.81	50.00
348	42.00	50.00
349	46.00	50.00
350	48.22	50.00
351	59.21	58.69
352	67.18	70.00
353	71.00	70.00
354	72.00	70.00
355	72.13	68.08
356	74.89	28.94
357	68.91	−10.00
358	49.71	−10.00
359	41.84	−10.00
360	38.30	−10.00
361	35.93	−10.00
362	28.00	−10.00
363	23.48	−10.00
364	10.16	−10.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
365	4.72	-10.00
366	0.82	5.90
367	-9.53	19.53
368	2.20	45.60
369	20.53	7.33
370	21.15	0.0
371	17.67	-10.00
372	13.04	-10.00
373	8.41	79.70
374	10.33	100.00
375	17.27	100.00
376	22.00	100.00
377	25.16	100.00
378	29.37	100.00
379	36.73	66.35
380	40.00	-10.00
381	23.50	-10.00
382	9.37	-10.00
383	8.00	-10.00
384	6.74	-10.00
385	2.86	-10.00
386	0.11	-10.00
387	0.0	0.0
388	0.0	0.0
389	0.0	0.0
390	0.0	0.0
391	0.0	0.0
392	0.0	0.0
393	0.0	0.0
394	0.0	0.0
395	0.0	0.0
396	0.0	0.0
397	0.0	0.0
398	0.0	0.0
399	0.0	0.0
400	0.0	0.0
401	0.0	0.0
402	0.0	0.0
403	0.0	0.0
404	0.0	0.0
405	0.0	0.0
406	0.0	0.0
407	0.0	0.0
408	0.0	0.0
409	0.0	0.0
410	0.0	0.0
411	0.0	0.0
412	0.0	0.0
413	0.0	0.0
414	0.0	0.0
415	0.0	0.0
416	0.0	0.0
417	0.0	0.0
418	0.0	0.0
419	2.27	20.00
420	2.82	14.11
421	0.0	0.0
422	0.0	0.0
423	0.0	0.0
424	0.0	0.0
425	0.0	0.0
426	0.0	0.0
427	0.0	0.0
428	0.0	0.0
429	0.0	0.0
430	0.0	0.0
431	0.26	0.78
432	16.60	31.63
433	45.32	29.78
434	43.00	10.00
435	40.69	10.00
436	35.12	10.00
437	28.18	19.70
438	28.26	47.45
439	30.00	30.00
440	30.00	30.00
441	30.00	30.00
442	34.54	30.00
443	36.00	30.00
444	36.43	30.00
445	43.84	30.00
446	50.00	30.00
447	50.00	24.56
448	50.00	20.00
449	50.00	-10.00
450	37.97	-10.00
451	35.30	-10.00
452	30.68	-10.00
453	27.02	-10.00
454	26.00	-10.00
455	26.00	-10.00
456	20.24	-10.00
457	14.00	-10.00
458	13.45	18.27
459	9.40	52.99
460	10.72	81.81
461	15.50	97.48
462	19.62	100.00
463	20.25	100.00
464	25.76	100.00
465	35.02	100.00
466	42.14	94.65
467	44.00	90.00
468	45.70	90.00
469	51.99	60.00
470	50.00	60.00
471	51.29	63.22
472	54.96	70.00
473	56.00	70.00
474	62.35	38.25
475	71.61	30.00
476	76.22	50.00
477	78.00	50.00
478	78.00	41.53
479	55.93	12.58
480	38.52	0.0
481	34.42	71.65
482	36.11	79.47
483	38.84	67.90
484	42.74	60.00
485	44.00	54.75
486	49.46	36.35
487	52.00	30.00
488	32.05	-10.00
489	25.69	0.0
490	24.00	0.0
491	24.00	-10.00
492	20.24	-10.00
493	10.16	68.43
494	8.00	80.58
495	10.20	80.99
496	13.54	90.00
497	18.00	94.13
498	20.28	100.00
499	22.00	100.00
500	23.77	91.15
501	26.08	90.00
502	30.00	86.01
503	32.85	80.70
504	32.86	100.00
505	33.37	100.00
506	36.00	100.00
507	51.77	100.00
508	60.57	95.72
509	64.00	70.00
510	64.91	70.00
511	75.83	70.00
512	82.00	70.00
513	85.72	51.42
514	86.17	49.14
515	88.49	35.13
516	90.00	15.99
517	91.12	26.74
518	92.00	32.85
519	93.74	30.00
520	89.29	-10.00
521	66.00	41.87
522	67.38	56.88
523	80.02	54.96
524	93.95	66.34
525	97.63	83.69
526	94.11	60.00
527	85.66	-10.00
528	70.00	-10.00
529	69.11	-10.00
530	66.80	-10.00
531	64.48	-10.00
532	53.00	44.98
533	52.73	49.27
534	62.00	40.00
535	62.00	43.88
536	64.18	44.55
537	53.36	4.88
538	46.28	15.79
539	46.00	19.83
540	45.65	10.00
541	45.99	10.00
542	46.05	10.00
543	44.71	3.54
544	46.82	-10.00
545	51.92	66.82
546	47.53	-10.00
547	36.31	9.23
548	17.73	55.58
549	29.43	38.22
550	36.00	37.46
551	36.00	40.00
552	34.00	40.00
553	34.00	40.00
554	34.00	36.25
555	38.26	24.88
556	43.38	61.38
557	50.78	46.12
558	52.00	19.92
559	52.32	0.0
560	52.09	3.19
561	48.00	10.00
562	48.00	10.00
563	48.00	10.00
564	30.94	19.48
565	28.00	20.00
566	28.00	20.00
567	28.00	15.81
568	28.00	10.00
569	26.53	10.00
570	26.00	10.00
571	23.71	-10.00
572	17.59	-10.00
573	11.65	-10.00
574	1.92	-10.00
575	0.0	0.0
576	0.0	0.0
577	0.0	0.0
578	0.0	0.0
579	0.0	0.0
580	0.0	0.0
581	0.0	0.0
582	0.0	0.0
583	1.26	25.19
584	6.72	47.87
585	13.67	40.56
586	16.20	80.00
587	18.52	80.00
588	25.83	75.83
589	35.15	70.00
590	38.93	77.31
591	41.78	80.00
592	40.00	10.00
593	40.00	20.18
594	40.00	52.78
595	40.00	34.82
596	40.00	30.00
597	40.00	38.33
598	40.00	30.09
599	38.30	100.00
600	40.61	100.00
601	42.00	100.00
602	42.00	100.00
603	42.00	100.00
604	42.00	100.00
605	42.00	100.00
606	42.50	97.50
607	43.19	85.93
608	43.13	85.65
609	44.00	90.00
610	44.00	90.00
611	44.00	80.00
612	44.00	80.00
613	44.70	80.00
614	46.00	74.91
615	46.00	63.34
616	46.00	60.00
617	46.00	60.00
618	44.00	10.00
619	44.00	10.00
620	43.09	10.00
621	42.00	10.00
622	42.00	10.00
623	43.85	19.26
624	50.00	90.00
625	50.00	90.00
626	50.00	90.00
627	50.00	90.00
628	50.00	90.00
629	48.26	90.00
630	48.00	69.73
631	48.37	80.00
632	49.32	80.00
633	48.00	80.00
634	48.00	80.00
635	48.00	80.00
636	48.00	70.28
637	48.00	70.00

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
638	48.00	70.00
639	48.00	74.44
640	48.00	61.96
641	49.52	50.00
642	50.00	50.00
643	50.00	40.00
644	50.00	44.62
645	50.78	60.00
646	52.00	49.09
647	52.00	40.00
648	52.00	40.00
649	52.04	40.89
650	54.00	90.00
651	54.00	90.00
652	54.00	85.10
653	55.29	73.53
654	56.00	70.00
655	56.00	70.00
656	56.00	60.00
657	56.00	57.23
658	56.00	50.00
659	56.00	38.17
660	56.00	30.00
661	56.00	30.00
662	54.00	39.36
663	54.00	27.79
664	54.00	20.00
665	54.00	20.00
666	54.00	20.00
667	54.00	11.49
668	54.00	0.08
669	54.00	13.31
670	54.00	30.00
671	54.96	30.00
672	57.28	30.00
673	56.41	30.00
674	57.91	30.00
675	58.22	36.60
676	60.00	90.00
677	60.00	90.00
678	60.00	95.82
679	60.00	92.60
680	60.00	90.00
681	60.00	90.00
682	60.42	90.00
683	62.74	90.00
684	65.05	90.00
685	66.00	83.16
686	66.00	71.59
687	66.00	70.00
688	66.00	70.00
689	66.00	73.14
690	66.00	80.00
691	66.00	86.28
692	66.00	90.00
693	66.00	90.00
694	68.20	100.00
695	70.00	100.00
696	70.00	100.00
697	70.00	100.00
698	74.38	100.00
699	76.00	100.00
700	72.09	100.00
701	73.60	100.00
702	72.00	100.00
703	72.00	100.00
704	72.00	100.00
705	72.00	100.00
706	72.00	100.00
707	72.29	100.00
708	73.39	100.00
709	72.92	100.00
710	74.00	100.00
711	74.00	100.00
712	77.73	100.00
713	78.00	100.00
714	77.50	100.00
715	76.00	100.00
716	76.00	100.00
717	76.00	100.00
718	72.49	100.00
719	71.79	100.00
720	67.16	100.00
721	72.70	100.00
722	75.02	100.00
723	73.34	100.00
724	73.64	91.78
725	74.00	31.21
726	78.27	28.63
727	80.00	17.05
728	80.00	5.48
729	80.00	−10.00
730	80.00	−10.00
731	80.00	63.93
732	84.00	80.00
733	85.43	82.39
734	87.62	93.96
735	84.00	100.00
736	84.00	100.00
737	84.00	91.32
738	86.00	100.00
739	86.73	100.00
740	90.00	96.59
741	91.99	90.00
742	94.00	90.00
743	95.63	81.87
744	96.00	89.70
745	100.00	98.72
746	100.57	78.60
747	102.88	50.00
748	104.00	73.99
749	104.00	90.00
750	104.00	25.98
751	103.71	20.00
752	99.54	20.00
753	98.00	20.00
754	99.09	25.44
755	98.60	65.08
756	103.15	80.00
757	100.03	80.00
758	102.35	80.00
759	104.00	73.38
760	104.00	55.11
761	101.42	30.62
762	98.39	11.97
763	57.65	−10.00
764	58.00	−10.00
765	57.45	−10.00
766	56.00	−10.00
767	56.00	−10.00
768	56.00	27.39
769	56.00	40.00
770	56.00	50.00
771	56.00	45.60
772	56.00	33.77
773	56.00	40.00
774	60.15	5.40
775	62.00	−10.00
776	62.00	−10.00
777	62.00	41.64
778	62.00	59.65
779	62.00	75.21
780	62.00	76.36
781	62.00	80.00
782	62.00	80.00
783	62.00	80.00
784	62.00	80.00
785	61.15	80.00
786	60.00	80.00
787	60.00	87.38
788	60.00	90.00
789	60.00	90.00
790	60.00	90.00
791	60.00	90.00
792	60.00	90.00
793	60.00	83.17
794	60.00	80.00
795	60.00	89.97
796	62.31	90.00
797	64.00	86.88
798	64.00	80.00
799	64.00	80.00
800	64.00	80.00
801	64.00	60.00
802	66.00	70.00
803	66.51	70.00
804	68.00	65.87
805	68.00	60.00
806	68.00	60.00
807	73.31	86.55
808	74.00	90.00
809	74.00	90.00
810	73.29	90.00
811	72.00	84.86
812	73.34	73.29
813	74.00	70.00
814	72.03	70.00
815	71.71	50.00
816	70.00	50.00
817	70.00	50.00
818	68.77	56.15
819	68.00	60.00
820	68.00	60.00
821	68.00	58.28
822	68.00	40.00
823	68.00	48.01
824	68.00	60.00
825	68.00	60.00
826	68.00	60.00
827	68.00	60.00
828	68.00	61.87
829	68.00	70.00
830	69.00	70.00
831	70.00	70.00
832	70.00	70.00
833	70.00	70.00
834	70.00	70.00
835	70.00	70.00
836	70.00	70.00
837	73.61	70.00
838	76.00	62.41
839	76.00	60.00
840	76.00	100.00
841	76.92	100.00
842	80.78	100.00
843	82.00	100.00
844	83.40	100.00
845	84.00	100.00
846	83.97	90.00
847	82.35	90.00
848	85.33	93.31
849	89.95	100.00
850	88.13	100.00
851	89.21	100.00
852	95.76	100.00
853	100.23	100.00
854	102.00	100.00
855	104.59	100.00
856	112.71	100.00
857	113.01	100.00
858	112.00	100.00
859	104.00	−10.00
860	103.56	−10.00
861	102.75	−10.00
862	102.94	−10.00
863	99.24	−10.00
864	94.61	−10.00
865	93.99	−10.00
866	92.32	−10.00
867	93.36	−10.00
868	92.00	−10.00
869	90.73	−10.00
870	88.42	−10.00
871	84.21	−10.00
872	82.00	10.00
873	82.00	7.38
874	82.00	−10.00
875	82.00	−10.00
876	68.79	48.69
877	64.00	70.00
878	64.00	70.00
879	58.66	67.95
880	37.27	60.00
881	34.96	60.00
882	32.65	73.54
883	30.33	80.00
884	28.02	80.00
885	25.70	50.00
886	23.39	37.76
887	21.07	10.00
888	18.76	10.00
889	14.89	−10.00
890	12.13	−10.00
891	5.45	−10.00
892	0.0	0.0
893	0.0	0.0
894	0.0	0.0
895	0.0	0.0
896	0.0	0.0
897	0.0	0.0
898	0.0	0.0
899	0.0	0.0
900	0.0	0.0
901	0.0	0.0
902	0.0	0.0
903	0.0	0.0
904	0.0	0.0
905	0.0	0.0
906	0.0	0.0
907	0.0	0.0
908	0.0	0.0
909	0.0	0.0
910	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
911	0.0	0.0
912	0.0	0.0
913	0.0	0.0
914	0.0	0.0
915	0.0	0.0
916	0.0	0.0
917	0.0	0.0
918	0.0	0.0
919	0.0	0.0
920	−1.78	44.40
921	0.0	65.35
922	4.25	100.00
923	27.47	100.00
924	42.96	100.00
925	45.79	100.00
926	48.11	99.46
927	50.42	90.00
928	52.74	75.23
929	54.00	50.00
930	44.42	8.96
931	45.05	−10.00
932	46.00	9.99
933	37.69	−10.00
934	31.61	5.68
935	22.94	35.29
936	24.00	4.87
937	20.86	−10.00
938	12.45	−10.00
939	6.00	−10.00
940	6.52	−10.00
941	7.17	−10.00
942	2.56	−10.00
943	0.0	0.0
944	0.0	0.0
945	0.0	0.0
946	0.0	10.11
947	4.32	46.40
948	8.90	45.17
949	1.95	50.00
950	3.33	41.68
951	4.00	89.46
952	13.76	55.60
953	26.43	26.96
954	33.85	6.16
955	36.00	−10.00
956	34.45	−10.00
957	34.00	−10.00
958	35.64	−10.00
959	32.99	27.39
960	36.00	80.00
961	41.63	74.37
962	60.41	26.76
963	48.44	−10.00
964	43.86	−10.00
965	40.39	−10.00
966	38.50	4.01
967	35.05	30.00
968	40.66	16.70
969	43.64	26.45
970	45.96	−10.00
971	47.10	−10.00
972	49.29	−10.00
973	37.10	−10.00
974	36.00	−10.00
975	34.47	−10.00
976	32.15	−10.00
977	31.67	−10.00
978	28.48	13.89
979	32.38	90.00
980	36.00	90.00
981	41.69	90.00
982	45.74	90.00
983	48.95	80.00
984	49.10	80.00
985	50.59	62.97
986	45.99	34.98
987	42.76	7.23
988	35.12	−10.00
989	32.06	67.92
990	35.53	62.55
991	46.57	68.60
992	49.77	48.85
993	52.00	60.00
994	58.06	60.00
995	63.66	23.42
996	64.14	17.84
997	59.58	3.76
998	38.00	42.26
999	39.09	30.00
1,000	40.00	30.00
1,001	34.85	47.18

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1,002	32.03	10.33
1,003	34.00	33.48
1,004	34.00	50.00
1,005	33.02	20.69
1,006	25.54	−10.00
1,007	15.57	−10.00
1,008	14.00	−10.00
1,009	14.47	27.64
1,010	18.00	4.49
1,011	17.13	−10.00
1,012	16.00	−10.00
1,013	10.02	−10.00
1,014	9.81	−10.00
1,015	5.88	−10.00
1,016	4.00	−10.00
1,017	4.00	−10.00
1,018	2.93	−10.00
1,019	0.62	−10.00
1,020	0.0	0.0
1,021	0.0	0.0
1,022	0.0	0.0
1,023	0.0	0.0
1,024	0.0	0.0
1,025	0.0	10.00
1,026	0.0	10.00
1,027	0.0	29.02
1,028	0.0	27.83
1,029	0.0	7.34
1,030	0.0	0.0
1,031	0.0	0.0
1,032	0.0	0.0
1,033	0.0	0.0
1,034	0.0	0.0
1,035	0.0	0.0
1,036	0.0	0.0
1,037	0.0	0.0
1,038	0.0	0.0
1,039	0.0	0.0
1,040	0.0	0.0
1,041	2.00	0.0
1,042	1.38	0.0
1,043	0.0	0.0
1,044	0.0	6.27
1,045	0.0	2.16
1,046	0.0	0.0
1,047	0.0	0.0
1,048	0.0	0.0
1,049	0.83	−10.00
1,050	2.00	−10.00
1,051	0.54	−10.00
1,052	0.0	0.0
1,053	0.0	0.0
1,054	0.0	0.0
1,055	0.0	0.0
1,056	0.0	0.0
1,057	0.0	0.0
1,058	0.0	0.0
1,059	0.0	0.0
1,060	0.0	0.0
1,061	0.0	0.0
1,062	0.0	22.01
1,063	1.23	72.29
1,064	6.63	80.00
1,065	17.29	89.29
1,066	22.17	90.00
1,067	24.00	82.70
1,068	24.00	31.96
1,069	24.00	−10.00
1,070	22.57	−10.00
1,071	22.00	−10.00
1,072	13.68	−10.00
1,073	10.00	−10.00
1,074	9.31	−10.00
1,075	3.99	−10.00
1,076	0.0	0.0
1,077	0.0	0.0
1,078	0.0	0.0
1,079	0.0	0.0
1,080	0.0	0.0
1,081	0.0	0.0
1,082	0.0	0.0
1,083	0.0	0.0
1,084	0.0	0.0
1,085	0.0	0.0
1,086	0.0	0.0
1,087	0.0	0.0
1,088	0.0	0.0
1,089	0.0	0.0
1,090	0.0	0.0
1,091	0.0	0.0
1,092	0.0	0.0

Record (section)	Percent	
	Normalized revolutions per minute	Normalized torque
1,093	0.0	0.0
1,094	0.0	0.0
1,095	0.0	0.0
1,096	0.0	0.0
1,097	0.0	0.0
1,098	0.0	0.0
1,099	−2.52	6.30
1,100	−4.22	15.28
1,101	0.0	10.00
1,102	0.0	10.00
1,103	0.0	10.00
1,104	0.0	75.93
1,105	0.0	32.22
1,106	1.67	35.00
1,107	15.48	29.02
1,108	25.48	−10.00
1,109	24.22	−10.00
1,110	23.44	−10.00
1,111	12.41	80.00
1,112	8.94	83.61
1,113	7.26	84.82
1,114	16.70	80.00
1,115	24.67	63.33
1,116	0.24	79.81
1,117	0.0	8.52
1,118	0.0	0.0
1,119	0.0	0.0
1,120	0.0	0.0
1,121	0.0	0.0
1,122	0.0	0.0
1,123	0.0	0.0
1,124	0.0	0.0
1,125	0.0	0.0
1,126	0.0	0.0
1,127	0.0	0.0
1,128	0.0	17.59
1,129	0.0	19.63
1,130	0.0	10.00
1,131	0.0	10.00
1,132	0.0	10.00
1,133	0.0	3.34
1,134	0.0	0.0
1,135	0.0	0.0
1,136	0.0	0.0
1,137	0.0	0.0
1,138	0.0	0.0
1,139	0.0	0.0
1,140	0.0	0.0
1,141	0.0	0.0
1,142	0.0	0.0
1,143	0.0	0.0
1,144	0.0	0.0
1,145	0.0	0.0
1,146	0.0	0.0
1,147	0.0	0.0
1,148	0.0	0.0
1,149	0.0	0.0
1,150	0.0	0.0
1,151	0.0	0.0
1,152	0.0	0.0
1,153	0.0	0.0
1,154	0.0	0.0
1,155	0.0	0.0
1,156	0.0	0.0
1,157	0.0	0.0
1,158	0.0	0.0
1,159	0.0	0.0
1,160	0.0	0.0
1,161	0.0	0.0
1,162	0.0	0.0
1,163	0.0	0.0
1,164	0.0	0.0
1,165	0.0	0.0
1,166	0.0	0.0
1,167	0.0	0.0

41. Subpart P is added to read as follows:

* * * * *

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

Sec.

86.1501–84 Scope, applicability.

Authority: Sections 202, 206, 207, 208, 301(a), Clean Air Act, as amended 42 U.S.C. 7521, 7525, 7541, 7542, and 7601.

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

§ 86.1501-84 Scope, applicability.

This subpart contains gaseous emission idle test procedures for heavy-duty gasoline-fueled engines, and gasoline-fueled light-duty trucks. It applies to 1984 and later model years.

§ 86.1502-84 Definitions.

The definitions in § 86.084-2 apply to this subpart.

§ 86.1503-84 Abbreviations.

The abbreviations in § 86.084-3 apply to this subpart.

§ 86.1504-84 Section numbering; construction.

(a) The model year of initial applicability is indicated by the section number. The two digits following the hyphen designate the first model year for which a section is effective. A section remains effective until superseded.

Example: Section 86.1511-84 applies to the 1984 and subsequent model years until superseded. If § 86.1511-85 is promulgated, it would take effect beginning with the 1985 model year; § 86.1511-83 would apply to model years 1983 and 1984.

(b) A section reference without a model year suffix refers to the section applicable for the appropriate model year.

(c) All provisions in this subpart apply to gasoline-fueled heavy-duty engines and gasoline-fueled light-duty trucks.

§ 86.1505-84 Introduction; structure of subpart.

(a) This subpart describes the equipment and the procedures required to perform idle exhaust emission tests on gasoline-fueled heavy-duty engines and gasoline-fueled light-duty trucks. Subpart A sets forth the testing requirements, reporting requirements, and test intervals necessary to comply with EPA certification procedures.

(b) Four topics are addressed in this subpart. §§ 86.1505-84 through 86.1515-84 set forth specifications and equipment requirements; §§ 86.1516-84 through 86.1526-84 discuss calibration methods and frequency; test procedures and data requirements are listed in §§ 86.1527-84 through 86.1542-84; and calculation formulae are found in § 86.1544-84.

§ 86.1506-84 Equipment required and specifications; overview.

(a) This subpart contains procedures for performing idle exhaust emission tests on gasoline-fueled heavy-duty engines and gasoline-fueled light-duty trucks. Equipment required and specifications are as follows:

(1) *Exhaust emission tests.* All engines and vehicles subject to this subpart are tested for exhaust emissions. Necessary equipment and specifications appear in §§ 86.1509-84 through 86.1511-84.

(2) *Fuel and analytical tests.* Fuel requirements for idle exhaust emission testing are specified in § 86.1513-84. Analytical gases are specified in § 86.1514-84.

§ 86.1507-84 [Reserved]

§ 86.1508-84 [Reserved]

§ 86.1509-84 Exhaust gas sampling system.

(a) The exhaust gas sampling system shall transport the exhaust sample from the engine or vehicle to the analysis system in such a manner as to maintain the integrity of the sample constituents that are to be analyzed.

(b) The sample system shall supply a dry sample (i.e., water removed) to the analysis system.

(c) A CVS sampling system with bag analysis as specified in § 86.1309-84 or § 86.109-82 is permitted. The inclusion of an additional raw carbon dioxide (CO_2) analyzer as specified in §§ 86.309-79 and 86.316-79 is required if the CVS system is used, in order to accurately determine the CVS dilution factor. The heated sample line specified in § 86.309-79 and § 86.310-79 for raw emission requirements is not required for the raw CO_2 measurement.

(d) A raw exhaust sampling system as specified in § 86.309-79 and § 86.310-79 is permitted.

§ 86.1510-84 [Reserved]

§ 86.1511-84 Exhaust gas analysis system.

(a) Analyzers used for this subpart shall meet the following specifications.

(1) The analyzers used must have a range such that the carbon monoxide (CO) idle standard specified in § 86.084-10 for heavy-duty engines or specified in § 86.084-9 for light-duty trucks will provide an analyzer response between 45 and 90 percent of full-scale deflection on the CO analyzer.

(2) The resolution of the readout device(s) for the range specified in paragraph (a)(1) of this section shall be equal to or less than 0.05 percent for the CO analyzer.

(3) For the range specified in paragraph (a)(1) of this section, the precision shall be less than ± 6 percent of full-scale deflection. The precision is defined as two times the standard deviation of five repetitive responses to a given calibration gas.

(4) For the range specified in paragraph (a)(1) of this section, the mean response to a zero calibration gas shall not exceed ± 3 percent of full-scale deflection during a 1-hour period.

(5) For the range specified in paragraph (a)(1) of this section the drift of the mean calibration response shall be less than ± 3 percent of full scale during a 1-hour period. The calibration response is defined as the analyzer response to a calibration gas after the analyzer has been spanned by the electrical spanning network at the beginning of the 1-hour period.

(6) The analyzer must respond to an instantaneous step change at the entrance to the sampling system with a response equal to 90 percent of that step change within 15 seconds or less on the range specified in paragraph (a)(1) of

this section. The step change shall be at least 60 percent of full-scale deflection.

(7) The interference gases listed shall individually or collectively produce an analyzer reading less than ±2 percent of full scale on the range specified in paragraph (a)(1) of this section.

Interference gas	Concentration	Applicable analyzer
CO_2	14 percent	CO
C_3H_8	1 percent	CO
H_2O	Saturated vapor at 100°F	CO
NO_x	1,000 ppm	CO
O_2	5 percent	CO

(8) The analyzer shall be able to meet the specifications in paragraph (a) of this section under the following conditions:

(i) After a 30 minute warm-up from the prevailing ambient conditions;

(ii) Between 0 to 85 percent relative humidity; and

(iii) During flow variations of ±50 percent.

(b) The inclusion of a raw CO_2 analyzer as specified in § 86.309–79 and § 86.316–79 is required in order to accurately determine the CVS dilution factor.

§ 86.1512–84 [Reserved]

§ 86.1513–84 Fuel specifications.

The requirements of this section are set forth in § 86.1313–84(a) for heavy-duty engines, and in § 86.113–82(a) for light-duty trucks.

§ 86.1514–84 Analytical gases.

(a) If the CVS sampling system is used, the analytical gases specified in § 86.1314–84 shall be used for heavy-duty engines, or § 86.114–79 for light-duty trucks.

(b) If the raw CO sampling system in § 86.309–79 is used, the analytical gases specified in § 86.308–79 shall be used.

§ 86.1515–84 [Reserved]

§ 86.1516–84 Calibration; frequency and overview.

(a) Calibrations shall be performed as specified in §§ 86.1518–84 through 86.1526–84.

(b) At least monthly or after any maintenance which could alter calibration, check the calibration of the CO analyzer. Adjust or repair the analyzer as necessary.

(c) Water traps, filters, or conditioning columns should be checked before each test.

§ 86.1517–84 [Reserved]

§ 86.1518–84 [Reserved]

§ 86.1519–84 CVS calibration.

If the CVS system is used for sampling during the idle emission test, the calibration instructions are specified in § 86.1319–84 for heavy-duty engines, and § 86.119–78 for light-duty trucks.

§ 86.1520–84 [Reserved]

§ 86.1521–84 [Reserved]

§ 86.1522–84 Carbon monoxide analyzer calibration.

(a) *Initial check.* (1) Follow good engineering practice for instrument start-up and operation. Adjust the analyzer to optimize performance on the range specified in § 86.1511–84(a)(1).

(2) Calibrate the analyzer with the calibration gas specified in § 86.1514–84.

(3) Adjust the electrical span network such that the electrical span point is correct when the analyzer reads the calibration gas correctly.

(4) Determine that the analyzer complies with the specifications in § 86.1511–84.

(b) *Periodic check.* Follow paragraphs (a)(1), (2), and (3) of this section as specified by § 86.1516–84(b). Adjust or repair the analyzer as necessary.

§ 86.1523–84 [Reserved]

§ 86.1524–84 Carbon dioxide analyzer calibration.

(a) The calibration requirements for the dilute-sample CO_2 analyzer are specified in § 86.1324–84 for heavy-duty engines and § 86.124–78 for light-duty trucks.

(b) The calibration requirements for the raw CO_2 analyzer are specified in § 86.330–79.

§ 86.1525–84 [Reserved]

§ 86.1526–84 Calibration of other equipment.

Other test equipment used for testing shall be calibrated as often as necessary according to good engineering practice.

§ 86.1527–84 Idle test procedure; overview.

(a) The idle emission test procedure is designed to determine the raw concentration (in percent) of CO in the exhaust flow at idle. The test procedure begins with the engine at normal operating temperature. (For example, the warm-up for an engine may be the transient engine or chassis dynamometer test.)

(b) Raw emission sampling must be made before dilution occurs from a single exhaust pipe in which exhaust products are homogeneously mixed. The configuration for dual-exhaust systems must also allow for raw emission measurements, which will require that an additonal "Y" pipe be placed in the exhaust system before dilution.

§ 86.1528–84 [Reserved]

§ 86.1529–84 [Reserved]

§ 86.1530–84 Test sequence; general requirements.

(a) The following test sequence lists the major steps encountered during the idle test:

Preparation
Warm-up (or Emission Test)
Preconditioning, 30 seconds minimum, six minutes maximum
Idle Stabilization, 30 ±5 seconds
Idle Emission Sampling, one minute minimum, six minutes maximum

These steps are described by subsequent procedures.

(b) Ambient test cell conditions during the test shall be those specified in § 86.1330–84 or § 86.130–78.

§§ 86.1531–84 through 86.1536–84 [Reserved]

§ 86.1537–84 Idle test run.

The following steps shall be taken for each test:

(a) Check the device(s) for removing water from the exhaust sample and the sample filter(s). Remove any water from the water trap(s). Clean and replace the filter(s) as necessary.

(b) Set the zero and span points of the CO analyzer with the electrical spanning network or with analytical gases.

(c) Achieve normal engine operating condition. The transient engine or chassis dynamometer test is an acceptable technique for warm-up to normal operating condition for the idle test. If the emission test is not performed prior to the idle emission test, a heavy-duty engine may be warmed-up according to § 86.1332–84(d)(2) (i) through (iv). A light-duty truck may be warmed up by operation through one Urban Dynamometer Driving Schedule test procedure (see § 86.115–78 and Appendix I to this part).

(d) Operate the warm engine at 2500 ±50 rpm and zero load for a minimum of 30 seconds and a maximum of 6 minutes.

(e) If the CVS sampling system is used, the following procedures apply:

(1) With the sample selector valves in the "standby" position, connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(2) Start the CVS (if not already on), the sample pumps, and the raw CO_2 analyzer. (The heat exchanger of the constant volume sampler, if used, shall be running at operating temperature before sampling begins).

(3) Adjust the sample flow rates to the desired flow rate and set the gas flow measuring devices to zero.

(4) Operate the engine or vehicle at curb idle for 30±5 seconds with the clutch disengaged or in neutral gear. A heavy-duty engine may also be disconnected from the dynamometer, or the dynamometer may be shut off.

(5) Begin CO bag sampling and raw CO_2 sampling.

(6) Sample idle emissions long enough to obtain a sufficient bag sample, but in no case shorter than 60 seconds nor longer than 6 minutes. Follow the sampling and exhaust measurements requirements of § 86.340–79(e) for the conducting of the raw CO_2 measurement.

(7) As soon as possible, tranfer the idle test exhaust and dilution air samples to the analytical system and process the samples according to § 86.1540–84. Obtain a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(f) If the raw exhaust sampling and analysis technique specified in § 86.309–79 is used, the following procedures apply:

(1) Warm up the engine or vehicle per paragraphs (c) and (d) of this section. Operate the engine or vehicle at the conditions specified in paragraph (e)(4) of this section.

(2) Follow the sampling and exhaust measurement requirements of § 86.340–79(e). The idle sample shall be taken for 60 seconds minimum, and no more than 64 seconds. The chart reading procedures of § 86.343–79 shall be used to determine the analyzer response.

(g) If the engine or vehicle stalls at any time during the test run, the test is void.

§ 86.1538–84 [Reserved]

§ 86.1539–84 [Reserved]

§ 86.1540–84 Idle exhaust sample analysis.

(a) Record the CO idle concentrations in percent.

(b) If the CVS sampling system is used, the analysis procedures for dilute CO and CO_2 specified in § 86.1340–84 apply. Follow the raw CO_2 analysis procedure specified in § 86.343–79 for the raw CO_2 analyzer.

(c) If the continuous raw exhaust sampling technique (§ 86.309–79) is used, the analysis procedures for CO specified in § 86.343–79 apply.

§ 86.1541–84 [Reserved]

§ 86.1542–84 Information required.

(a) *General data—heavy-duty engines.* Information shall be recorded for each idle emission test as specified in § 86.1344–84 (b), (c), and (d). The following test data is required:

(1) Date and time of day.

(2) Test number.

(3) Engine intake air or test cell temperature.

(4) Barometric pressure.

Note.—A central laboratory barometer may be used: *Provided,* that individual test cell barometric pressures are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(5) Engine intake or test cell and CVS dilution air humidity.

(6) Curb idle speed during the test.

(7) Idle exhaust CO concentration (dry basis).

(8) Idle exhaust raw CO_2 concentration (if applicable).

(9) Dilute bag sample CO and CO_2 concentrations (if applicable).

(10) Total CVS flow rate with calculated dilution factor for the idle mode (if applicable).

(b) *General data—light-duty trucks.* The following information shall be recorded with respect to each test:

(1) Test number.

(2) System or device tested (brief description).

(3) Date and time of day for the test.

(4) Instrument operated.

(5) Vehicle: ID number, manufacturer, model year, standards, engine family, evaporative emissions family, basic engine description (including displacement, number of cylinders, turbocharger used and catalyst usage), fuel system (including number of carburetors, number of carburetor barrels, fuel injection type and fuel tank(s) capacity and location), engine code, gross vehicle weight rating, inertia weight class and transmission configuration, as applicable.

(6) All pertinent instrument information such as tuning, gain, serial number, detector number and range. As an alternative a reference to a vehicle test cell number may be used, with the advance approval of the Administrator, provided test cell calibration records show the pertinent instrument information.

(7) *Recorder charts:* Identify zero, span, exhaust gas and dilution air sample traces.

(8) Test cell barometric pressure, ambient temperature and humidity.

Note.—A central laboratory barometer may be used: *Provided,* that individual test cell barometric pressures are shown to be within ±0.1 percent of the barometric pressure at the central barometer location.

(9) Pressure of the mixture of exhaust and dilution air entering the CVS metering device (or pressure drop across the CFV), the pressure increase across the device, and the temperature at the inlet. The temperature may be recorded continuously or digitally to determine temperature variations.

(10) The number of revolutions of the positive displacement pump accumulated while exhaust samples are being collected. The number of standard cubic feet metered by a critical flow venturi would be the equivalent record for a CFV.

(11) The humidity of the dilution air.

Note.—If conditioning columns are not used (see §§ 86.122 and 86.144) this measurement can be deleted. If the conditioning columns are used and the dilution air is taken from the test cell, the ambient humidity can be used for this measurement.

(12) Curb idle engine speed during the test.

(13) Idle exhaust CO concentration (dry basis).

(14) Idle exhaust raw CO_2 concentration (if applicable).

(15) Dilute bag sample CO and CO_2 concentrations (if applicable).

(16) Total CVS flow rate with calculated dilution factor for the idle mode (if applicable).

§ 86.1543–84 [Reserved]

§ 86.1544–84 Calculation; idle exhaust emissions.

(a) The final idle emission test results shall be reported as percent for carbon monoxide on a dry basis. The results shall be reported to three significant digits.

(b) If a CVS sampling system is used, the following procedure shall apply:

(1) Use the procedures, as applicable, in § 86.1342–84 to determine the dilute wet-basis CO and CO_2 in percent.

(2) Use the procedure, as applicable, in § 86.345–79 to determine the raw dry-basis CO_2 in percent.

(3) Convert the raw dry-basis CO_2 to raw wet-basis. An assumption that the percent of water by volume in the raw sample is equal to the percent of raw dry-basis CO_2 minus 0.5 percent is acceptable. For example:

10.0% dry CO_2 − 0.5% = 9.5% water

(1.00 − 0.095) (10.0% dry CO_2) = 9.05% wet CO_2

(4) Calculate the CVS dilution factor (DF) by:

$$DF = \frac{\text{Raw wet } CO_2\text{—background } CO_2}{\text{Dilute wet } CO_2\text{—background } CO_2}$$

(5) Convert the dilute wet-basis CO to dilute dry-basis values. An assumption that the percent of water by volume in the sample bag is 2 percent is acceptable. For example:

Dilute dry CO = (dilute wet CO)/(1.00-0.02)

(6) Calculate the raw dry-basis CO values by:

Raw dry CO = (DF) (dilute dry CO)

(c) If the raw exhaust sampling and analysis system specified in § 86.309-79 is used, the percent for carbon monoxide on a dry basis shall be calculated using the procedure, as applicable, in § 86.345-79.

[FR Doc. 83-29446 Filed 11-15-83; 8:45 am]

BILLING CODE 6560-50-M

federal register

Wednesday
November 16, 1983

Part III

Environmental Protection Agency

Municipal Wastewater Treatment; Secondary Treatment Information and National Pollutant Discharge Elimination System; Proposed Rules

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 133

[WH-FRL-2410-5]

Secondary Treatment Information

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule with request for comments.

SUMMARY: This proposed rule amends the secondary treatment information regulation to reflect changes required by section 23 of the "Municipal Wastewater Treatment Construction Grant Amendments of 1981," (Pub. L. 97-117) and experience with the secondary treatment requirements by both EPA and the States. The proposed rule would make the following changes in response to the Act:

• Define a category of facilities eligible for treatment equivalent to secondary treatment as those facilities that use a trickling filter (TF) or waste stabilization pond (WSP) treatment process and provide significant biological treatment of wastewater, but cannot consistently meet secondary treatment requirements,

• Define the minimum level of effluent quality attainable by such facilities during a 30-day period as an average value not to exceed 45 milligrams per liter (mg/l) for the pollutant parameters biochemical oxygen demand, 5-day (BOD_5) and suspended solids (SS), an average 7-day value for BOD_5 and SS not to exceed 65 mg/l, and a percentage removed of BOD_5 and SS not less than 65 percent,

• Provide procedures by which NPDES permitting authorities may establish alternative effluent requirements for facilities providing treatment equivalent to secondary treatment,

• Require that the case-by-case adjustment of individual POTW permits for such facilities reflect the performance or design capabilities of the facility, and assure that water quality is not adversely affected, where treatment equivalent to secondary treatment is provided, and

• Remove the 2 million gallons per day (mgd) flow limitation for WSPs eligible for adjustment of suspended solids effluent limitations.

This proposed rule would also add a definitions section to the secondary treatment information regulation for key terms and make minor editorial changes. Such changes are not substantive in nature. Unchanged regulatory language is also being printed in this proposal for the sake of completeness to the reader.

This proposed rulemaking does not make any change in the existing 85 percent removal requirement. However, in response to comments on various options for modifying the requirement which are discussed later in this preamble, the Agency intends to promulgate one or a combination of the options discussed. Interested readers are directed to the discussion in Section X and the Comments Invited section of this preamble.

DATES: Written comments on this proposed rule must be submitted on or before January 16, 1984.

ADDRESSES: Comments on this proposed rule should be addressed to: Central Docket Section [A-130], Attention: Docket No. G-81-3, Environmental Protection Agency, Washington, D.C. 20460.

The public may inspect the complete record for this rulemaking and all comments received on this proposed rule at: Central Docket Section, Gallery 1, West Tower Lobby, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. between the hours of 8:00 a.m. and 4:30 p.m., business days.

In accordance with Section 3504(h) of the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.* EPA has submitted a copy of this proposed rule, and supporting documents for a collection of information requirements to the Director of OMB for review and approval. Comments on the information requirements of this proposed rule may be sent to: Office of Management and Budget, Office of Information and Regulatory Affairs, Attention: Desk Officer, EPA, 726 Jackson Place, Washington, D.C. 20503.

FOR FURTHER INFORMATION CONTACT: Charles Mooar, Office of Water Program Operations [WH-595], Environmental Protection Agency, Washington, D.C. 20460, (202) 382-7276.

SUPPLEMENTARY INFORMATION: The **SUPPLEMENTARY INFORMATION** section of this preamble describes the legal authority, background, technical and other aspects of the proposed regulations. The abbreviations, acronyms, and other terms used in the **SUPPLEMENTARY INFORMATION** section are defined in Appendix A of this notice.

These proposed regulations are supported by technical documents available from EPA. An overview of the design criteria, performance, reliability and limitations of biological treatment systems is provided in "Innovative and Alternative Technology Assessment Manual," [EPA 430/9-78-009, MCD-53, 1980]. Data collection efforts, performance analyses for various biological treatment systems and the methodologies used to develop this proposal are discussed in docket materials available for public inspection at the location indicated in the **ADDRESSES** section of this preamble, and in the "Technical Support Document for Proposed Regulations under Section 304(d)(4)," September 1983, which may be obtained from Office of Water Program Operations, Facility Requirements Division (WH-595), Environmental Protection Agency, 401 M Street SW, Washington, D.C. 20460: (202) 382-7271.

The Agency is also publishing in today's **Federal Register** a proposed rule for separate changes to the secondary treatment regulation that concern the optional use of alternative effluent limitations for five day carbonaceous biochemical oxygen demand ($CBOD_5$) instead of BOD_5. The potential use of $CBOD_5$ effluent limitations for TFs and WSPs is discussed in that proposal.

Also proposed elsewhere in today's **Federal Register** are revisions to permit program requirements for the National Pollutant Discharge Elimination System (NPDES) that would allow NPDES permits to be modified or reissued to reflect the limits required by the proposed revisions to the secondary treatment regulation.

Information in this preamble is presented in the following order:

I. Introduction

A. Statutory Authority

Section 301(b)(1)(B) of the Clean Water Act (CWA or the Act), 33 U.S.C. 1311(b)(1)(B), requires that publicly owned treatment works (POTWs) achieve effluent limitations based upon secondary treatment as defined by the Administrator of EPA pursuant to section 304(d)(1) of the Act. Section 304(d)(1), 33 U.S.C. 1314(d)(1), requires that the Administrator publish information on the degree of effluent reduction attainable through the application of secondary treatment within sixty days of enactment and from time to time thereafter.

Section 304(d)(4) of the Act, 33 U.S.C. 1314(d)(4), as amended by section 23 of the "Municipal Wastewater Treatment Construction Grant Amendments of 1981" (Pub. L. 97-117), deems such biological treatment facilities as oxidation ponds, lagoons, and ditches and trickling filters as the equivalent of secondary treatment, and further directs the Administrator to provide guidance under section 304(d)(1) on design criteria for such facilities, taking into account pollutant removal efficiencies. Section 304(d)(4) further requires that water quality not be adversely affected by deeming such facilities as the equivalent of secondary treatment.

B. Previous Regulations

The secondary treatment information regulation was originally promulgated on August 17, 1973 [38 FR 22298]. Generally, it established levels of effluent quality for the parameters biochemical oxygen demand, suspended solids, fecal coliform bacteria, and pH. Special consideration was provided for facilities subject to wet weather flows from combined sanitary and storm sewers, and facilities receiving high strength industrial wastes.

Two subsequent amendments promulgated on July 26, 1976 [41 FR 30788] and October 7, 1977 [42 FR 5665] provided for: (1) Deletion of the fecal coliform bacteria limitations and clarification of the pH requirement, and (2) special consideration for the suspended solids effluent limitations applicable to WSPs with wastewater flows of less than 2 million gallons per day (mgd).

The current secondary treatment information regulation defines "secondary treatment" (§ 133.102) as attaining an average effluent quality for both biochemical oxygen demand, five-day (BOD_5) and suspended solids (SS) of 30 milligrams per liter (mg/l) in a period of 30 consecutive days, an average effluent quality of 45 mg/l for the same pollutants in a period of 7 consecutive days, and 85 percent removal of the same pollutants in a period of 30 consecutive days. The effluent values for pH must be maintained between 6.0 and 9.0 unless certain demonstrations are made.

The regulation provides special consideration in three instances:

(1) Where secondary treatment works are affected by wet weather flows due to combined sewers, the percentage removal requirements may be adjusted (§ 133.103(a)).

(2) Where industrial contributions exceed 10 percent of the design flow, and the discharge of BOD_5 and SS by the industrial contributor permitted under sections 301(b)(1)(A)(i) or 306 of the Act would be less stringent than secondary treatment requirements, the 30-day and 7-day requirements for BOD_5 and SS may be adjusted (§ 133.103(b)).

(3) Where WSPs are the sole process used for secondary treatment and wastewater flows are less than 2 mgd, Regional Administrators and State Directors are authorized to adjust the SS effluent limitations to reflect the effluent quality achieved 90 percent of the time within a State or appropriate contiguous geographic area (§ 133.103(c)).

The existing regulation (§ 133.104(a)) requires the use of sampling and testing procedures for BOD_5 and SS specified in guidelines promulgated pursuant to sections 304(h) and 402 of the Act (40 CFR Part 136). The current secondary treatment information regulation also allows use of chemical oxygen demand (COD) or total organic carbon (TOC) testing as a substitute for BOD_5 when a long-term BOD:COD or BOD:TOC correlation has been demonstrated (§ 133.104(b)).

II. Background

A. The Clean Water Act—Pub. L. 92-500 and EPA Response

Sections 301, 304 and 402 of the Act provide the basic structure for translating Congress' broad goal of eliminating "the discharge of pollutants into the navigable waters," [35 U.S.C. 1251(a)(1)] into specific requirements that must be met by individual point sources. Section 301(b) of the Act authorizes the Administrator to set effluent limitations for categories of point sources. For POTWs, section 301(b)(1)(B) of the Act requires the achievement of effluent limitations based on secondary treatment as defined by the Administrator in section 304(d)(1) of the Act.

Section 304 of the Act contains requirements for the Administrator to follow in issuing regulations, information and guidelines. In section 304(d)(1) of the Act, the Administrator is directed to publish information on the "degree of effluent reduction attainable through application of secondary treatment."

Section 402 of the Act authorizes the establishment of the National Pollutant Discharge Elimination System (NPDES), under which every discharger of pollutants is required to obtain a permit. The permit requires the discharger to meet all the applicable requirements specified in regulations issued under sections 301 and 304 of the Act.

With the exception of the SS adjustment for WSPs, the current secondary treatment regulation itself does not address the type of technology used to achieve secondary treatment requirements. However, in section 304(d)(2) of the Act, the Administrator was directed to publish information on alternative waste management techniques and systems for best practicable waste treatment technology (BPWTT). The BPWTT requirement (CWA section 201(g)(2)(A)) is specifically applicable to grantees receiving federal assistance under section 201 of the Act. In EPA's 1975 and 1976 notices on BPWTT [40 FR 49598, 41 FR 6190] and the BPWTT document ["Alternative Waste Management Techniques for Best Practicable Waste Treatment," EPA-430/9-75-013, MCD-13, October 1975], secondary treatment (or more stringent treatment) is stated as a minimum requirement for waste management alternatives employing treatment and discharge into navigable waters.

The BPWTT document reviewed alternative techniques available for achieving secondary treatment, including biological treatment such as the use of (waste stabilization) ponds, activated sludge, and TFs, but left basic decisions on the choice of a technology or alternative waste management technique to a case-by-case cost-effectiveness analysis.

B. The 1981 Amendments—Section 23 of Pub. L. 97-117

1. *Provisions and Legislative History.* The full text of section 23 of Pub. L. 97-117 reads as follows:

(4) For the purposes of this subsection [section 304(d)], such biological treatment facilities as oxidation ponds, lagoons, and ditches and trickling filters shall be deemed the equivalent of secondary treatment. The Administrator shall provide guidance under paragraph (1) of this subsection on design criteria for such facilities, taking into account pollutant removal efficiencies and, consistent with the objective of the Act, assuring that water quality will not be adversely affected by deeming such facilities as the equivalent of secondary treatment. [33 U.S.C. 1314(d)(4).]

The legislative history for section 23 shows that Congress was concerned that EPA had not "sanctioned" the use of certain biological treatment techniques that are effective in achieving significant reductions of BOD and SS for secondary treatment [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981)]. The Report of the House Subcommittee on Investigations and Oversight stated that the 1973 secondary treatment standards—

Contributed to the design and construction of sophisticated and costly plants. This in turn has given rise to complaints of over-design and the need to upgrade or replace plants employing simpler processes that could not meet the new performance requirements, even though these plants were operating well in terms of achieving their original design performance levels.

* * * * *

The EPA definition of secondary also frequently imposed higher capital and operating costs on grantees, many of them smaller communities and operating costs on grantees, many of them smaller communities and sanitation districts, resulting from the more sophisticated technologies needed to meet the new standard and a need for higher plant operating skills and management capabilities. [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 34-35 (1981).]

The House Oversight Report concluded by recommending that—

It would be constructive to permit a range of effluent limitations which permit the use, where appropriate, of such forms of treatment as trickling filters, lagoons, and ponds. Consideration should be given to basing the appropriate secondary municipal technology on the general characteristics of the receiving stream, the nature of the wastes involved and the affordability of various secondary treatment processes available to the community. [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 73 (1981).]

In the same vein, the Senate Committee on Environment and Public Works reported that methods such as oxidation ponds and TFs are generally cheaper and more energy-efficient than "standard" methods, and that such technologies are particularly useful in smaller communities. The Senate Committee noted that "methods of achieving secondary treatment are also at the discretion of the Administrator," but concluded that EPA has not "sanctioned" the use of these methods (*i.e.*, oxidation ponds and TFs) for secondary treatment. Therefore, the Senate Report continues, section 23—

Permits the use of certain biological treatment facilities to meet the secondary requirement provided that water quality and particularly the objective of the Act is not adversely affected, *in spite of the fact that they may not consistently meet 85 percent removal.* [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981), emphasis added.]

The legislative history presented above suggests that the amendment was intended to minimize the need for increased treatment and construction of costly new facilities where an alternative treatment technology could achieve significant biological treatment. The legislative history further suggests that the amendment would apply primarily to smaller communities, which could use TFs and WSPs that are not capable of consistently meeting effluent limitations based on current secondary treatment requirements.

Changes between the original Senate bill (S. 1274) and enacted provisions provide a further indication of legislative intent. The following language was used in Section 16 of S. 1274.

(4) For the purposes of this subsection [section 304(d)], such facilities as oxidation ponds, lagoons, and trickling filters shall be deemed the equivalent of secondary treatment when the owner or operator of a publicly owned treatment works makes a showing satisfactory to the Administrator that, taking into account local climate, the limited population served, and assurances as to the operation and maintenance of such facility, water quality will not be adversely affected by deeming such facilities as the equivalent of secondary treatment. [S. 1274, 97th Cong., 1st Sess. section 16 (1981); 127 Cong. Rec. S5527 (May 21, 1981).]

In the enacted version of section 23 of Pub. L. 97-117 (supra) language was added to read: "such *biological treatment* facilities as oxidation ponds, lagoons, and ditches and trickling filters shall be deemed the equivalent of secondary treatment" [italics added]. The enacted provisions make clear that the equivalent facilities shall provide for biological treatment.

The enacted provisions contain language that requires the Administrator to provide criteria on the design and pollutant removal efficiencies of such biological treatment facilities, in accordance with the Administrator's existing authority to define the degree of effluent reduction attainable through secondary treatment [CWA section 304(d)(1)]. In implementing these provisions, the Administrator is directed to—

Take into account not only pollutant removal efficiencies, but also differing geographical/climatic conditions which affect treatment plant performance. The Administrator should also address the seasonal and geographical variability of biological treatment plant performance in the regulations issued to carry out this section. [S. Rep No. 97-204, 97th Cong., 1st Sess. 18 (1981).]

Apart from the references already cited which would suggest that such "equivalent" facilities cannot consistently meet secondary treatment performance requirements, but do achieve *significant* reductions of BOD and SS, the legislative history provides only limited direction on what other biological treatment technologies could be deemed equivalent. For example, the Senate Report only states that "this section is not intended to sanction the introduction of raw sewage into the Nation's waterways" [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981)], while the report of the House Subcommittee on Investigations and Oversight states that "[t]here is a large range of both conventional and alternative technology available providing levels of treatment between primary and secondary for this purpose." [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 73 (1981).]

In addressing water quality issues, the legislative history clearly rejects the use of receiving water quality as a factor in setting effluent limitations when using the technology-based standard. The report of the House Subcommittee on Investigations and Oversight stated—

Prior to enactment of the 1972 Federal Water Pollution Control Act Amendments, which set out a technology based requirement that all communities have, as a minimum, secondary treatment, municipal (and industrial) treatment requirements were generally established on the basis of assessing a stream's assimilative capacity. Unfortunately, this water quality-based approach was, and still is, too vague and subject to analytical weaknesses. [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 35 (1981).]

The Senate Report stated that—

Although water quality impact is not a consideration in defining technology-based regulations, a technology would not be acceptable for any category of dischargers if it is found that the technology is inadequate in terms of necessary water quality protection. [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981)].

Instead of requiring POTW owner/operators to make assurances satisfactory to the Administrator that water quality will not be adversely affected [cf. S. 1274, 97th Cong., 1st Sess. section 16 1981)], the enacted provisions require that guidance be issued by the Administrator that assures no adverse effects on water quality as a result of deeming certain facilities as equivalent to secondary treatment. The report of the House Subcommittee on Investigations and Oversight provides some direction on the type of analysis that would be considered sufficient:

[I]t should not be necessary to make precise determinations of wasteload allocations as done (with great imprecision) in the establishment of water quality based effluent standards. Instead, it should suffice to categorize generally the volume and rate of flow of the water body, and nature and sensitivity of the aquatic life inhabiting it. [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 73 (1981).]

2. *Summary.* The Agency believes that is should consider the following in implementing section 23 of Pub. L. 97-117:

(a) Facilities deemed equivalent to secondary treatment consist of biological treatment facilities that are capable of achieving significant reductions in BOD and SS, but cannot consistently achieve existing secondary treatment requirements;

(b) Oxidation pounds and lagoons [*i.e.*, waste stabilization ponds] and TFs are noted as examples of such facilities in both the Act and legislative history;

(c) Sophisticated and costly facilities built to achieve the current secondary treatment requirements are contrasted with "equivalent" biological facilities and technologies that are cheaper, easier to operate, but cannot consistently meet the current secondary treatment requirements;

(d) EPA has discretion under section 304(d)(1) of the Act in defining "facilities deemed equivalent to secondary treatment" and the degree of effluent reduction attainable by such facilities, but should also establish the criteria for such facilities based on design and pollutant removal efficiencies;

(e) The regulations should address variations in plant performance caused by geographic, climatic, or seasonal conditions;

(f) the provisions should be especially useful to smaller communities; and;

(g) The use of an approach that sets technology-based effluent limitations based on assimilative capacity of receiving waters was rejected, and a "technology-based approach" maintained, but implementation of these provisions must include assurances that water quality will not be adversely affected.

III. Overview of Biological Treatment Systems

A. Biological Treatment Systems for Achieving Secondary Treatment

In 1975 EPA published "Alternative Waste Management Techniques for Best Practicable Waste Treatment," [EPA-430/9-75-013, MCD-14, 1975], which identified three types of biological treatment systems for achieving secondary treatment: Activated sludge, trickling filters, and ponds. All three types of biological treatment were in general use in 1975 and prior to the passage of Pub. L. 92-500 either as sole processes or in combination; however, the activated sludge process is by far the most typical or "standard" method in use [cf. S. Rep, No. 97-204, 97th Cong., 1st Sess. 18 (1981)].

Suspended growth type systems, including activated sludge, generally consist of an aerator and clarifier and are usually preceded by primary sedimentation. The aerator, utilizing air (either diffused or mechanical) or pure oxygen, provides conditions for a suspended microbial growth that metabolizes the biodegradable wastes. The microbial growth is clarified and a portion recycled to maintain metabolism in the aeration tankage. The other portion (the build-up of microbial growth) and the primary solids go to an appropriate solids-handling facility. There are many variants of activated sludge or suspended growth systems, including oxidation ditches.

Attached growth type systems, *e.g.*, trickling filters, generally consist of filter bed of rock or synthetic media and clarifier and are usually preceded by primary sedimentation. Biological treatment occurs in a manner similar to a suspended growth system, except the microbial growth is attached to a fixed medium over which wastewater is repeatedly recycled. The excessive microbial growth is sloughed off the media and captured in a clarifier. In addition to rock and plastic media TFs, attached growth type systems include variations such as rotating biological contactors.

Ponds, or *waste stabilization pond* (WSP) type systems, consist of basins within which natural stabilization processes occur with any necessary oxygen provided by photosynthetic and/or mechanical sources. WSPs are commonly referred to as oxidation ponds or lagoons, and may stabilize wastes through aerobic metabolism, anaerobic metabolism, or both (facultative).

B. Design, Performance, and Reliability

In December 1980, the Agency published "Innovative and Alternative Technology Assessment Manual," [EPA 430/9-78-009, MCD-53, 1980]. The manual contains two-page fact sheets on various municipal treatment technologies, including biological treatment technologies. The fact sheets describe the treatment processes, process applicability, common process modifications, process limitations, performance and design criteria, construction and operation and maintenance cost curves, and process reliability.

1. *Activated Sludge.* The manual fact sheets describe several activated sludge type technologies and their general design criteria. When the technology is applied to provide secondary treatment (as opposed to advanced treatment), the manual indicates that an effluent quality for BOD_5 and SS on the order of 20 mg/l], can be achieved. The percentage removal of BOD_5 and SS achieved by such facilities is characterized as between 85 percent and 90 percent. The manual describes the limitations for such systems in terms of operational complexity, high operating costs, and high energy consumption.

For oxidation ditches, the manual indicates that the process is highly reliable in achieving an effluent quality of 20-30 mg/l for BOD_5 and SS. Oxidation ditches are characterized as offering an added measure of reliability and performance over other biological treatment processes, but are subject to some of the same limitations that other activated sludge treatment processes face. The process cost of treatment is generally lower than other biological treatment processes in the range of wastewater flows between 0.1 and 10 mgd.

2. *Trickling Filters.* The manual fact sheets for TF technologies provide general design criteria and describe the effluent quality attainable by such facilities in a range of 25–45 mg/l BOD_5 and 20–45 mg/l SS, depending on the type of TF and operating conditions. For various TF technologies, the manual indicates the following ranges of percentage removal of BOD_5 and SS: 80 to 90 percent, 60–80 percent, and 75 to 90 percent. In moderate climates, the processes are characterized as highly reliable; however, the processes are also characterized as subject to vulnerability where wastewater temperatures fall below 13°C for prolonged periods. The processes are consistently noted as mechanically reliable and simple to operate.

3. *Waste Stabilization Ponds.* The manual fact sheets for WSP technologies indicate design criteria for ponds and describe the effluent quality attainable by various pond technologies in domestic waste applications as 25–30 mg/l BOD_5 and 20–150 mg/l SS.

Note.—Section 133.103(c) allows SSS values less stringent than 30 mg/l.

Algal problems are noted as affecting performance for SS removal. The manual notes that BOD_5 removal efficiencies of 75 to 95 percent have been reported for some WSPs. The processes are described as highly reliable and require little operator expertise.

C. Types of Biological Treatment Systems in Use

Since 1973, the suspended growth-activated sludge systems have been widely used as the "typical" or "standard" biological treatment method for achieving secondary treatment. Excluding pond installations, nearly 90 percent of the secondary treatment facilities put in place since 1973 have used some form of suspended growth system.

Approximately 1425 of the estimated 1700 existing TF facilities were constructed prior to 1973, while approximately 2950 of estimated 4050 existing WSPs were constructed prior to 1973. In the period between 1973 and July 1982, the Agency estimates that it has participated in funding the construction of over 3500 facilities to meet secondary treatment requirements. Of those facilities, only 281 of the facilities employed TF processes, while 1100 of the facilities employed WSP processes.

EPA believes that the limited number of TF facilities constructed following the passage of Pub. L. 92–500 and EPA's promulgation of the secondary treatment requirements can be attributed in part to a general awareness that the level of effluent quality consistently achieved by TF facilities is somewhat poorer than that consistently achieved by activated sludge type facilities. Although the cited biological treatment techniques were identified in the October 1975 BPWTT document as being capable of meeting current secondary treatment requirements, the ranges of design loadings (or other design criteria) for TFs would often result in more costly facilities than facilities constructed in accordance with designs for TFs that typically existed prior to passage of Pub. L. 92–500.

IV. Data Collection Efforts

In developing this regulation, EPA studied 324 existing biological treatment facilities to determine whether differences in wastewater characteristics, treatment process, design, size and age of facility, location, climate, or cost factors required the development of separate standards for certain classes of facilities. The Agency analyzed at least two years of performance records from each facility, and described the operational limitations, process variability, and process reliability of each facility with respect to meeting the existing secondary treatment requirements. The sample included the following process types and number of facilities: Conventional activated sludge (66), contact stabilization activated sludge (57), extended aeration activated sludge (28), oxidation ditches (28), rock media TFs (64), plastic media TFs (17), rotating biological contactors (27), and WSPs (37).

The technical data collection effort for these analyses is described in the docket materials for this proposed rule and the "Technical Support Document for Proposed Regulations under Section 304(d)(4)," September 1983. Although EPA fully believes that the available data support the minimum levels of effluent quality proposed (see Section VI of this preamble), the Agency continues to seek additional effluent data on the performance of biological treatment processes (see Section XII of this preamble).

V. Classification of Treatment Processes

As discussed in Section II of this preamble, the Agency believes that any relaxation of secondary treatment requirements under section 23 of Pub. L. 97–117 by deeming a facility as providing treatment equivalent to secondary treatment must be based on: (1) A determination that secondary treatment requirements cannot be met consistently through the use of a given *biological treatment process*, and (2) for such biological treatment processes, a determination that a given *facility* cannot consistently achieve secondary treatment requirements. In this section of the preamble, the Agency describes the methodology by which a treatment process would be classified as capable of providing either "treatment equivalent to secondary treatment," or as capable of providing "secondary treatment." Section VI of this preamble describes the basis of determining the level of effluent quality that is attainable by facilities that: (1) Use an equivalent treatment process, and (2) cannot consistently achieve secondary treatment requirements.

In developing the definition of "facilities eligible for treatment equivalent to secondary treatment," the Agency took into account the specific references in the Act to biological treatment, TFs, WSPs, and oxidation ditches. As a further refinement, and to ensure consideration of other types of biological treatment systems, the Agency reviewed the performance of 324 facilities that use a range of biological treatment processes.

The performance data for each of the 324 facilities in the data base were analyzed to estimate an effluent quality value (*i.e.*, empirical 95th percentiles estimated from sets of 30-day moving averages) which the given facility rarely exceeds on a monthly basis. Each of the facilities in the sample was classified by type of treatment process.

For this proposal, a treatment process was considered capable of providing secondary treatment if the median facility's BOD_5 and SS values of the 30-day average were less than mg/l BOD_5 and 30 mg/l SS. If the median value, for a given type of treatment process, of the 95th percentile estimates were greater than 30 gm/l for either BOD_5 or SS then the process type was classified as providing treatment equivalent to secondary treatment. (See Technical Support Document.)

In accordance with the methodology described above and in more detail in the support document, the Agency concluded that TF and WSP treatment processes could not consistently meet secondary treatment requirements; thus, the TF and WSP treatment processes were classified as equivalent treatment processes. The proposed classification is thus consistent with the statutory language that references oxidation ponds, lagoons and TFs.

Using the same methodology, the Agency concluded that oxidation ditches, although they are referenced in the statute, could consistently achieve an effluent quality equal to or better than current secondary treatment requirements. As noted in Section III of this preamble, oxidation ditches are subject to the same limitations of operational complexity, operation costs and energy consumption as standard activated sludge type treatment processes. Given the legislative history that characterizes equivalent treatment processes as: (1) Simpler, more energy efficient and easier to operate than standard methods, and (2) unable to meet secondary performance standards consistently, even though operated to achieve original design performance levels [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981); H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 34-35 (1981)], the Agency believes that oxidation ditches are appropriately classified as a treatment process capable of providing secondary treatment.

All other biological treatment processes were likewise found to be capable of consistently achieving secondary treatment requirements, and are thus classified as treatment processes capable of providing secondary treatment.

VI. Effluent Quality Attainable Through Treatment Equivalent to Secondary Treatment

As discussed in Section II of this preamble, Congress indicated that the use of certain biological treatment facilities should be permitted in spite of the fact that such facilities may not consistently meet a secondary treatment requirement [S. Rep. No. 97-204, 97th Cong., 1st Sess. 18 (1981)]. Thus, in order to determine the level of effluent quality attainable by certain *facilities* using equivalent treatment processes, *i.e.*, certain TF and WSP facilities that cannot consistently met secondary treatment requirements, the Agency believes that it is appropriate to group TF and WSP facilities based on their existing performance capabilities relative to current secondary treatment requirements.

For each pollutant and permit averaging period, Group A included those TF and WSP facilities whose empirically estimated 95th percentiles of their respective sets of 30-day moving averages were less than or equal to 30 mg/l. Since such facilities can be considered as capable of consistently meeting secondary treatment requirements for a given parameter and permit averaging periods, Group A facilities were not included for further analysis.

Group B included facilities whose empirically estimated 95th percentiles of their respective 30-day moving averages for each pollutant were greater than 30 mg/l. Group B facilities were used as the basis for determining the effluent quality attainable by providing treatment equivalent to secondary treatment.

A. 30-day and 7-day Averages

From the resulting sample of well-operated and maintained TF and WSP facilities, and the estimated 30-day BOD_5 and SS effluent values for each facility, a characterization of the effluent quality generally attainable by equivalent treatment processes was made for each pollutant, treatment process type, and permit averaging period by selecting the median (50th percentile) facility. In accordance with the methodology described in more detail in the technical support document, the Agency has concluded that the level of effluent quality attainable by treatment equivalent to secondary treatment can be characterized in terms of a 30-day average BOD_5 and SS of 45 mg/l.

Based on performance data for secondary treatment facilities, the maximum 7-day average effluent quality will be higher than the maximum 30-day average effluent quality by a factor in a range of 1.2 to 1.8. A discussion of the relationship of 30-day to 7-day values for TF and WSP facilities can be found in the tehnical support document for this proposed regulation. In keeping with the 1.5 factor (7-day/30-day) suggested by the 45 mg/l/30 mg/l requirements of the current secondary treatment standard, the Agency believes that a factor of 1.4 to 1.5 is appropriate; thus, the proposed 7-day average BOD_5 and SS effluent attainable by treatment equivalent to secondary treatment is 65 mg/l.

B. Percent Removal

The Agency investigated the feasibility of determining the characteristic pollutant removal efficiencies for BOD_5 and SS that are achieved by the subgroupings of TFs and WSPs. As noted in Section X of this preamble, the plant performance study determined that more than 75 percent of the facilities studied receive raw wastewater with concentrations of less than 200 mg/l for BOD_5 and SS. In more than 40 percent of the facilities the influent strengths were less than 150 mg/l BOD_5 and SS.

Since significant variation in influent strength affects the ability of the Agency to compare the pollutant removal efficiencies achieved by equivalent treatment processes, a percentage removal rate achieved by the median facility within each group was rejected as a basis for classifying the removal efficiency of TF and WSP treatment processes.

In general, however, the Agency's studies show that TF and WSP facilities are capable of achieving between 60 and 85 percent removal of BOD_5 on a 30-day average basis (cf. Section III of this preamble). Equivalent TF facilities are capable of achieving between 60 and 85 percent removal of SS on a 30-day average basis. For WSPs, SS removal requirements can be adjusted under existing provisions of § 133.103(c); thus no further changes are warranted.

For the purposes of this regulation, the Agency believes that 65 percent removal of BOD_5 and SS on a 30-day average basis represents a baseline pollutant removal efficiency that ensures a significant level of biological treatment beyond that generally achieved by primary treatment. Comments are requested in Sections X and XII of this preamble on issues relating to percentage removal requirements.

C. Conclusions

As discussed in Section II of this preamble, Congress indicated that "it would be constructive to permit a range of effluent limitations," rather than "a rigid, single set of numbers applicable on a nationwide basis" [H.R. Rep. No. 97-30, 97th Cong., 1st Sess. 73 (1981)]. Although the effluent values described above in this section of the preamble characterize the average or general capabilities of TF and WSP facilities that cannot consistently meet secondary treatment requirements, the Agency believes that significant variation in performance among TF and WSP facilities would limit the usefulness of a single set of numbers as a blanket effluent limitation applicable to TF and WSP facilities.

The Agency therefore proposes that the calculated effluent values for equivalent treatment facilities act as a minimum level of effluent quality (*i.e.*, an upper limit for a range of effluent quality). The minimum levels of effluent quality for equivalent treatment facilities would thus be specified in terms of a 30-day average for BOD_5 and SS not to exceed 45 mg/l, a 7-day average for BOD_5 and SS not to exceed 65 mg/l, and a 30-day average percent removal of BOD_5 and SS not less than 65 percent. In addition, the existing regulation also provides for an alternative range of SS values achievable by WSPs under § 133.103(c).

which the Agency proposes to retain (amended § 133.103(c)).

The Agency suggests that the existing provisions of the secondary treatment regulation already provide the basis for a lower limit of the range, *i.e.*, 30 mg/l BOD_5 and SS on a 30-day average, 45 mg/l BOD_5 and SS on a 7-day average, and 85 percent removal of BOD_5 and SS. To account for variations in TF and WSP performance within the "range," *e.g.*, 30 to 45 mg/l, which may occur due to differences in design, wastewater characteristics, climate, seasonal and unique local factors, the Agency proposes that the adjusted NPDES permit effluent limitations for TF and WSP facilities be set based on an individual facility's performance capability. The Agency is thus proposing that a facility not be allowed to obtain NPDES effluent limitations that are any less stringent than the level of effluent quality that a facility is capable of achieving (see Section IX of this preamble). This policy will help to minimize additional pollutant loadings that could result from implementation of these proposed secondary treatment requirements, and will help to ensure that facilities continue to operate in accordance with their design capabilities [cf. 33 U.S.C. 1314(d)(4); H.R. Rep. No. 97–30, 97th Cong., 1st Sess. 34–35 (1981); S. Rep. No. 97–204, 97th Cong., 1st Sess. 18 (1981)].

Where local or unique factors would result in a level of effluent quality that is higher than the proposed minimum level of effluent quality, EPA proposes that States be allowed to recommend specific alternative effluent requirements, subject to EPA approval, that take into account those factors (see Section VIII of this preamble). These proposed provisions would also help to ensure that implementation of section 23 of Pub. L. 97–117 by the Agency takes into account differing geographical/climatic conditions which affect treatment plant performance, and that an opportunity be provided to address any seasonal or geographical variability in biological treatment plant performance that could not be addressed in writing a regulation on a national basis [cf. S. Rep. No. 97–204, 97th Cong., 1st Sess. 18 (1981)].

VII. Summary of Proposed Rule

Today's proposed rulemaking for the secondary treatment requirements involves the following changes that the Agency believes explicity address the requirements of section 304(d)(4) of the Act: (1) A definition of "significant biological treatment" (proposed § 133.101(k)); (2) a definition of "facilities eligible for treatment equivalent to secondary treatment (proposed § 133.101(g)); (3) new provisions (proposed § 133.105 (a), (b) and (c)) which would define the effluent quality attainable by facilities eligible for treatment equivalent to secondary treatment; (4) new provisions (proposed § 133.105(d)) that would set forth criteria that a Regional Administrator or State could use to establish alternative effluent requirements; (5) new provisions (proposed § 133.105(c)) which set forth the conditions under which NPDES permits may be adjusted for equivalent facilities; and (6) changes to the eligibility requirements for adjusting the SS values achievable by WSPs (amended § 133.103(c)). Other proposed changes include the addition of definitions for key terms (proposed § 133.101)), the addition of necessary cross-references to new provisions, and the elimination of redundant text. Such changes are not substantive in nature. Unchanged regulatory language is also being printed for the sake of completeness to the reader. Except as noted for certain TF and WSP facilities, the current secondary treatment requirements would not be changed under this proposal.

A. Definition of Facilities Eligible for Treatment Equivalent to Secondary Treatment

The proposed rule would use the following criteria (proposed § 133.101(g)) to define a category of existing facilities that provide treatment equivalent to secondary treatment: (a) The facilities cannot consistently achieve secondary treatment as currently defined, (b) the facilities employ either a TF or a WSP as the principal biological treatment process, and (c) the facilities provide for significant biological treatment of raw wastewater (at least 65 percent removal of BOD_5).

1. *Inability of Facility to Consistently Achieve Secondary Treatment.* Under the proposed provisions (proposed § 133.101(g)(1)), only those TF and WSP facilities that cannot consistently meet secondary treatment requirements would be eligible for a relaxation of the secondary treatment requirements. A discussion of the basis for this provision can be found in Sections II, V and IX of this preamble, and in the technical support document.

2. *Use of TF or WSP as Principal Process.* The Agency is proposing that an eligible facility use a TF or WSP as the principal process for providing significant biological treatment (proposed § 133.101(g)(2)). The justification for classifying equivalent facilities based on the use of a TF or WSP is discussed in Section V of this preamble and the technical support document. The term "principal process" is used to suggest the major biological treatment components that are directly in the treatment process train, rather than ancillary components. By focusing on "principal" processes, the proposed regulation would not exclude those facilities that incorporate minor components for improved treatment, *e.g.*, the addition of covers, chemical feeds, solids contact processes for TF, or the addition of sand filters or aeration for WSPs, provided that the TF or WSP unit is the principal process that results in significant removal of BOD_5

3. *Significant Biological Treatment.* The Agency is proposing that equivalent treatment works provide significant biological treatment of wastewater. These provisions ae based on the legislative history that Congress intended for certain facilities to be deemed the equivalent of secondary treatment if they achieve significant pollutant reductions, even though they cannot consistently meet EPA's existing secondary treatment requirements.

EPA findings referenced in Section III of this preamble show that when TF and WSP facilities are used as a biological treatment process they can be expected to remove between 60 and 90 percent of BOD_5. It is also noted that the legislative history of the 1972 Clean Water Act described primary treatment as removing from 30 to 50 percent of organic matter, *i.e.*, BOD_5, while secondary treatment was described as removing from 50 to 90 percent removal of BOD_5 [*Leg. Hist.* at 1424]. In proposed §§ 133.101(k) and 133.101(g)(3) the Agency would require that facilities deemed equivalent to secondary treatment provide at least 65 percent removal (across the plant) of BOD_5 on a 30-day average basis.

This proposed provision would ensure that the facilities applying for permit adjustments provide a level of treatment significantly beyond that achieved through primary treatment, *i.e.*, physical separation and removal of grit, coarse sands, settlable, and floatable materials. Thus, TF and WSP facilities that do not provide significant biological treatment, *e.g.*, roughing filters or equalization basins, would not meet the definition of significant biological treatment (proposed § 133.101(k)).

B. Minimum Level of Effluent Quality Attainable

Except for SS values for WSPs under the existing regulation (§ 133.103(c)), the proposed rule would define the effluent quality generally attainable by TF and WSP facilities during a 30-day period in terms of a minimum level of effluent quality not to exceed 45 mg/l for BOD_5 and SS, during a 7-day period in terms of a minimum level not to exceed 65 mg/l for BOD_5 and SS, and 65 percent removal of BOD_5 and SS on a 30-day average basis (proposed § 133.105 (a) and (b)). The existing pH requirements for secondary treatment would not be adjusted (proposed § 133.105(c)). Under proposed § 133.105(b), the SS values for WSPs would be established in accordance with existing § 133.103(c). Applicable SS values established under § 133.103(c) were published on November 27, 1978 [43 FR 55279] and are reprinted as Appendix B to this preamble as guidance. The rationale for the proposed minimum levels of effluent quality is discussed in Section III, IV and VI of this preamble, and the technical support document for this proposed rule.

C. Alternative State Requirements

The proposed rule would allow States to recommend (subject to EPA approval) alternative requirements for the 30-day and 7-day effluent BOD_5 and SS concentrations based on effluent concentrations consistently achieved through proper operation and maintenance of the "median" facility in a sample of facilites meeting the defintion of "facilities eligible for treatment equivalent to secondary treatment" (proposed § 133.105(d)). The rational for this proposal is the Congressional intent that the Administrator should take into account geographic, seasonal and climatic conditions affecting plant performance. Further discussion is provided in Sections II and VIII of this preamble.

D. NPDES Permit Adjustments

Specific numeric effluent limitations for an eligible facility would be established on a case-by-case basis by the NPDES permitting authority based on the performance capabilities of the given facility (proposed § 133.105(e)); in no case, however, could the minimum levels of effluent quality established at the national (or State) level be exceeded. Further discussion on the relationship of this proposal to NPDES permits can be found in Section IX of this preamble.

E. Other Proposed Changes

1. *Suspended Solids Limits for Waste Stabilization Ponds (WSPs).* In 1977 EPA amended the secondary treatment regulation to allow an adjustment of the suspended solids (SS) effluent limitations where a WSP is used as the sole treatment process, provided that the wastewater flow was less than 2 million gallons per day (mgd). This proposed regulation would eliminate the 2 mgd "cap."

Agency experience with WSPs indicated that very few WSPs have been constructed to handle flows in excess of 2 mgd. Moreover, in those cases where existing WSP facilities with flows over 2 mgd have experienced violations of SS effluent limitations, the violations have primarily resulted from algal growth, as with smaller WSPs. The Agency does not believe that the additional SS allowance for WSP with flows over 2 mgd will result in any environmental effects, since § 301.(b)(1)(C) and 401 of the Act require effluent limitations that will meet water quality standards. Since there appears to be no compelling reason for maintaining the 2 mgd limit on application of the WSP/SS permit adjustment, the Agency is proposing elimination of the 2 mgd "cap" (existing § 133.103(c)(2)).

The docket materials for this proposed rulemaking indicate that many WSPs are not capable of reliably achieving 30 mg/l BOD_5 on a 30-day average. Since the performance data indicate that WSPs are generally capable of achieving an effluent quality of 45 mg/l BOD_5, they would be eligible for a BOD_5 permit adjustment under the proposed § 133.105 provisions for treatment equivalent to secondary treatment. Therefore, the reference in the existing § 133.103(c) to BOD_5 effluent quality achieved by WSPs has been changed from § 133.102(a) ("Secondary Treatment") to proposed § 133.105(a) ("Treatment Equivalent to Secondary Treatment").

2. *Definitions.* The proposed rule contains a "Definitions" section (proposed § 133.101) that would allow short-hand reference to key terms. Where appropirate, the existing regulation has been revised to eliminate redundancies by use of the defintitions. For example, the terms "30-day average" and "7-day average" have been used in place of longer statements. Changes to the existing language in § 133.102 and 133.103 are not substantive in nature, and have been included in this proposal for the sake of completeness to the reader.

In addition, cross-references have been added in existing sections of the regulation to reflect new amendments. For example, under the provisions for WSPs, references are made to proposed § 133.105 ("Treatment Equivalent to Secondary Treatment").

VIII. Modification of Effluent Ranges

The proposed regulations would establish a minimum level of effluent quality attainable by treatment equivalent to secondary treatment (proposed § 133.105 (a), (b) and (c)) with further provision that individual permits be adjusted to reflect plant performance capabilities (proposed § 133.105(e)). As an alternative to the effluent concentrations for BOD_5 and SS concentrations specified in proposed §§ 133.105 (a)(1), (a)(2), (b)(1) and (b)(2), EPA further proposes that individual States be allowed to recommend alternative effluent requirements that would reflect the performance of TF and WSP facilities within their State more accurately than the national limits. This proposed provision (proposed § 133.105(d)) would provide States with the flexibility to take into account additional local factors, and would thus be consistent with Congressional intent that the Agency take into account geographic, climatic, and seasonal factors affecting plant performance (see Section II of this preamble).

The WSP permit adjustment for SS concentrations (existing § 133.103(c)) provides a precedent for allowing States to participate in setting alternative effluent requirements by assessing the performance of local treatment works. In order to implement a similar process in an expedited manner, the Agency is proposing that a Regional Administrator or State determine the effluent concentrations consistently achieved by TF and WSP facilities in accordance with a methodology set forth in proposed §§ 133.105(b), 133.101(f), and 133.101(g). EPA would retain responsibility for approving any alternative requirements suggested by a State, and may veto any non-conforming permit (40 CFR 123.44(c)).

A Regional Administrator, or State, would have to demonstrate that: (1) Only TF and WSP facilities eligible for treatment equivalent to secondary treatment (proposed § 133.101(g)) are included the analysis, and (2) the recommended alternative requirements reflect the effluent concentrations consistently achieved by the median facility in a representative sample of facilities within a State or appropriate contiguous geographical area. Application of the proposed criteria would ensure that alternative requirements are developed in the same manner as used by EPA in developing the national numbers (see Section VI of this preamble and "Technical Support Document for Proposed Regulations under Section 304(d)(4)," September 1983). In developing alternative requirements, Regional Administrators and States may consider disaggregation of the sample of eligible facilities based on significant differences in climate (or geography), seasonal performance, or variations in the type of TF or WSP employed. For each disaggregated sample, however, the criteria specified in proposed § 133.105(d) would have to be satisfied.

Since the implementation of the alternative State requirements provision would involve application of the regulatory criteria set forth in proposed § 133.105(d) during the NPDES permit process, EPA would not be proposing or promulgating the approved alternative effluent requirements. Although the Agency intends to publish values in the **Federal Register** as a notice to the public as was done for WSPs [43 FR 55279], approval of the alternative effluent requirements without a separate rulemaking should speed implementation of section 23 of Pub. L. 97–117. The Agency solicits comments on the appropriateness of such an approach. Comments on the proposed methodology should be made in response to this proposed rulemaking.

As an alternative to implementing alternative State requirements through the NPDES permit process, the Agency considered the use of formal rulemaking for each alternative State requirement. Under such a proposal, States would be required to submit recommendations within a specified time period, *e.g.*, 180 days. EPA would review the recommendations and any supporting data and analyses. Each alternative requirement deemed approvable by EPA, in accordance with the methodology proposed in this regulation, would be published as a proposed rule in the **Federal Register**. After taking public comment, the Agency would promulgate, if appropriate, the alternative State requirements. Approved alternative requirements could not be used in NPDES permits until EPA had promulgated them.

Although the Agency believes that implementation of the provisions contained in today's proposal (proposed § 133.105(d)) is appropriate, comments are invited on the advisability of formally promulgating both the methodology for determining alternative requirements *and* the alternative State requirements developed from application of that methodology.

On Section XII of this preamble, the Agency requests comments from States at this time on whether the State is likely to recommend an alternative State range, the level of effluent quality that might be recommended, and the number of facilities affected.

IX. Relationship to NPDES Permits

Section 402(a)(1) of the Act authorized the setting of requirements for direct dischargers on a case-by-case basis; however, Congress intended that, for the most part, control requirements would be based on regulations promulgated by the Administrator. In the case of section 23 of Pub. L. 97–117, Congress directed the Administrator to deem certain facilities as the equivalent of secondary treatment, taking into account pollutant removal efficiency. The legislative history (see Section II of this preamble) indicates that Congress intended the Agency to consider design capability, performance, variability, and inability of these facilities to meet secondary treatment requirements consistently. The legislative history further suggests that the Administrator should consider the use of a "range" in setting requirements. Additional provision of section 23 require that assurances be made that water quality not be adversely affected.

In implementing a case-by-case approach, the Agency proposes that permit adjustments be based upon the performance capabilities of a treatment works. These requirements would reflect the direction of Congress that the Administrator issue regulations that consider the design of the facilities. Since the legislative history does not indicate any intent on the part of Congress to sanction poor operation and maintenance, or the abandonment of treatment processes, and since the legislative history does indicate that proper operation and maintenance for facilities within their original design performance levels should be assured [cf. S. 1274, 97th Cong., 1st Sess. section 16 (1981), 127 Cong. Rec. S5527 (May 21, 1981); H.R. Rep. No. 97–30, 97th Cong., 1st Sess. 34–35 (1981)], the Agency proposes to set effluent limitations based on proper operation and maintenance of facilities within their design capacity.

A. Case-by-Case Adjustments of NPDES Permits

The following amendments are proposed to implement case-by-case adjustments of NPDES permits for eligible facilities. Although these changes are proposed as part of the Secondary Treatment Information Regulation (40 CFR Part 133), the Agency believes that such changes may be more appropriately included as part of the NPDES permit regulation (40 CFR Part 122). Therefore, if the provisions set forth in proposed § 133.105(e) are promulgated, the Agency may promulgate them as an amendment to 40 CFR Part 122.

1. *Performance and Design Capability Factors.* For facilities that meet the eligibility requirements (proposed § 133.101(g)), the proposed regulation would allow the NPDES permitting authority to adjust effluent limitations for an individual treatment facility based on the performance capabilities of the treatment works (proposed § 133.105 (e)(1) and (e)(2). However, in no case, would the individual NPDES effluent limitations be set to values less stringent than those established at the national levels (proposed § 133.105 (a), (b), and (c)) or those established through procedures for alternative State requirements (proposed § 133.105(d)). (For those TF and WSP facilities that do not meet the eligibility requirements, *e.g.*, a TF that can consistently achieve the current secondary treatment requirements, an adjuustment of the permits would not be made.)

These provisions are intended to ensure that increased concentrations of pollutant do not result from facilities that are currently achieving a significantly higher degree of pollutant removal than would be allowed at the minimum level of established effluent quality, *e.g.*, 45 mg/l BOD_5 and SS on a 30-day average basis. It is important to note here that the essence of the proposed permit adjustment procedure is not to sanction increased levels of pollutant discharges, but to encourage the continued use of existing facilities using equivalent treatment processes and minimize unnecessary or untimely facility upgrading. Thus, levels of effluent quality that are already achieved by a facility must be maintained (proposed § 133.105(e)(1)).

Permit writer guidance on issues to consider in setting case-by-case effluent limitations will be issued in conjunction with any final rule. The effluent limitations should reflect the effluent quality achievable by a facility, based on present performance capabilities. In those cases where a facility is operating below its hydraulic design capacity, effluent concentrations should also be based on present performance data, taking into account that the total BOD_5 and SS pollutant load may increase as the effluent flow approaches the facility's hydraulic design capacity.

2. *NPDES Permits for New Facilities.* In developing NPDES permits for new TF and WSP facilities, the NPDES permitting authority would have to use a registered engineer's best professional judgment (BPJ) of the ultimate design capability of the proposed treatment process, taking into account geographical and climatic conditions (proposed § 133.105(e)(2)). Such BPJ determinations for new facilities should consider the performance capabilities of recently constructed facilities in similar

situations. Data available in technical support document and docket materials for this proposed regulation provide an indication of the performance capabilities of recently constructed facilities using TF and WSP processes.

In designing new TF and WSP facilities, design engineers should use appropriate design criteria that reflect the recent designs of such facilities in comparable situations. The design criteria specified in MCD–53 will provide general design guidance. However, it should also be recognized that engineering advances in the design of TF facilities, including the use of synthetic media, changes in geometry and sizing of TF towers, the use of covers, chemical additions, and low-cost "add-on" processes can result in significantly improved effluent quality from a TF facility in a cost-effective manner.

3. *Water Quality Assurances.* Section 23 of Pub. L. 97–117 (§ 304(d)(4) of the Act) requires that assurances be made that water quality will not be advesely affected by deeming facilities as the equivalent of secondary treatment. The Agency's NPDES permit regulations already require that any effulent limitations established in NPDES permits result in compliance with applicable water quality standards, State effluent requirements, and other provisions of the Act (see 40 CFR 122.44 at 48 FR 14169 and 40 CFR 124.53).

4. *Seasonal Permits.* EPA recognizes that the performance of "equivalent" treatment processes such as TFs and WPSs may be affected by differences in temperature, and thus, such facilities may exhibit variation in performance depending on geographical, climatic, or seasonal factors. For a given facility, there may be significant differences in performance from one period of the year to another. In implementing proposed § 133.105(e), the Agency suggests that NPDES permit writers consider the development of seasonal permits that would reflect such differences in performance where the differences are significant. If a seasonal permit is developed, a specific time period, during which the different effluent limitations would apply, should be established during the permit revision process based on historical records for either mean monthly ambient air temperature or effluent wastewater temperature.

B. Implementation

Due to the large number of municipal permits that could be impacted by the proposed rule, a priority system must be established by EPA and NPDES authorized States to implement the rule. The preferred method of implementation would be during normal permit reissuance.

In the Agency's sample of 64 rock media TF facilities, 41 facilities could not reliably achieve 30 mg/l BOD_5 on a 30-day average, while 36 facilities could not reliably achieve 30 mg/l SS on a 30-day average. For the 17 plastic media TFs in the study, 9 facilities could not reliably achieve 30 mg/l BOD_5 on a 30-day average, while 6 facilities could not reliably achieve 30 mg/l SS on a 30-day average. (For the purposes of deriving effluent ranges for TFs, plastic media TF facilities were grouped with rock media TFs). Of the 37 WSP facilities, 23 facilities could not consistenly achieve the Agency's existing BOD_5 requirements.

Applying these findings to the performance of the approximately 5800 existing TFs and WSPs nationwide, it is estimated that two-thirds of all TF and WSP facilities (or approximately 3800 facilities) would be potentially eligible for adjustment of NPDES permit effluent limitations.

It is also estimated that approximately one-half of the NPDES permits for TF and WSP facilities have expired or are due for reissuance. Thus, about 1900 facilities could be handled through the preferred method of adjusting NPDES permits at time of reissuance. The other 1900 facilities would be reissued over a 5-year period.

Elsewhere in today's **Federal Register** the Agency is proposing changes to 40 CFR 122.62 that would allow municipalities to request permit modification prior to reissuance. Therefore, if the changes to 40 CFR 122.62 are published as a final rule, permittees who wish to request modification prior to reissuance may do so, but must submit their requests for modification within 90 days of the publication date for the final secondary treatment regulation (cf. section 122.6(a)(3)(i)(C)).

In setting priorities for water quality standards, wasteload allocation and monitoring resources needed to implement permit adjustments, States should take into account other program activities (cf. Water Quality Standards regulation, 40 CFR Part 131, and Water Quality Planning and Managentent regulation 409 CFR Part 130).

X. Additional Issues

A. Percentage Removal Requirements

In addition to the 30-day average effluent concentration requirements of 30 mg/l for BOD_5 and SS established under §§ 133.102 (a)(1), and (b)(1), the current secondary treatment regulation requires 85 percent removal of those pollutants on a 30-day average basis (§§ 133.102 (a)(3) and (b)(3)). For less concentrated wastewaters (for the purposes of the following discussion, less concentrated wastewaters shall mean wastewaters with influent concentrations of less than 200 mg/l for BOD_5 and SS), the existing regulation thus requires a POTW to provide a level of treatment more stringent than that required by the 30 mg/l secondary treatment effluent limitations for BOD_5 and SS. Although the requirement can result in forcing "advance treatment," the 85 percent removal requirement was originally established to achieve two basic objectives: (1) To help encourage municipalities to correct excessive infiltration and inflow (I/I) to their sanitary sewer systems, and (2) to help prevent intentional dilution of influent wastewater.

Based on EPA and State experience with the secondary treatment requirements, EPA is aware that changes to the mandatory 85 percent removal requirement should be considerd. Although the Agency is not proposing to make any changes to the percentage removal requirements at this time, the Agency requests comments on the following questions in order to determine whether the nature of the problems warrants changes in the requirement:

(1) Are measures to correct sources of less concentrated wastewaters, such as correction of I/I, as effective as previously assumed?

(2) Will sewer systems subject to nonexcessive quantities of I/I (*i.e.*, I/I that cannot be economically and effectively reduced in a sewer system) have wastewaters with BOD_5 concentrations of 200 mg/l or will they by significantly less?

(3) Is the typical influent wastewater to POTW's generally less than 200 mg/l?

(4) Will maintenance of the 85 percent removal requirement require certain POTWs to provide overly stringent treatment where I/I cannot be economically and effectively reduced in a sewer system? and

(5) Would other regulatory mechanism, such as sewer use ordinances, grant conditions, flow limits, mass load limits, and other permit requirements, be more effective in prevention of deliberate dilution of influent wastewater to meet effluent concentration requirements?

B. Discussion of Issues

1. *Correction of I/I Sources of Less Concentrated Wastewaters.* Under the Clean Water Act (33 U.S.C. 1281(g)(3))

and EPA's construction grants program (cf. 40 CFR 35.2005(b)(16) and 35.2120), grants for the construction of treatment works cannot be made unless an applicant has demonstrated that the sewer system is not subject to "excessive" I/I. The Agency has defined excessive I/I as quantities of I/I which can be economically eliminated from a sewer system as determined in cost-effectiveness analysis that compares the costs of correcting the I/I conditions to the total costs of transportation and treatment of the I/I.

The 85 percent removal requirements can be an element in the cost-effectiveness analysis by requiring a municipality to provide a higher level of treatment when the influent wastewaters are less concentrated than 200 mg/l for BOD_5 and SS. The 85 percent removal requirement also acts to hold a POTW to a more stringent level of treatment until such time as the causes of the less concentrated wastewater are corrected. The feasibility of this regulatory approach is based on an assumption that a municipality will in fact be able to implement corrective measures that are less costly than the alternative of providing additional hydraulic capacity.

EPA initally believed that substantial portion of the I/I problem (from seventy to one hundred percent) could be corrected through cost-effective sewer system rehabilitation. However, more recent information ("Evaluation of Infiltration/Inflow Program," draft technical reports, 1979, 1980) indicates that available infiltration correction techniques are far less effective than initially predicted, and that the actual portion of infiltration amenable to correction may be in a range from zero to forty percent. As a result, even large expenditures for correction of sewer leakage may result in relatively small ultimate reduction of the infiltration problem, while BOD_5 and SS concentrations remain below 200 mg/l.

The Agency requests comments on the ability of infiltration and inflow correction programs to result in raw wastewater with concentrations of 200 mg/l BOD_5 and SS or greater.

2. *Expected Influent Concentrations under Allowable Infiltration/Inflow Conditions.* Although influent wastewater for POTWs is often characterized as typically having concentrations of 200 mg/l for BOD_5 and SS, less concentrated influent wastewaters are likely even where facilities receive flows from properly maintained sewer systems. The construction grants programs has specified a base flow of 120 gallons per capita per day (gpcd), which is used to determine grant eligible capacity for treatment of domestic wastewater (40 CFR 35.2005(b) (28), and 40 CFR 35.2120). This figure is based on an assumed 70 gpcd domestic wastewater and 50 gpcd of nonexecessive infiltration. No further I/I work is required if domestic wastewater plus nonexecessive infiltration is less than 120 gpcd. For nonexcessive inflow, the construction grant regulations allow a rainfall induced peak from inflow sources that does not exceed the hydraulic capacity of the treatment works or cause chronic operational problems during storm events (cf. 35.2005(b)(29)).

Based on a typical BOD_5 load from domestic uses and flows within the grant allowable level, an influent strength of approximately 170 mg/l for BOD_5 and SS could be expected. Where a sewer system is subject to higher levels of infiltration that cannot be economically or effectively eliminated (cf. 40 CFR 35.2005(b)(16)), or nonexecessive inflow during storm events, the influent strength would be reduced below 170 mg/l for BOD_5 and SS. Thus, the 85 percent removal requirement could require treatment more stringent than 30 mg/l BOD_5 and SS, even though cost-effective I/I correction had been implemented.

3. *Typical Influent Concentrations.* The discussion above suggests that influent strength to POTWs without large industrial contributions will generally have concentrations less than 200 mg/l for BOD_5 and SS. In fact, EPA studies referenced in Section IV of this preamble have found that more than three-quarters of the facilities studied had influent strengths of less than 200 mg/l for BOD_5 and SS. Approximately 40 percent of the facilities had influent strengths less than 150 mg/l for BOD_5 and SS. Thus, the significant majority of the facilities in this representative sample would be expected to provide a level of treatment more stringent than 30 mg/l for BOD_5 and SS under the 85 percent removal requirement. The Agency requests comments on whether typical influent wastewater strengths are less than 200 mg/l for BOD_5 and SS.

4. *Unnecessarily Stringent Levels of Treatment.* It has been suggested that the current requirement may drive a facility to providing advanced treatment of municipal wastewaters, even though there is no water quality basis for that level of treatment. In such situations, a cost-effectiveness analysis would have determined that treatment was more cost-effective than correction of the sources of the less concentrated wastewater. The Agency requests comments on whether advanced treatment would be needed for less concentrated wastewaters to comply with the 85 percent removal requirement.

C. Options for Modifying the Percentage Removal Requirements

The Agency has identified and requests comments on the following options (or combination of options) for modifying the percentage removal requirement:

(1) Eliminate the mandatory requirement, but provide substitute language allowing an NPDES permitting authority to establish percent removal requirements for BOD_5 and SS;

(2) Modify the requirement so that it applies on an annual average basis instead of applying on a 30-day average basis;

(3) Modify the requirement to provide for a percent removal of BOD_5 and SS on a 30-day average that is less than 85 percent;

(4) Retain the 85 percent removal requirement, but allow the substitution of either a flow limit or a mass loading limit for BOD_5 and SS; and

(5) Determine percentage removal requirements on a case-by-case basis using the design removal efficiency for BOD_5 and SS.

Based on comments received, the Agency will determine whether changes in the requirement are warranted. At this time, EPA is considering all five options (or combination of options). The Agency currently believes that elimination of the mandatory requirement at the discretion of the NPDES permitting authority (Option 1), or the substitution of mass limits or flow limits (Option 4) are the preferred options if a change in the existing requirement is appropriate. Elimination of the requirement, with flexibility to impose percentage removal requirements where needed, would allow the existing requirement to be imposed when necessary, but would also provide relief to facilities that are violating the 85 percent removal requirement even though the facilities and sewer systems are in good condition. A mass limit or flow limit would help to ensure against the introduction of clear water into sewer systems to achieve effluent concentration limitations through dilution.

The Agency specifically invites comment on the need to modify the existing regulation and on each of these alternative ways of modifying the requirement. Any of these alternatives might be selected in the final regulation Accordingly, the public should submit comments on this issue at this time. If

EPA determines that a change in the requirement is necessary, EPA intends to promulgate new requirements based on one of the five options.

XI. Regulatory Reviews

A. Executive Order 12291

Under Executive Order (E.O.) 12291 EPA is required to judge whether a regulation is "major" and therefore subject to the regulatory impact analysis requirements of the Order or whether it may follow other development procedures. The Agency has determined that this proposed regulation is not a major rule within the scope of E.O. 12991. This proposed rulemaking was submitted to the Office of Management and Budget (OMB) for review as required under E.O. 12291. Any comments from OMB and any EPA response are available for public inspection at the location noted in the **ADDRESSES** section.

B. Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*, EPA must submit a copy of any proposed rule which contains a collection of information requirement to the Director of OMB for review and approval. The Agency has determined that a new collection of information requirement would be involved under proposed § 133.105(d). EPA has submitted the proposed rule and supporting documents on the information collection requirement to OMB under Section 3504(h) of the Paperwork Reduction Act. Comments on the Agency's proposed information collection request may be sent to: Office of Information and Regulatory Affairs, OMB, Attention: Desk Officer, EPA, and to the location given in the **ADDRESSES** section of this preamble. The final rule will explain how the Agency has responded to any OMB or public comments.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act, 5 U.S.C. 601 *et seq.*, requires EPA to assess the impact of its regulatory proposals on "small entities." No regulatory flexibility analysis is required, however, where the head of the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.

The NPDES permit modifications proposed today will allow NPDES permitting authorities to modify discharge requirements for many of the small communities that use TF and WSP treatment technologies. In those cases, where requirements are modified, the costs of construction of new facilities, and operation and maintenance costs of existing facilities would be eliminated or reduced. The estimates of the ultimate benefits that will accrue to small communities as a result of this proposal are uncertain because of the flexibility provided, and inherent resulting difficulties in estimating cost impacts. Although precise quantification of costs and benefits of this proposal is not possible, the Agency believes that this proposal will have a net beneficial effect.

For operational facilities that meet the criteria for treatment equivalent to secondary treatment (proposed §§ 133.101(g) and 133.105), communities may seek adjustment of NPDES permits where current requirements are not being met. The Agency estimates that the proposed rule would enable over 3900 facilities to experience significant cost savings through deferral or elimination of costly capital improvements. In Section XII of this preamble the Agency is requesting additional summary data and estimates of the number of facilities that would be eligible for adjustments of their NPDES permits under this proposed rule.

For new TF and WSP facilities, the adjustments from secondary treatment requirements would be based on the best professional judgment of the design capabilities of the proposed facility. This provision should result in the expanded use of these less expensive wastewater treatment technologies, and the initial capital investment would be less than under current requirements. This should also result in lower EPA grant awards in many cases, releasing funds for additional projects that may not have been funded except for this cost savings measure. Additional operation and maintenance savings will result as well.

Thus, the Agency believes that today's proposal will not result in any significant economic impact on small communities. Accordingly, I hereby certify, pursuant to 5 U.S.C. 605(b), that this amendment will not have a significant impact on a substantial number of small entities.

D. Science Advisory Board

Pursuant to provisions of the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA) of 1978, 42 U.S.C. 4365, EPA's Science Advisory Board (SAB) has reviewed certain technical aspects of this proposed rule. Public meetings were held on November 29, 1982, January 17, 1983, February 10–11, 1983, April 27, 1983, and June 22–23, 1983 [47 FR 51471, 48 FR 508, 48 FR 3652, 48 FR 15535, 48 FR 24970]. The SAB has noted that it believes that new TF facilities can be designed to meet current secondary treatment requirements. In Section XII of this preamble, the Agency is requesting comments on the performance capabilities and associated costs of new TF facilities. SAB comments received prior to publication of this proposed rule are a part of the record for this proposed rulemaking, and are available for public inspection at the location given in the **ADDRESSES** section of this notice. Any additional SAB comments will be considered during the public comment period on this proposed rule, and will be available for public inspection as part of the record for promulgation of a rule.

XII. Comments Invited

The Agency invites and encourages comments on any aspect of the proposal set forth in this notice but is particularly interested in receiving comments on the issues listed below. All comments received within 60 days will be considered in the promulgation of a final rule. In order for the Agency to evaluate the views expressed, the comments should contain specific data and information to support those views.

A. The Agency requests comments and supporting summary data from States on the number and type of facilities that may be eligible for the proposed effluent limitations adjustments (proposed § 133.105)). Where appropriate, the agency is also interested in receiving comments from States (together with preliminary estimates of any alternative BOD_5 and SS limits, and the number of affected facilities) on any alternative State effluent requirements (proposed § 133.105(d)) that might be recommended for treatment equivalent to secondary treatment. Comments are specifically requested on the appropriateness of implementing the alternative State requirements in the NPDES permit process in accordance with the methodology set forth in the proposed criteria (see Section VIII of this preamble). In addition, the Agency invites comments on whether it would be appropriate to establish alternative State requirements through formal rulemaking procedures.

B. As discussed in Section X of this preamble, the Agency is considering promulgation of one of the following potential changes to the mandatory percentage removal requirements:

(1) Eliminate the mandatory requirement, but provide substitute language allowing an NPDES permitting

authority to establish percent removal requirements for BOD_5 and SS;

(2) Modify the requirement so that it applies on an annual average basis instead of applying on a 30-day average basis;

(3) Modify the requirement to provide for a percent removal of BOD_5 and SS on a 30-day average that is less than 85 percent;

(4) Retain the 85 percent removal requirement, but allow the substitution of either a flow limit or a mass loading limit for BOD_5 and SS; and

(5) Determine percentage removal requirements on a case-by-case basis using the design removal efficiency for BOD_5 and SS.

C. In order to help it evaluate its current preference to promulgate either Option (1) or Option (4), the Agency requests comments on the following questions:

(1) Are measures to correct sources of less concentrated wastewaters, such as correction of I/I, as effective as previously assumed?

(2) Will sewer systems subject to nonexcessive quantities of I/I (*i.e.*, I/I that cannot be economically and effectively reduced in a sewer system) have wastewaters with BOD_5 concentrations of 200 mg/l or will they be significantly less?

(3) Is the typical influent wastewater to POTWs generally less than 200 mg/l?

(4) Will maintenance of the 85 percent removal requirement require certain POTWs to provide overly stringent treatment where I/I cannot be economically and effectively reduced in a sewer system? and

(5) Would other regulatory mechanisms, such as sewer use ordinances, grant conditions, flow limits, mass load limits, and other permit requirements, be more effective in prevention of deliberate dilution of influent wastewater to meet effluent concentration requirements?

D. In proposed § 133.105(e)(2), the Agency is proposing that NPDES permit effluent limitations for new TF and new WSP facilities be developed using best professional judgment of design capabilities of the proposed treatment process, taking into account geographical and climatic conditions. The Agency's Science Advisory Board has suggested that new TF facilities can be designed to achieve current secondary treatment requirements. However, the Agency's experience in the construction grants program is that new TF facilities are rarely proposed as the preferred treatment alternative for meeting secondary treatment. In order to assess the need for guidance on the issue of permit effluent limitations for new TF (as well as WSP) facilities, the Agency requests comments and supporting data on the performance capabilities, capital costs and operating costs of newly designed TF (and WSP) facilities. If possible, such comments and data should address the comparative performance data and the costs for alternative treatment technologies considered in cost-effectiveness analysis for such facilities.

List of Subjects in 40 CFR Part 133

Publicly owned treatment works, Waste treatment and disposal, Water pollution control.

Dated: November 4, 1983.

William D. Ruckelshaus,

Administrator.

Appendix A—Abbreviations; Acronyms and Terms Used in This Notice

Act—The Clean Water Act

Agency—The United States Environmental Protection Agency

BOD_5—Biochemical oxygen demand (BOD_5)

BPWTT—Best practicable waste treatment technology, under sections 201(g)(2)(A) and 304(d)(2) of the Act, and repealed section 301(b)(2)(B) of the Act

CWA—The Clean Water Act

Clean Water Act—The Federal Water Pollution Control Act Amendments of 1972 [33 U.S.C. 1251 *et seq.*], as amended by the Clean Water Act of 1977 [Pub. L. 95-217] and the Municipal Wastewater Treatment Construction Grant Amendments of 1981 [Pub. L. 97-117]

EPA—The United States Environmental Protection Agency

mgd—Million gallons per day

mg/l—Milligrams per liter

MCD-53—"Innovative and Alternative Technology Assessment Manual," [EPA 430/9-78-009, MCD-53, 1980]

NPDES permit—A National Pollutant Discharge Elimination System permit issued under section 402 of the Act

POTW—Publicly owned treatment works

SS—Suspended solids

TF—Trickling Filter

WSP—Waste stabilization pond

1981 Amendments—The Municipal Wastewater Treatment Construction Grant Amendments of 1981 [Pub. L. 97-117]

Appendix B—Suspended Solids Limitations for Wastewater Treatment Ponds [1] [Source: 43 FR 55279, November 27, 1978]

Location	Suspended solids limit [2] (mg/l)
Alabama	90
Alaska	70
Arizona	90
Arkansas	90
California	95
Colorado:	
Aerated Ponds	75
All Others	105
Connecticut	N.C.
Delaware	N.C.
District of Columbia	N.C.
Florida	N.C.
Georgia	90
Guam	N.C.
Hawaii	N.C.
Idaho	N.C.
Illinois	37
Indiana	70
Iowa:	
Controlled discharge, 3 cell	([3])
All Others	80
Kansas	80
Kentucky	N.C.
Louisiana	90
Maine	45
Maryland	90
Massachusetts	N.C.
Michigan:	
Controlled seasonal discharge	
Summer	70
Winter	40
Minnesota	N.C.
Mississippi	90
Missouri	80
Montana	100
Nebraska	80
North Carolina	90
North Dakota:	
North and east of Missouri River	60
South and west of Missouri River	100
Nevada	90
New Hampshire	45
New Jersey	N.C.
New Mexico	90
New York	70
Ohio	65
Oklahoma	90
Oregon:	
East of Cascade Mts.	85
West of Cascade Mts.	50
Pennsylvania	N.C.
Puerto Rico	N.C.
Rhode Island	45
South Carolina	90
South Dakota	120
Tennessee	100
Texas	90
Utah	N.C.
Vermont	55
Virginia:	
East of Blue Ridge Mts.	60
West of Blue Ridge Mts.	78
East slope counties: Loudoun, Fauquier, Rappahannock, Madison, Green, Albemarle, Nelson, Amherst, Bedford, Franklin, Patrick	([4])
Virgin Islands	N.C.
Washington	75
West Virginia	80
Wisconsin	80
Wyoming	100
Trust Territories and N. Marianas	N.C.

[1] The values set for Iowa and Virginia incorporate a specific case-by-case provision; however, in accordance with 40 CFR 133.103(c), adjustments of suspended solids limitations for individual ponds in all States are to be authorized on a case-by-case basis.

[2] Thirty consecutive day average or average over the period of discharge when the duration of the discharge is less than 30 days.

[3] Case-by-case but not greater than 80.

[4] Case-by-case application of 60/78 limits.

Notes.—N.C.—No change from existing criteria.

Based on the reasons presented in the preamble, EPA proposes to revise 40 CFR Part 133 to read as follows:

PART 133—SECONDARY TREATMENT INFORMATION

Sec.

Authority: Sections 301(b)(1)(B), 304(d)(1), 304(d)(4), 308, and 501, Clean Water Act [Federal Water Pollution Control Act Amendments of 1972, as amended by the Clean Water Act of 1977, and the Municipal Wastewater Treatment Construction Grant Amendments of 1981]; 33 U.S.C. 1311(b)(1)(B); 1314(d) (1) and (4); 1318; and 1361; 86 Stat. 816, Pub. L. 92–500; 91 Stat. 1567, Pub. L. 95–217; 95 Stat. 1623, Pub. L. 97–117.

§ 133.100 Purpose.

This part provides information on the level of effluent quality attainable through the application of secondary or equivalent treatment.

§ 133.101 Definitions.

For the purposes of this part, the following terms shall be defined as follows:

(a) *"7-day average."* The arithmetic mean of pollutant parameter values for samples collected in a period of 7 consecutive days.

(b) *"30-day average."* The arithmetic mean of pollutant parameter values for samples collected in a period of 30 consecutive days.

(c) *"Act."* The Clean Water Act (33 U.S.C. 1251 *et. seq.*, as amended).

(d) *"BOD_5."* The five day measure of the pollutant parameter biochemical oxygen demand (BOD).

(e) [Reserved].

(f) *"Effluent concentrations consistently achieved through proper operation and maintenance."* (1) For a given pollutant parameter, the 95th percentile value for the 30-day average effluent quality achieved by a treatment works in a period of at least two years, excluding values attributable to upsets, bypasses, operational errors, or other unusual conditions, and (2) a 7-day average value equal to 1.5 times the value derived under paragraph (f)(1) of this section.

(g) *"Facilities eligible for treatment equivalent to secondary treatment."* Treatment works shall be eligible for consideration for effluent limitations described for treatment equivalent to secondary treatment (§ 133.105), if:

(1) The BOD_5 and SS effluent concentrations consistently achieved through proper operation and maintenance (§ 133.101(f)) of the treatment works exceed the minimum level of effluent quality set forth in § 133.102(a) and § 133.102(b),

(2) A trickling filter or waste stabilization pond is used as the principal process, and

(3) The treatment works provide significant biological treatment of municipal wastewater.

(h) *"mg/l."* Milligrams per liter.

(i) *"NPDES."* National Pollutant Discharge Elimination System.

(j) *"Percent removal."* A percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent pollutant concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given time period.

(k) *"Significant biological treatment."* The use of an aerobic or anaerobic biological treatment process in a treatment works to consistently achieve a 30-day average of at least 65 percent removal of BOD_5.

(l) *"SS."* The pollutant parameter total suspended solids.

§ 133.102 Secondary treatment.

The following paragraphs describe the minimum level of effluent quality attainable by secondary treatment in terms of the parameters—BOD_5, SS and pH. All requirements for each parameter shall be achieved except as provided for in §§ 133.103 and 133.105.

(a) *BOD_5:* (1) The 30-day average shall not exceed 30 mg/l.

(2) The 7-day average shall not exceed 45 mg/l.

(3) The 30-day average percent removal shall not be less than 85 percent.

(b) *SS:* (1) The 30-day average shall not exceed 30 mg/l.

(2) The 7-day average shall not exceed 45 mg/l.

(3) The 30-day average percent removal shall not be less than 85 percent.

(c) *pH.* The effluent values for pH shall be maintained within the limits of 6.0 to 9.0 unless the publicly owned treatment works demonstrates that: (1) inorganic chemicals are not added to the waste stream as part of the treatment process; and (2) contributions from industrial sources do not cause the pH of the effluent to be less than 6.0 or greater than 9.0.

§ 133.103 Special Considerations.

(a) *Combined Sewers.* Treatment works subject to this part may not be capable of meeting the percentage removal requirements established under § 133.102(a)(3) and § 133.102(b)(3), or § 133.105(a)(3) and § 133.105(b)(3) during wet weather where the treatment works receive flows from combined sewers (*i.e.*, sewers which are designed to transport both storm water and sanitary sewage). For such treatment works, the decision must be made on a case-by-case basis as to whether any attainable percentage removal level can be defined, and if so, what the level should be.

(b) *Industrial wastes.* For certain industrial categories, the discharge to navigable waters of BOD_5 and SS permitted under sections 301(b)(1)(A)(i) or 306 of the Act may be less stringent than the values given in § 133.102(a)(1) and § 133.102(b)(1). In cases when wastes would be introduced from such an industrial category into a publicly owned treatment works, the values for BOD_5 and SS in § 133.102(a)(1) and § 133.102(b)(1) may be adjusted upwards provided that: (1) The permitted discharge of such pollutants, attributable to the industrial category, would not be greater than that which would be permitted under section 301(b)(1)(A)(i) or 306 of the Act if such industrial category were to discharge directly into the navigable waters, and (2) the flow or loading of such pollutants introduced by the industrial category exceeds 10 percent of the design flow or loading of the publicly owned treatment works. When such an adjustment is made, the values for BOD_5 or SS in § 133.102(a)(2) and § 133.102(b)(2) should be adjusted proportionately.

(c) *Waste Stabilization Ponds.* The Regional Administrator, or, if appropriate, State Director subject to EPA approval, is authorized to adjust the minimum levels of effluent quality set forth in §§ 133.105 (b)(1), (b)(2), and (b)(3) for treatment works subject to this part, to conform to the SS concentrations achievable with waste stabilization ponds, provided that: (1) Waste stabilization ponds are the sole process used for secondary treatment; and (2) operation and maintenance data indicate that the SS values specified in §§ 133.105 (b)(1), (b)(2), and (b)(3) cannot be achieved. The term "SS concentrations achievable with waste stabilization ponds" means a SS value, determined by the Regional Administrator, or, if appropriate, State Director subject to EPA approval, which is equal to the effluent concentration achieved 90 percent of the time within a State or appropriate contiguous geographical area by waste stabilization ponds that are achieving the levels of effluent quality for BOD_5 specified in § 133.105(a)(1). [cf. 43 FR 55279]

§ 133.104 Sampling and test procedures.

(a) Sampling and test procedures for pollutants listed in this part shall be in accordance with guidelines promulgated by the Administrator in 40 CFR Part 136.

(b) Chemical oxygen demand (COD) or total organic carbon (TOC) may be substituted for BOD_5 when a long-term BOD:COD or BOD:TOC correlation has been demonstrated.

§ 133.105 Treatment equivalent to secondary treatment.

This section describes the minimum level of effluent quality attainable by facilities eligible for treatment equivalent to secondary treatment (§133.101(g)) in terms of the paramenters—BOD_5, SS and pH. All requirements for the specified parameters in paragraphs (a), (b), and (c) of this section shall be achieved except as provided for in § 133.103, and paragraphs (d) and (e) of this section.

(a) *BOD_5*. (1) The 30-day average shall not exceed 45 mg/l.

(2) The 7-day average shall not exceed 65 mg/l.

(3) The 30-day average percent removal shall not be less than 65 percent.

(b) *SS*. Except where SS values have been adjusted in accordance with § 133.103(c):

(1) The 30-day average shall not exceed 45 mg/l.

(2) The 7-day average shall not exceed 65 mg/l.

(3) The 30-day average percent removal shall not be less than 65 percent.

(c) *pH*. The requirements of § 133.102(c) shall be met.

(d) *Alternative State Requirements*. Except as limited by paragraph (e) of this section, the Regional Administrator, or, if appropriate, State Director subject to EPA approval, is authorized to adjust the minimum levels of effluent quality set forth in paragraphs (a)(1), (a)(2), (b)(1) and (b)(2) of this section for trickling filter facilities and in paragraphs (a)(1) and (a)(2) of this section for waste stabilization pond facilities, to conform to the BOD_5 and SS effluent concentrations consistently achieved through proper operation and maintenance (§ 133.101(f)) by the median (50th percentile) facility in a representative sample of facilities within a State or appropriate contiguous geographical area that meet the definition of facilities eligible for treatment equivalent to secondary treatment (§ 133.101(g)).

(e) *Permit Adjustments*. (1) For existing facilities, no effluent limitations established under this section shall be less stringent than the 30-day average and 7-day average BOD_5 and SS effluent values achieved through proper operation and maintenance of the treatment works, based on an analysis of the past performance of the treatment works.

(2) For new facilities, no effluent limitations established under this section shall be less stringent than the 30-day average and 7-day average BOD_5 and SS effluent values achieved through proper operation and maintenance of the treatment works, as determined by a registered engineer's best professional judgment of the design capability of the treatment process, taking into account geographical and climatic conditions.

[FR Doc. 83-30726 Filed 11-15-83; 8:45 am]
BILLING CODE 6560-50-M

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40 CFR Part 133

[WH-FRL-2428-7]

Secondary Treatment Information

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: This notice proposes amendments to the secondary treatment information regulation to reflect experienced gained in the secondary treatment program by both EPA and the States. The proposed change would allow National Pollutant Discharge Elimination System (NPDES) permitting authorities the option of substituting the carbonaceous biochemical oxygen demand, five day ($CBOD_5$) pollutant parameter for the biochemical oxygen demand, five day (BOD_5) pollutant parameter. Where the five day $CBOD_5$ parameter is used, the oxygen demand from secondary treatment would be defined as a level of effluent quality that does not exceed an average five day $CBOD_5$ concentration of 25 milligrams per liter (mg/l) in a period of 30 consecutive days and 40 mg/l in a period of 7 consecutive days (proposed § 133.102(a)(4)). The Agency expects that the $CBOD_5$ parameter will be applied selectively for those cases where it will correct unintended inaccuracies in BOD_5 test results.

Pursuant to the "Municipal Wastewater Treatment Construction Grant Amendments of 1981" (referred to hereafter as the 1981 Amendments), EPA is also proposing, elsewhere in today's **Federal Register**, to amend 40 CFR Part 133 by defining a class of facilities (trickling filters (TFs) and waste stabilization ponds (WSPs) eligible for treatment equivalent to secondary treatment, by specifying a minimum level of effluent quality attainable by such facilities, and by setting forth procedures by which alternative State requirements may be developed (proposed § 133.105).

A separate five day $CBOD_5$ value has not been proposed for TFs and WSPs because adequate five day $CBOD_5$ data are not available for these processes. However, based on non-TF/WSP data, the Agency believes that $CBOD_5$ values of 40 mg/l (30-day average) and 60 mg/l (7-day) would be comparable to the proposed BOD_5 values of 45 mg/l (30-day average) and 65 mg/l (7-day). In Section IX of this preamble, the Agency is requesting comments and data to determine appropriate $CBOD_5$ values for facilities eligible for treatment equivalent to secondary treatment.

DATES: Written comments on this proposed rule must be received on or before January 16, 1984.

ADDRESSES: Comments should be addressed to: Central Docket Section [A-130], Attention: Docket No. G-83-01, Environmental Protection Agency, Washington, D.C. 20460.

The public may inspect the record of this rulemaking and all comments received on this proposed rule at: Central Docket Section, Gallery 1, West Tower Lobby, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. between the hours of 8:00 a.m. and 4:30 p.m., business days.

FOR FURTHER INFORMATION CONTACT: Charles Mooar, Office of Water Program Operations [WH-595], Environmental Protection Agency, Washington, D.C. 20460; (202) 382-7276.

SUPPLEMENTARY INFORMATION: Information in this preamble is presented in the following order: