ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86, 89, 90, 1027, 1033, 1042, 1048, 1054, 1060, 1065, and 1068

[EPA–HQ–OAR–2005–0047; FRL–8750–3]

RIN 2060–AL92

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Regulations Requiring Onboard Diagnostic Systems on 2010 and Later Heavy-Duty Engines Used in Highway Applications Over 14,000 Pounds; Revisions to Onboard Diagnostic Requirements for Diesel Highway Heavy-Duty Vehicles Under 14,000 Pounds

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: In 2001, EPA finalized a new, major program for highway heavy-duty engines. That program, the Clean Diesel Trucks and Buses program, will result in the introduction of advanced emissions control systems such as catalyzed diesel particulate filters (DPF) and catalysts capable of reducing harmful nitrogen oxide (NO_X) emissions. This final rule will require that these advanced emissions control systems be monitored for malfunctions via an onboard diagnostic system (OBD), similar to those systems that have been required on passenger cars since the mid-1990s. This final rule will require manufacturers to install OBD systems that monitor the functioning of emission control components and alert the vehicle operator to any detected need for emission related repair. This final rule will also require that manufacturers make available to the service and repair industry information necessary to perform repair and maintenance service on OBD systems and other emission related engine components. Lastly, this final rule revises certain existing OBD requirements for diesel engines used in heavy-duty vehicles under 14,000 pounds.

DATES: This rule is effective on April 27, 2009. The incorporation by reference of certain publications listed in this regulation is approved by the Director of the Federal Register as of April 27, 2009.

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2005–0047. All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, e.g., Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the Air Docket, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Todd Sherwood, U.S. EPA, National Vehicle and Fuel Emissions Laboratory, Assessment and Standards Division, 2000 Traverwood Drive, Ann Arbor, MI 48105; telephone (734) 214–4405, fax (734) 214–4816, e-mail *sherwood.todd@epa.gov*.

SUPPLEMENTARY INFORMATION:

Regulated Entities

This action will affect you if you produce or import new heavy-duty engines which are intended for use in highway vehicles such as trucks and buses, or produce or import such highway vehicles, or convert heavy-duty vehicles or heavy-duty engines used in highway vehicles to use alternative fuels.

The following table gives some examples of entities that may have to follow the regulations. But because these are only examples, you should carefully examine the regulations in 40 CFR part 86. If you have questions, call the person listed in the **FOR FURTHER INFORMATION CONTACT** section of this preamble:

Category	NAICS codes [a]	SIC codes [b]	Examples of potentially regulated entities
Industry	336111	3711	Motor Vehicle Manufacturers; Engine and Truck Manufacturers.
	336112		
	336120		
Industry	811112	7533	Commercial Importers of Vehicles and Vehicle Components.
	811198	7549	
	541514	8742	
Industry	336111	3592	Alternative fuel vehicle converters.
	336312	3714	
	422720	5172	
	454312	5984	
	811198	7549	
	541514	8742	
	541690	8931	

[a] North American Industry Classification Systems (NAICS).
[b] Standard Industrial Classification (SIC) system code.

Outline of This Preamble

I. Overview

A. Background

Section 202(m) of the CAA, 42 U.S.C. 7521(m), directs EPA to promulgate regulations requiring 1994 and later model year light-duty vehicles (LDVs) and light-duty trucks (LDTs) to contain an OBD system that monitors emission-related components for malfunctions or deterioration ''which could cause or result in failure of the vehicles to comply with emission standards established'' for such vehicles. Section 202(m) also states that, ''The Administrator may, in the Administrator's discretion, promulgate regulations requiring manufacturers to install such onboard diagnostic systems on heavy-duty vehicles and engines.''

On February 19, 1993, we published a final rule requiring manufacturers of light-duty applications to install such OBD systems on their vehicles beginning with the 1994 model year (58 FR 9468). The OBD systems must monitor emission control components for any malfunction or deterioration that could cause emissions to exceed certain emission thresholds. The regulation also required that the driver be notified of any need for repair via a dashboard light, or malfunction indicator light (MIL), when the diagnostic system detected a problem. We also allowed optional compliance with California's second phase OBD requirements, referred to as OBDII (13 CCR 1968.1), for purposes of satisfying the EPA OBD requirements. Since publishing the 1993 OBD final rule, EPA has made several revisions to the OBD requirements, most of which served to align the EPA OBD requirements with revisions to the California OBDII requirements (13 CCR 1968.2).

On August 9, 1995, EPA published a final rulemaking that set forth service information regulations for light-duty vehicles and light-duty trucks (60 FR 40474). These regulations, in part, required each Original Equipment Manufacturer (OEM) to do the following: (1) List all of its emission-related service and repair information on a Web site called FedWorld (including the cost of each item and where it could be purchased); (2) either provide enhanced information to equipment and tool companies or make its OEM-specific diagnostic tool available for purchase by aftermarket technicians, and (3) make reprogramming capability available to independent service and repair professionals if its franchised dealerships had such capability. These requirements are intended to ensure that aftermarket service and repair facilities have access to the same emission-related service information, in the same or similar manner, as that provided by OEMs to their franchised dealerships. These service information availability requirements have been revised since that first final rule in response to changing technology among other reasons. (68 FR 38428)

In October of 2000, we published a final rule requiring OBD systems on heavy-duty vehicles and engines up to 14,000 pounds GVWR (65 FR 59896). In that rule, we expressed our intention of developing OBD requirements in a future rule for vehicles and engines used in vehicles over 14,000 pounds. We expressed this same intention in our 2007HD highway final rule (66 FR 5002) which established new heavy-duty highway emissions standards for 2007 and later model year engines. In June of 2003, we published a final rule extending service information availability requirements to heavy-duty vehicles and engines weighing up to 14,000 pounds GVWR. We declined extending these requirements to engines above 14,000 pounds GVWR at least until such engines are subject to OBD requirements.

On January 18, 2001, EPA established a comprehensive national control program—the Clean Diesel Truck and Bus program—that regulates the heavy-duty vehicle and its fuel as a single system. (66 FR 5002) As part of this program, new emission standards will begin to take effect in model year 2007 and will apply to heavy-duty highway engines and vehicles. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies. Because these devices are damaged by sulfur, the regulation also requires the level of sulfur in highway diesel fuel be reduced by 97 percent.[1]

On January 24, 2007, we proposed new OBD requirements for highway engines used in vehicles greater than 14,000 pounds (72 FR 3200). Today's action finalizes those proposed requirements. Today's action also requires new availability requirements for emission-related service information, also proposed in the January 24, 2007 action, that will make this information more widely available to the industry servicing vehicles over 14,000 pounds.

B. What Is EPA Requiring?

1. OBD Requirements for Engines Used in Highway Vehicles Over 14,000 Pounds GVWR

We believe that OBD requirements should be extended to include over 14,000 pound heavy-duty vehicles and engines for many reasons. In the past, heavy-duty diesel engines have relied primarily on in-cylinder modifications to meet emission standards. For example, emission standards have been met through changes in fuel timing, piston design, combustion chamber design, charge air cooling, use of four valves per cylinder rather than two valves, and piston ring pack design and location improvements. In contrast, the 2004 and 2007 emission standards represent a different sort of technological challenge that are being met with the addition of exhaust gas recirculation (EGR) systems and the addition of exhaust aftertreatment devices such as diesel particulate filters (DPF), sometimes called PM traps, and NO_X catalysts. Such ''add on'' devices can experience deterioration and malfunction that, unlike the engine design elements listed earlier, may go unnoticed by the driver. Because deterioration and malfunction of these devices can go unnoticed by the driver, and because their primary purpose is emissions control, and because the level of emission control is on the order of 50 to 99 percent, some form of diagnosis and malfunction detection is crucial. We believe that such detection can be effectively achieved by employing a well designed OBD system.

The same is true for gasoline heavy-duty vehicles and engines. While emission control is managed with both engine design elements and aftertreatment devices, the catalytic converter is the primary emission control feature accounting for over 95 percent of the emission control. We believe that monitoring the emission control system for proper operation is critical to ensure that new vehicles and engines certified to the very low emission standards set in recent years continue to meet those standards throughout their full useful life.

Further, the industry trend is clearly toward increasing use of computer and electronic controls for both engine and powertrain management, and for emission control. In fact, the heavy-duty industry has already gone a long way, absent any government regulation, to standardize computer communication protocols.[2] Computer and electronic control systems, as opposed to mechanical systems, provide improvements in many areas including, but not limited to, improved precision and control, reduced weight, and lower cost. However, electronic and computer controls also create increased difficulty in diagnosing and repairing the malfunctions that inevitably occur in any engine or powertrain system. Today's OBD requirements will build on the efforts already undertaken by the industry to ensure that key emissions related components will be monitored in future heavy-duty vehicles and engines and that the diagnosis and repair of those components will be as efficient and cost effective as possible.

Lastly, heavy-duty engines and, in particular, diesel engines tend to have very long useful lives. With age comes deterioration and a tendency toward increasing emissions. With the OBD systems we are requiring, we expect that these engines will continue to be properly maintained and therefore will continue to emit at low emissions levels even after accumulating hundreds of thousands and even a million miles.

For the reasons laid out above, most manufacturers of vehicles, trucks, and engines have incorporated some type of OBD system into their products that are capable of identifying when certain types of malfunctions occur, and in what systems. In the heavy-duty industry, those OBD systems traditionally have been geared toward detecting malfunctions causing drivability and/or fuel economy related problems. Without specific requirements for manufacturers to include OBD mechanisms to detect emission-related problems, those types of malfunctions that could result in high emissions without a corresponding adverse drivability or fuel economy impact could go unnoticed by both the driver and the repair technician. The resulting increase in emissions and detrimental impact on air quality could

[1] Note that the 2007HD highway rule contained new emissions standards for gasoline engines as well as diesel engines.

[2] See ''On-Board Diagnostics, A Heavy Duty Perspective,'' SAE 951947; ''Recommended Practice for a Serial Control and Communications Vehicle Network,'' SAE J1939 which may be obtained from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA, 15096–0001; and ''Road Vehicles-Diagnostics on Controller Area Network (CAN)—Part 4: Requirements for emission-related systems,'' ISO 15765–4:2001 which may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland.

be avoided by incorporating an OBD system capable of detecting emission control system malfunctions.

2. Requirements That Service Information Be Made Available

We are requiring that makers of engines that go into vehicles over 14,000 pounds make available to any person engaged in repair or service all information necessary to make use of the OBD systems and for making emission-related repairs, including any emissions-related information that is provided by the OEM to franchised dealers. This information includes, but is not limited to, manuals, technical service bulletins (TSBs), a general description of the operation of each OBD monitor, etc. We discuss the new requirements further in section III of this preamble.

The new requirements are similar to those required currently for all 1996 and newer light-duty vehicles and light-duty trucks and 2005 and newer heavy-duty applications up to 14,000 pounds. See section III for a complete discussion of the new service information provisions. Note that information for making emission-related repairs does not include information used to design and manufacture parts, but it may include OEM changes to internal calibrations and other indirect information, as discussed in section III.

3. OBD Requirements for Diesel Heavy-Duty Vehicles and Engines Used in Vehicles Under 14,000 Pounds

We are also making some changes to the existing diesel OBD requirements for heavy-duty applications under 14,000 pounds (i.e., 8,500 to 14,000 pounds). Some of these changes are being made for immediate implementation to relax some of the requirements that we currently have in place for 8,500 to 14,000 pound applications that cannot be met by diesels without granting widespread deficiencies to industry. Other changes are being made for the 2010 and later model years since they represent an increase in the stringency of our current OBD requirements and, therefore, some leadtime is necessary for manufacturers to comply. All of the changes being made for 8,500 to 14,000 pound diesel applications will result in OBD emissions thresholds identical, for all practical purposes, to the OBD thresholds for over 14,000 pound applications.

4. Technical Amendments for Other Programs

We are finalizing a variety of technical amendments in this final rule. Most of these changes involve minor adjustments or corrections to the regulations we adopted on October 8, 2008 (73 FR 59034) and on June 30, 2008 (73 FR 37096). See the memorandum in the docket entitled ''Technical Amendments to EPA Regulations'' for a description of these changes.[3]

C. Why Is EPA Promulgating These Requirements?

1. Highway Engines and Vehicles Contribute to Serious Air Pollution Problems

The pollution emitted by heavy-duty highway engines contributes greatly to our nation's continuing air quality problems. Our 2007HD highway rule was designed to address these serious air quality problems. These problems include premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. Numerous studies also link diesel exhaust to increased incidence of lung cancer. We believe that exposure to diesel exhaust is likely to be carcinogenic to humans by inhalation and that this cancer hazard exists for occupational and environmental levels of exposure.

Our 2007HD highway rule regulates the heavy-duty vehicle and its fuel as a single system. As part of this program, new emission standards began to take effect in model year 2007 and are phased-in through model year 2010, and will apply to heavy-duty highway engines and vehicles. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies and a cap on the allowable sulfur content in both diesel fuel and gasoline.

In the 2007HD highway final rule, we estimated that, by 2007, heavy-duty trucks and buses would account for about 28 percent of nitrogen oxides emissions and 20 percent of particulate matter emissions from mobile sources. In some urban areas, the contribution is even greater. The 2007HD highway program will reduce particulate matter and oxides of nitrogen emissions from heavy-duty engines by 90 percent and 95 percent below current standard levels, respectively. In order to meet these more stringent standards for diesel engines, the program calls for a 97 percent reduction in the sulfur content of diesel fuel. As a result, diesel vehicles will achieve gasoline-like exhaust emission levels. We have also established more stringent standards for heavy-duty gasoline vehicles, based in part on the use of the low sulfur gasoline that will be available when the standards go into effect.

2. Emissions Control of Highway Engines and Vehicles Depends on Properly Operating Emissions Control Systems

The emissions reductions and resulting health and welfare benefits of the 2007HD highway program will be dramatic when fully implemented. By 2030, the program will reduce annual emissions of nitrogen oxides, nonmethane hydrocarbons, and particulate matter by a projected 2.6 million, 115,000 and 109,000 tons, respectively. However, to realize those large emission reductions and health benefits, the emission control systems on heavy-duty highway engines and vehicles must continue to provide the 90 to 95 percent emission control effectiveness throughout their operating life. Today's OBD requirements, in conjunction with/support of EPA's existing compliance programs, will help to ensure that emission control systems continue to operate properly by detecting when those systems malfunction, by then notifying the driver that a problem exists that requires service and, lastly, by informing the service technician what the problem is so that it can be properly repaired.

3. Basis for Action Under the Clean Air Act

Section 202(m) of the CAA, 42 U.S.C. 7521(m), directs EPA to promulgate regulations requiring 1994 and later model year light-duty vehicles (LDVs) and light-duty trucks (LDTs) to contain an OBD system that monitors emission-related components for malfunctions or deterioration ''which could cause or result in failure of the vehicles to comply with emission standards established'' for such vehicles. Section 202(m) also states that, ''The Administrator may, in the Administrator's discretion, promulgate regulations requiring manufacturers to install such onboard diagnostic systems on heavy-duty vehicles and engines.''

Section 202(m)(5) of the CAA states that the Administrator shall require manufacturers to, ''provide promptly to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines * * * with any and all information needed to make use of the emission control diagnostics system prescribed under this subsection and such other information including

[3] See Document ID No. EPA–HQ–OAR–2005–0047–0057. Also see Document ID No. EPA–HQ–OAR–2005–0047–0058.

instructions for making emission related diagnosis and repairs.''

4. The Importance of a Nationwide HDOBD Program

In 2005, the California Air Resources Board put into place HDOBD requirements.[4] More recently, we granted a waiver from federal preemption to the State of California that allows them to implement the HDOBD program (73 FR 52042). Given the nature of the heavy-duty trucking industry in the United States and the importance of the free and open movement of goods across state borders, we believe that a consistent nationwide HDOBD program is a desirable outcome. We have worked closely with California on our proposal and with both California and industry stakeholders on this final rule, in an effort to develop a consistent set of HDOBD requirements. As a result, the program we are finalizing today is consistent with the California program in almost all important aspects. We believe that, while minor differences exist in the requirements we are promulgating today and the California requirements, we will end up with OBD systems that will be compliant with both our federal program and the California program. Promulgating and implementing this final rule is an important step in our efforts working with the California Air Resources Board to develop a consistent national program.

5. Worldwide Harmonized OBD (WWH–OBD)

The Worldwide Harmonized OBD effort (WWH–OBD) is part of the United Nations Economic Commission for Europe. We discussed this effort in detail in our proposal. In line with what we said in our proposal, while the WWH–OBD global technical regulation (gtr) is consistent with many of the specific requirements of our final rule, it is not currently as comprehensive (e.g., it does not contain the same level of detail with respect to certification requirements and enforcement provisions). For that reason, at this time, we do not believe that the gtr could fully replace what is in our final rule. It is important to note that California had HDOBD requirements in place prior to the WWH–OBD gtr being adopted as a final document. The California HDOBD requirements were analogous to the WWH–OBD requirements, but were not identical. At industry's request, we have patterned both our proposal and final rule after the California regulation. Note that we have an obligation to one day propose the gtr for consideration as a U.S. regulation, and it is our expectation that working together with industry and other stakeholders we will determine the appropriate process and requirements to incorporate the WWH–OBD requirements into our regulatory structure.

[4] See 13 CCR 1971.1.

II. How Have the Proposed OBD Requirements Been Changed for This Final Rule and When Will They Be Implemented?

The following subsections describe how we have changed the proposed OBD monitoring requirements in this final rule. We also describe the timelines for their implementation. The requirements are indicative of our goal for the program which is a set of OBD monitors that provide robust diagnosis of the emission control system. Our intention is to provide industry sufficient time and experience with satisfying the demands of the OBD program. While their engines already incorporate OBD systems, those systems are generally less comprehensive and do not monitor the emission control system in the ways we are requiring. Additionally, the OBD requirements represent a new set of technological requirements and a new set of certification requirements for the industry in addition to the 2007HD highway program and the challenging emission standards for PM and NO_X and other pollutants to be implemented in 2010. As a result, we believe the monitoring requirements and timelines outlined in this section appropriately weigh the need for OBD monitors on the emission control system and the need to gain experience with not only those monitors but also the newly or recently added emission control hardware.

The changes we have made to the proposed requirements are the result of comments received on our proposal and meetings with stakeholders held in the time between proposal and final rule. The changes are also the result of our collaboration with CARB staff. For a detailed summary and analysis of the comments we received, and the rationale behind the changes made for this final rule, refer to the Summary and Analysis document contained in the docket for this rule.

In general, the remainder of this preamble—in particular, sections II.B through II.H—presents the changes made to the final OBD requirements relative to the proposed OBD requirements. As such, we do not restate details of the proposed requirements unless it is necessary to do so for clarity. Of interest to readers when comparing the final OBD regulatory text to the proposed OBD regulatory text is that we have moved all of the requirements for over 14,000 pound OBD into § 86.010–18. Where certain requirements are not applicable until 2013 or 2016, etc., the regulatory text in § 86.010–18 makes that clear. In our proposal, we had separated out the requirements for model year 2013 into § 86.013–18 and those for 2016 into § 86.016–18 and those for 2019 into § 86.019–18. This created some confusion and we decided that it would be easier to read the regulations if we restructured things such that all the requirements appear in one section. We have done so in the final rule and have placed all requirements for over 14,000 pound OBD in § 86.010–18. This is also true for OBD requirements on heavy-duty engines under 14,000 pounds where we have moved proposed provisions for model years 2010 through 2012 and 2013 and later from proposed §§ 86.010–17 and 86.013–17, respectively to final § 86.007–17 with appropriate mention of when requirements apply to specific model years. The same holds true for proposed §§ 86.1806–07, 86.1806–10, and 86.1806–13, for OBD systems on under 14,000 pound vehicles, where all final OBD requirements can be found in § 86.1806–05 with appropriate mention of when requirements apply to specific model years.

The remainder of Section II below highlights the changes made to our proposed requirements relative to the final rule. The reader is directed to the more detailed discussion that follows and/or is found in our Summary and Analysis of Comments document contained in the docket. However, Table II–1 provides a brief summary of the changes made although this tabular summary is not meant to provide a thorough explanation of each change. For a thorough explanation, refer to the more detailed discussion below and/or the Summary and Analysis of Comments.

TABLE II–1—SUMMARY OF CHANGES IN THE FINAL REGULATIONS RELATIVE TO THE PROPOSED REGULATIONS

[Please refer to the text for acronym definitions]

Change	Discussed in preamble section	Regulatory cite
Restructuring—§§ 86.013–18, 86.016–18, 86.019–18 have been moved into § 86.010–18 with appropriate date qualifiers.	II Introduction	All >14,000 pound OBD text now in § 86.010–18.
Allow EPA to certify systems demonstrated to comply with CARB HDOBD (13 CCR 1971.1)	II.A.5	§ 86.010–18(a)(5).
Changed MIL location requirement to read "primary driver's side" rather than "driver's side" to accommodate vehicles with both left and right side steering.	*	§ 86.010–18(b)(1)(i).
Slight change to erasure of pending DTC upon storage of MIL-on DTC	II.A.2	§ 86.010–18(b)(2)(ii).
Change to the permanent DTC erasure provisions	II.F.4	§ 86.010–18(b)(3)(iii)(A)–(D).
Minor revisions, for clarity, to the general provisions governing monitoring conditions	*	§ 86.010–18(c)(3).
Added clarifying text to general provisions governing in-use performance tracking	*	§ 86.010–18(d).
Revision to trip definition, in the context of rate based monitoring, for denominator incrementing on diesel engines.	II.E.1	§ 86.010–18(d)(4)(ii)(B).
Change to idle definition in specifications for incrementing the denominator (from vehicle speed ≤1 mph to "engine speed less than or equal to 200 rpm above normal warmed up idle or vehicle speed ≤1 mph").	II.E.2	§ 86.010–18(d)(4)(ii)(C).
Added text stating that monitors must run over test that gives the most robust monitor rather than most stringent monitor.	II.A.4	§ 86.010–18(f)(1)(i).
Added text to identify in certification documentation which test cycle would provide the most stringent and/or the most robust monitor.	*	§ 86.010–18(f)(1)(ii).
Added text stating that OBD-specific IRAFs need not be included in OBD threshold determinations.	II.A.4	§ 86.010–18(f)(2).
Revision to NO_X malfunction thresholds for NO_X catalyst systems and NO_X sensors (2010–2012 only).	II.B.6; II.B.7; II.B.9 (and shown in Table II.B–1.	§ 86.010–18(g), Table 1.
Added provision to diesel fuel system pressure, timing, and quantity malfunction criteria allowing unit injector systems to conduct functional checks during model years 2010 to 2012.	II.B.1	§ 86.010–18(g)(1)(ii)(A)–(C).
Added new paragraph allowing diesel unit injector systems to combine into one malfunction the three separate malfunction criteria of pressure, timing, and quantity.	II.B.1	§ 86.010–18(g)(1)(ii)(D).
Minor changes to diesel fuel system monitoring conditions consistent with changes to malfunction criteria.	II.B.1	§ 86.010–18(g)(1)(iii)(A) & (B).
Diesel engine misfire malfunction criteria for multiple continuous misfire changed from "more than one cylinder" to "more than one or more than one but less than half (if approved)".	II.B.2	§ 86.010–18(g)(2)(ii)(A).
Minor change to diesel EGR monitoring conditions (i.e., a change to the proposed monitoring conditions) which allows for temporary disables of "continuous monitoring".	II.B.3	§ 86.010–18(g)(3)(iii)(D).
Diesel turbo boost malfunction criteria changed to note "for engines so equipped" where appropriate.	II.B.4	§ 86.010–18(g)(4)(ii)(A)–(C).
Added a new diesel turbo boost monitoring condition that allows for temporary disables of "continuous monitoring".	II.B.4	§ 86.010–18(g)(4)(iii)(D).
Removed text noting that NMHC conversion over a DPF is required under paragraph (g)(8) and added clarifying text that monitoring of NMHC conversion over a DPF is not required.	II.B.8	§ 86.010–18(g)(5)(i).
Removal of malfunction thresholds from diesel NMHC catalyst malfunction criteria	II.B.5	§ 86.010–18(g)(5)(ii)(A).
Added "delta temperature within time period" provision to diesel NMHC aftertreatment assistance malfunction criteria.	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Removal of proper feedgas generation malfunction criteria for diesel NMHC catalysts	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Added provision to forego monitoring of diesel NMHC catalysts located downstream of a DPF provided their malfunction will not result in failure of the NMHC emission standard.	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Change to the DPF malfunction criteria—addition of an optional malfunction criteria for DPF filtering performance for model years 2010 to 2012.	II.B.8	§ 86.010–18(g)(8)(ii)(A).
Change to the DPF malfunction criteria—removal of NMHC conversion monitoring	II.B.8	§ 86.010–18(g)(8)(ii)(D)**.
Added new monitoring conditions applicable to those systems using the optional DPF malfunction criteria of § 86.010–18(g)(8)(ii)(A).	II.B.8	§ 86.010–18(g)(8)(iii).
Added provision that allows Administrator to approve limited misfire monitor disablement for gasoline engines.	II.C	§ 86.010–18(h)(2)(iii)(D).
Added provision that allows misfire monitor disables for gasoline engines with >8 cylinders	II.C	§ 86.010–18(h)(2)(iii)(E).
Added phrase allowing lower thermostat regulating temperature requirement for ambient temperatures between 20–50 degrees F.	II.D.2	§ 86.010–18(i)(1)(ii)(A).
Added phrase "With Administrator approval" to the provision allowing alternative thermostat malfunction criteria.	*	§ 86.010–18(i)(1)(ii)(B).
Change to the comprehensive component monitoring requirements such that components must be monitored if their malfunction can cause emissions to exceed standards rather than affect emissions during any reasonable driving condition.	II.D.4	§ 86.010–18(i)(3)(i)(A).
Change to diesel engine glow plug malfunction criteria for 2010–2012	II.D.4	§ 86.010–18(i)(3)(iii)(D).
Added provision stating that monitoring of wait-to-start lamp and MIL circuit is not required for systems using light-emitting diodes versus incandescent bulbs.	II.A.2	§ 86.010–18(i)(3)(iii)(E).

TABLE II–1—SUMMARY OF CHANGES IN THE FINAL REGULATIONS RELATIVE TO THE PROPOSED REGULATIONS—Continued

[Please refer to the text for acronym definitions]

Change	Discussed in preamble section	Regulatory cite
Removed introductory text to the standardization requirements (done to provide greater clarity).	*	§ 86.010–18(k)(1).
Removal of SAE J2534 from the OBD section (it remains in the Service Information Availability requirements of § 86.010–38(j)).	*	§ 86.010–18(k)(1)(i)(H)**.
Added text allowing the Administrator to approve alternative DLC locations	II.F.2	§ 86.010–18(k)(2)(i).
Added text allowing data link signals to report an error state or other predefined status indicator if they are defined for those signals in the SAE J1979/J1939 specifications.	*	§ 86.010–18(k)(4)(ii).
Added the phrase "to the extent possible" to the provision to use separate DTCs for out-of-range and circuit checks.	*	§ 86.010–18(k)(4)(iv)(B).
Added provision to allow for multiple CAL IDs with Administrator approval provided CAL IDs response is in order of highest to lowest priority.	II.F.4	§ 86.010–18(k)(4)(vi).
Added provision to require multiple CVNs if using multiple CAL IDs as allowed under newly added provision in (k)(4)(vi).	II.F.4	§ 86.010–18(k)(4)(vii)(A).
Added provision allowing, for 2010–2012, a default value for the CVN for systems that are not field programmable.	*	§ 86.010–18(k)(4)(vii)(A).
Revised CVN calculation requirement from "once per drive cycle" to "once per ignition cycle"	*	§ 86.010–18(k)(4)(vii)(C).
Change to idle definition in engine run-time tracking (from vehicle speed ≤1 mph to "engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed ≤1 mph").	II.F.4; II.F.5	§ 86.010–18(k)(6)(i)(B).
Added new certification demonstration provisions for systems using the optional DPF monitoring provisions.	*	§ 86.010–18(l)(3)(i)(H).
Added new documentation provisions for systems meeting § 86.010–18 with a system designed to CARB 13 CCR 1971.1.	II.A.5	§ 86.010–18(m)(3).
Added a provision that allows Administrator to approve alternative engine ratings as parent ratings in 2010–2012.	II.G.1	§ 86.010–18(o)(1)(i).
Added a provision that allows Administrator to approve alternative engine ratings as parent ratings in 2010–2012.	II.G.1	§ 86.010–18(o)(2)(ii)(B).
Added text to make clear that for all engine ratings in years 2019+, the certification emissions thresholds apply in-use (provides clarification, no change to original intent).	*	§ 86.010–18(p)(4)(i).
Revised 2007–2009 and 2010–2012 engine certification NO_X thresholds from FEL+0.5 to FEL+0.6 (for 8500–14K pound diesel engines).	Table II.H–2	§ 86.007–17(b) & § 86.007–30(f).
Added definition of "engine and engine system" applicable to OBD	*	§ 86.010–2.
Moved definition of "OBD group" from § 86.013–2 to § 86.010–2	*	§ 86.010–2.
Added "delta temperature within time period" provision to NMHC malfunction description for engine certifications.	II.H.3	§ 86.007–17(b) & § 86.007–30(f).
Removed 2010–2012 & 2013+ engine certification NMHC thresholds for DPFs (8500–14K pound diesel engines).	Table II.H–2	§ 86.007–17(b) & § 86.007–30(f).
Change to the DPF malfunction criteria—addition of an optional malfunction criteria for DPF filtering performance.	II.H.2	§ 86.007–17(b) & § 86.007–30(f).
§ 86.013–17 moved to § 86.007–17 with appropriate date qualifiers (8500–14K pound diesel engines; no content change, just formatting).	II.A	§ 86.007–17(b).
§ 86.013–30 moved to § 86.007–30 with appropriate date qualifiers (8500–14K pound diesel engines; no content change, just formatting).	II.A	§ 86.007–30(f).
Revised 2007–2009 vehicle certification NO_X thresholds from 3x to 4x the standard (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Revised 2010–2012 vehicle certification NO_X thresholds for NO_X catalysts and NO_X sensors from +0.3 to +0.6 (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Added "delta temperature within time period" provision to NMHC malfunction description for vehicle certifications.	II.H.3	§ 86.1806–05(n) & (o).
Removed 2010–2012 & 2013+ vehicle certification NMHC thresholds for DPFs (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Added the phrase "and superseding sections" to the provision for optional chassis certification of diesel vehicles.	*	§ 86.1863–07.

* Items not discussed in the preamble since we consider them to be very minor.

** This is the applicable citation for the proposed regulatory text, but this paragraph contains different text (due to renumbering) or has been removed in the final regulatory text.

A. General OBD System Requirements

1. The OBD System

The OBD system must be designed to operate for the actual life of the engine in which it is installed. Further, the OBD system cannot be programmed or otherwise designed to deactivate based on age and/or mileage of the vehicle during the actual life of the engine. This requirement does not alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its regulatory useful life, except where an engine has been programmed or otherwise designed so that an OBD system deactivates based on age and/or mileage of the engine.

In addition, computer coded engine operating parameters cannot be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) computer enclosures). Upon Administrator approval, certain product lines may be exempted from this requirement if those product lines can be shown to not need such protections. In making the approval decision, the Administrator will consider such things as the current availability of performance chips, performance capability of the engine, and sales volume.

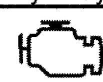
2. Malfunction Indicator Light (MIL) and Diagnostic Trouble Codes (DTC)

Consistent with our proposal, the final rule requires that upon detecting a malfunction within the emission control system,[5] the OBD system must make some indication to the driver so that the driver can take action to get the problem repaired. A dashboard malfunction indicator light (MIL) must be illuminated to inform the driver that a problem exists that needs attention. Upon illumination of the MIL, a diagnostic trouble code (DTC) must be stored in the engine's computer that identifies the detected malfunction. This DTC can then be read by a service technician to assist in making the necessary repair.

Because the MIL is meant to inform the driver of a detected malfunction, we are requiring that the MIL be located on the driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions. We are requiring that the MIL be amber (yellow) in color when illuminated because yellow is synonymous with the notion of a ''cautionary warning''; the use of red for the MIL will be strictly prohibited because red signifies ''danger'' which is not the proper message for malfunctions detected according to today's rule. Further, we are requiring that, when illuminated, the MIL display the International Standards Organization (ISO) engine symbol shown in Table II.A–1 because this symbol has become accepted after more than 10 years of light-duty OBD as a communicator of engine and emissions system related problems. We are also requiring that there be only one MIL used to indicate all malfunctions detected by the OBD system on a single vehicle. We believe this is important to avoid confusion over multiple lights and, potentially, multiple interpretations of those lights.

Generally, a manufacturer would be allowed sufficient time to be certain that a malfunction truly exists before illuminating the MIL. No one benefits if the MIL illuminates spuriously when a real malfunction does not exist. Thus, for most OBD monitoring strategies, manufacturers will not be required to illuminate the MIL until a malfunction clearly exists which will be considered to be the case when the same problem has occurred on two sequential driving cycles.[6]

Table II.A-1. ISO Warning Light Symbol

ISO 2575:2004 Designation	Displayed Symbol
F01	

To keep this clear in the onboard computer, we are requiring that the OBD system make certain distinctions between the problems it has detected, and that the system maintain a strict logic for diagnostic trouble code (DTC) storage/erasure and for MIL illumination/extinguishment. Whenever the enable criteria for a given monitor are met, we would expect that monitor to run. For continuous monitors, this would be during essentially all engine operation.[7] For non-continuous monitors, it would be during only a subset of engine operation.[8] In general, we are requiring that non-continuous monitors make a diagnostic decision just once per drive cycle that contains operation satisfying the enable criteria for the given monitor.

When a problem is first detected, we are requiring that a ''pending'' DTC be stored. If, during the subsequent drive cycle that contains operation satisfying the enable criteria for the given monitor, a problem in the components/system is not again detected, the OBD system would declare that a malfunction does not exist and would, therefore, erase the pending DTC. However, if, during the subsequent drive cycle that contains operation satisfying the enable criteria for the given monitor, a problem in the component/system is again detected, a malfunction has been confirmed and, hence, a ''confirmed'' or ''MIL-on'' DTC would be stored.[9] Upon storage of a MIL-on DTC, the pending DTC would either remain stored or be erased, depending on what the manufacturer determines to be the most effective approach. Consistent with the proposal, the final rule does not stipulate which communication protocol be used. Upon storage of the MIL-on DTC, the MIL must be illuminated.[10] Also at this time, a ''permanent'' DTC would be stored (see section II.F.4 for more details regarding permanent DTCs).[11]

As we proposed, we are requiring that, after three subsequent drive cycles that contain operation satisfying the enable criteria for the given monitor without any recurrence of the previously detected malfunction, the MIL should be extinguished (unless there are other MIL-on DTCs stored for which the MIL must also be illuminated), the permanent DTC should be erased, but a ''previous-MIL-

[5] What constitutes a ''malfunction'' for over 14,000 pound applications under today's action is covered in section II.B for diesel engines, section II.C for gasoline engines, and section II.D for all engines.

[6] Generally, a ''driving cycle'' or ''drive cycle'' consists of engine startup and engine shutoff or consists of four hours of continuous engine operation.

[7] A ''continuous'' monitor—if used in the context of monitoring conditions for circuit continuity, lack of circuit continuity, circuit faults, and out-of-range values—means sampling at a rate no less than two samples per second. If a computer input component is sampled less frequently for engine control purposes, the signal of the component may instead be evaluated each time sampling occurs.

[8] A ''non-continuous'' monitor being a monitor that runs only when a limited set of operating conditions occurs.

[9] Different industry standards organizations—the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO)—use different terminology to refer to a ''MIL-on'' DTC. For clarity, we use the term ''MIL-on'' DTC throughout this preamble to convey the concept and not any requirement that standard making bodies use the term in their standards.

[10] Throughout this final rule, we refer to MIL illumination to mean a steady, continuous illumination during engine operation unless stated otherwise. This contrasts with the MIL illumination logic used by many engine manufacturers today by which the MIL would illuminate upon detection of a malfunction but would remain illuminated only while the malfunction was actually occurring. Under this latter logic, an intermittent malfunction or one that occurs under only limited operating conditions may result in a MIL that illuminates, extinguishes, illuminates, etc., as operating conditions change.

[11] A permanent DTC must be stored in a manner such that electrical disconnections do not result in their erasure (i.e., they must be stored in non-volatile random access memory (NVRAM)).

on'' DTC should remain stored.[12] We are requiring that the previous-MIL-on DTC remain stored for 40 engine warmup cycles after which time, provided the identified malfunction has not been detected again and the MIL is presently not illuminated for that malfunction, the previous-MIL-on DTC can be erased.[13] However, if an illuminated MIL is not extinguished, or if a MIL-on DTC is not erased, by the OBD system itself but is instead erased via scan tool or battery disconnect (which would erase all non-permanent, volatile memory), the permanent DTC must remain stored. This way, permanent DTCs can only be erased by the OBD system itself and cannot be erased through human interaction with the system.

As proposed, we are allowing the manufacturer, upon Administrator approval, to use alternative statistical MIL illumination and DTC storage protocols to those described above (i.e., alternatives to the ''first trip—pending DTC, second strip—MIL-on DTC logic). The Administrator will consider whether the manufacturer provided data and/or engineering evaluation adequately demonstrates that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Alternative strategies requiring, on average, more than six driving cycles for MIL illumination would probably not be accepted.

As proposed, upon storage of either a pending DTC and/or a MIL-on DTC, we are requiring that the computer store a set of ''freeze frame'' data. These freeze frame data will provide a snap shot of engine operating conditions present at the time the malfunction occurred and was detected. This information serves the repair technician in diagnosing the problem and conducting the proper repair. The freeze frame data should be stored upon storage of a pending DTC. If the pending DTC matures to a MIL-on DTC, the manufacturer can choose to update the freeze frame data or retain the freeze frame stored in conjunction with the pending DTC. Likewise, any freeze frame stored in conjunction with any pending or MIL-on DTC should be erased upon erasure of the DTC. Further information concerning the freeze frame requirement and the data required in the freeze frame is presented in section II.F.4, below.

As proposed, we are also requiring that the OBD system illuminate the MIL and store a MIL-on DTC to inform the vehicle operator whenever the engine enters a mode of operation that can affect the performance of the OBD system. If such a mode of operation is recoverable (i.e., operation automatically returns to normal at the beginning of the following ignition cycle[14]), then in lieu of illuminating the MIL when the mode of operation is entered, the OBD system may wait to illuminate the MIL and store the MIL-on DTC if the mode of operation is again entered before the end of the next ignition cycle. We are requiring this because many operating strategies are designed such that they continue automatically through to the next key-off. Regardless, upon the next key-on, the engine control would start off in ''normal'' operating mode and would return to the ''abnormal'' operating mode only if the condition causing the abnormal mode was again encountered. In such cases, we are allowing that the MIL be illuminated during the second consecutive drive cycle during which such an ''abnormal'' mode is engaged.[15]

Whether or not the ''abnormal'' mode of operation is recoverable, in this context, has nothing to do with whether the detected malfunction goes away or stays. Instead, it depends solely on whether or not the engine, by design, will stay in abnormal operating mode on the next key-on. We are requiring this MIL logic because often the diagnostic (i.e., monitor) that caused the engine to enter abnormal mode cannot run again once the engine is in the abnormal mode. So, if the MIL logic associated with abnormal mode activation was always a two-trip diagnostic, abnormal mode activation would set a pending DTC on the first trip and, since the system would then be stuck in that abnormal operating mode and would never be able to run the diagnostic again, the pending DTC could never mature to a MIL-on DTC nor illuminate the MIL. Hence, the MIL must illuminate upon the first entry into such an abnormal operating mode. If such a mode is recoverable, the engine will start at the next key-on in ''normal'' mode allowing the monitor to run again and, assuming another detection of the condition, the system would set a MIL-on DTC and illuminate the MIL.

As proposed, the OBD system need not store a DTC nor illuminate the MIL upon abnormal mode operation if other telltale conditions would result in immediate action by the driver. Such telltale conditions would be, for example, an overt indication like a red engine shut-down warning light. The OBD system also need not store a DTC nor illuminate the MIL upon abnormal mode operation if the mode is indeed an auxiliary emission control device (AECD) approved by the Administrator.

There may be malfunctions of the MIL itself that would prevent it from illuminating. A repair technician—or possibly an I/M inspector—would still be able to determine the status of the MIL (i.e., commanded ''on'' or ''off'') by reading electronic information available through a scan tool, but there would be no indication to the driver of an emissions-related malfunction should one occur. Unidentified malfunctions may cause excess emissions to be emitted from the vehicle and may even cause subsequent deterioration or failure of other components or systems without the driver's knowledge. In order to prevent this, the manufacturer must ensure that the MIL is functioning properly. For this reason and consistent with our proposal, we are requiring two checks of the functionality of the MIL itself. First, the MIL will be required to illuminate for a minimum of five seconds when the vehicle is in the key-on, engine-off position. This allows an interested party to check the MIL's functionality simply by turning the key to the key-on position. While the MIL would be physically illuminated during this functional check, the data stream value for the MIL command status would be required to indicate ''off'' during this check unless, of course, the MIL was currently being commanded ''on'' for a detected malfunction. This functional check of the MIL is not required during vehicle operation in the key-on, engine-off position subsequent to the initial engine cranking of an ignition cycle (e.g., due to an engine

[12] This general ''three trip'' condition for extinguishing the MIL is true for all but two diesel systems/monitors—the misfire monitor and the SCR system—and three gasoline systems/monitors—the fuel system, the misfire monitor, and the evaporative system—which have further conditions on extinguishing the MIL. This is discussed in more detail in sections II.B and II.C.

[13] For simplicity, the discussion here refers to ''previous-MIL-on'' DTCs only. The ISO 15765 standard and the SAE J1939 standard use different terms to refer to the concept of a previous-MIL-on DTC. Our intent is to present the concept of our proposal in this preamble and not to specify the terminology used by these standard making bodies.

[14] ''Ignition Cycle'' means a drive cycle that begins with engine start and includes an engine speed that exceeds 50 to 150 rotations per minute (rpm) below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission) for at least two seconds plus or minus one second.

[15] Note that we use the term ''abnormal'' to refer to an operating mode that the engine is designed to enter upon determining that ''normal'' operation cannot be maintained. Therefore, the term ''abnormal'' is somewhat of a misnomer since the engine is doing what it has been designed to do. Nonetheless, the abnormal operating mode is clearly not the operating mode the manufacturer has intended for optimal operation. Such operating modes are sometimes referred to as ''default'' operating modes or ''limp-home'' operating modes.

stall or other non-commanded engine shutoff).

The second functional check of the MIL is a circuit continuity check of the electrical circuit that is used to illuminate the MIL to verify that the circuit is not shorted or open (e.g., a burned out bulb). While there would not be an ability to illuminate the MIL when such a malfunction is detected, the electronically readable MIL command status in the onboard computer would be changed from commanded ''off'' to ''on''. This would allow the truck owner or fleet maintenance staff to quickly determine whether an extinguished MIL means ''no malfunctions'' or ''broken MIL.'' It would also serve, should it become of interest in the future, complete automation of the I/M process by eliminating the need for inspectors to input manually the results of their visual inspections. Feedback from passenger car I/M programs indicates that the current visual bulb check performed by inspectors is subject to error and results in numerous vehicles being falsely failed or passed. By requiring monitoring of the circuit itself, the entire pass/fail criteria of an I/M program could be determined by the electronic information available through a scan tool, thus better facilitating quick and effective inspections and minimizing the chance for manually-entered errors. Unlike our proposal, the final rule does not require this circuit continuity check of the MIL circuit for systems that employ light emitting diode (LED) MILs.[16] These systems are very robust and circuit checks are very difficult and, we believe, unnecessary. We do not want to discourage their use or encourage use of bulb-based MILs over LED MILs via our OBD requirements.

As proposed, the MIL may be used to indicate readiness status in a standardized format (see Section II.F) in the key-on, engine-off position. Readiness status is a term used in light-duty OBD that refers to a vehicle's readiness for I/M inspection. For a subset of monitors—those that are non-continuous monitors for which an emissions threshold exists (see sections II.B and II.C for more on emissions thresholds)—a readiness status indicator must be stored in memory to indicate whether or not that particular monitor has run enough times to make a diagnostic decision. Until the monitor has run sufficient times, the readiness status would indicate ''not ready''. Upon running sufficient times, the readiness status would indicate ''ready.'' This serves to protect against drivers disconnecting their battery just prior to the I/M inspection so as to erase any MIL-on DTCs. Such an action would simultaneously set all readiness status indicators to ''not ready'' resulting in a notice to return to the inspection site at a future date. Readiness indicators also help repair technicians because, after completing a repair, they can operate the vehicle until the readiness status indicates ''ready'' and, provided no DTCs are stored, know that the repair has been successful. We are requiring that HDOBD systems follow this same readiness status logic as used for years in light-duty OBD both to assist repair technicians and to facilitate potential future HDOBD I/M programs.

We are also allowing the manufacturer, upon Administrator approval, to use the MIL to indicate which, if any, DTCs are currently stored (e.g., to ''blink'' the stored codes). The Administrator will approve the request if the manufacturer can demonstrate that the method used to indicate the DTCs will not be unintentionally activated during any inspection test or during routine driver operation.

3. Monitoring Conditions

a. Background

Given that the intent of the OBD requirements is to monitor the emission control system for proper operation, it is logical that the OBD monitors be designed such that they monitor the emission control system during typical driving conditions. While many OBD monitors would be designed such that they are continuously making decisions about the operational status of the engine, many—and arguably the most critical—monitors are not so designed. For example, an OBD monitor whose function is to monitor the active fuel injection system of a NO_X adsorber or a DPF cannot be continuously monitoring that function since that function occurs on an infrequent basis. This OBD monitor presumably would be expected to ''run,'' or evaluate the active injection system, during an actual fuel injection event.

For this reason, manufacturers are allowed to determine the most appropriate times to run their non-continuous OBD monitors. This way, they are able to make an OBD evaluation either at the operating condition when an emission control system is active and its operational status can best be evaluated, and/or at the operating condition when the most accurate evaluation can be made (e.g., highly transient conditions or extreme conditions can make evaluation difficult). Importantly, manufacturers are prohibited from using a monitoring strategy that is so restrictive such that it rarely or never runs. To help protect against monitors that rarely run, we are requiring an ''in-use monitor performance ratio'' requirement which is detailed in section II.E.

The set of operating conditions that must be met so that an OBD monitor can run are called the ''enable criteria'' for that given monitor. These enable criteria are often different for different monitors and may well be different for different types of engines. A large diesel engine intended for use in a Class 8 truck would be expected to see long periods of relatively steady-state operation while a smaller engine intended for use in an urban delivery truck would be expected to see a lot of transient operation. Manufacturers will need to balance between a rather loose set of enable criteria for their engines and vehicles given the very broad range of operation HD highway engines see and a tight set of enable criteria given the desire for greater monitor accuracy.

b. General Monitoring Conditions

i. Monitoring Conditions for All Engines

As guidance to manufacturers, we are providing the following criteria to assist manufacturers in developing their OBD enable criteria. These criteria will be used by the Agency during our OBD certification approval process to ensure that monitors run on a frequent basis during real world driving conditions. These criteria will be:

- The monitors should run during conditions that are technically necessary to ensure robust detection of malfunctions (e.g., to avoid false passes and false indications of malfunctions);
- The monitor enable criteria should ensure monitoring will occur during normal vehicle operation; and,
- Monitoring should occur during at least one test used by EPA for emissions verification—either the HD Federal Test Procedure (FTP) transient cycle, or the Supplementary Emissions Test (SET).[17]

As discussed in more detail in sections II.B through II.D, we are requiring that manufacturers define the monitoring conditions, subject to Administrator approval, for detecting the malfunctions required by this rule. The Administrator would determine if the monitoring conditions proposed by the manufacturer for each monitor abide by the above criteria.

In general, except as noted in sections II.B through II.D, the regulation requires

[16] See proposed § 86.010–18(i)(3)(iii)(E) and compare to the final § 86.010–18(i)(3)(iii)(E).

[17] See 40 CFR part 86, subpart N for details of EPA's test procedures.

each monitor to run at least once per driving cycle in which the applicable monitoring conditions are met. It also requires certain monitors to run continuously throughout the driving cycle. These include a few threshold monitors (e.g., fuel system monitor) and most circuit continuity monitors. While a basic definition of a driving cycle (e.g., from ignition key-on and engine startup to engine shutoff) has been sufficient for passenger cars, the driving habits of many types of vehicles in the heavy-duty industry dictate an alternate definition. Specifically, many heavy-duty operators will start the engine and leave it running for an entire day or, in some cases, even longer. As such, any period of continuous engine-on operation of four hours will be considered a complete driving cycle. A new driving cycle would begin following such a four hour period, regardless of whether or not the engine had been shut down. Thus, the ''clock'' for monitors that are required to run once per driving cycle would be reset to run again (in the same key-on engine start or trip) once the engine has been operated beyond four hours continuously. This would avoid an unnecessary delay in detection of malfunctions simply because the heavy-duty vehicle operator has elected to leave the vehicle running continuously for an entire day or days at a time.

Consistent with our proposal, manufacturers may request Administrator approval to define monitoring conditions that are not encountered during the FTP cycle. In evaluating the manufacturer's request, the Administrator will consider the degree to which the requirement to run during the FTP cycle restricts in-use monitoring, the technical necessity for defining monitoring conditions that are not encountered during the FTP cycle, data and/or an engineering evaluation submitted by the manufacturer which demonstrate that the component/system does not normally function, or monitoring is otherwise not feasible, during the FTP cycle, and, where applicable, the ability of the manufacturer to demonstrate that the monitoring conditions will satisfy the minimum acceptable in-use monitor performance ratio requirement as defined below.

ii. In-Use Performance Tracking Monitoring Conditions

In addition to the general monitoring conditions above, and consistent with our proposal, we are requiring manufacturers to implement software algorithms in the OBD system to individually track and report in-use performance of the following monitors in the standardized format specified in section II.E:

- Diesel NMHC converting catalyst(s)
- Diesel NO_X converting catalyst(s)
- Gasoline catalyst(s)
- Exhaust gas sensor(s)
- Gasoline evaporative system
- Exhaust gas recirculation (EGR) system
- Variable valve timing (VVT) system
- Gasoline secondary air system
- Diesel particulate filter system
- Diesel boost pressure control system
- Diesel NO_X adsorber(s)

The OBD system is not required to track and report in-use performance for monitors other than those specifically identified above.

iii. In-Use Performance Ratio Requirement

We are also requiring manufacturers to define, for all 2013 and subsequent model year engines, monitoring conditions that, in addition to meeting the general monitoring conditions, ensure that certain monitors yield an in-use performance ratio (which monitors and the details that define the performance ratio are defined in section II.E) that meets or exceeds the minimum acceptable in-use monitor performance ratio for in-use vehicles. As proposed, we are requiring a minimum acceptable in-use monitor performance ratio of 0.100 for all monitors specifically required to track in-use performance. This means that the monitors listed in section II.A.3.ii above must run and make valid diagnostic decisions during 10 percent of the vehicle's trips. We intend to work with industry during the initial years of implementation to gather data on in-use performance ratios and may revise this ratio as appropriate depending on what we learn.

Note that manufacturers may not use the calculated ratio (or any element thereof), or any other indication of monitor frequency, as a monitoring condition for a monitor. For example, the manufacturer would not be allowed to use a low ratio to enable more frequent monitoring through diagnostic executive priority or modification of other monitoring conditions, or to use a high ratio to enable less frequent monitoring.

4. Determining the Proper OBD Malfunction Criteria

For determining the malfunction criteria for monitors associated with an emissions threshold (see sections II.B and II.C for more on emissions thresholds), we are requiring manufacturers to determine the appropriate emissions test cycle during which their monitors will run. Unlike our proposal, we have removed the requirement that the manufacturer choose the cycle over which the most stringent monitor would result.[18] We have made this change to provide manufacturers the flexibility to develop robust monitors that meet all applicable requirements of the rule rather than requiring the most stringent monitor with disregard for its robustness. That said, the Administrator retains the right to challenge the manufacturer's choice of cycles. While we do not necessarily anticipate challenging a manufacturer's determination of which test cycle to use, the final regulations make clear that the manufacturer should be prepared, perhaps with test data, to justify their determination.

We are eliminating our requirement that, for engines equipped with emission controls that experience infrequent regeneration events (e.g., a DPF and/or a NO_X adsorber), a manufacturer must adjust the emission test results for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold.[19] For each such monitor, the manufacturer need not adjust the emission result as done in accordance with the provisions of section 86.004–28(i) with the component for which the malfunction criteria are being established having been deteriorated to the malfunction threshold. As proposed, the adjusted emission value would have to have been used for purposes of determining whether or not the applicable emission threshold is exceeded.

As we noted in our proposal, we believe that this adjustment process for monitors of systems that experience infrequent regeneration events makes sense and will result in robust monitors, we also believe that it could prove to be overly burdensome for manufacturers. For example, a NO_X adsorber threshold being evaluated by running an FTP using a ''threshold'' part (i.e., a NO_X adsorber deteriorated such that tailpipe emissions are at the applicable thresholds) may be considered acceptable provided the NO_X adsorber does not regenerate during the test, but it may be considered unacceptable if the NO_X adsorber does happen to regenerate during the test. This could happen because emissions would be expected to increase slightly during the regeneration event thereby causing emissions to be

[18] See proposed § 86.010(f)(1)(i) and compare to final § 86.010–18(f)(1)(i).

[19] See proposed § 86.010–18(f)(2) and compare to final § 86.010–18(f)(2).

slightly above the applicable threshold. This would require the manufacturer to recalibrate the NO_X adsorber monitor to detect at a lower level of deterioration to ensure that a regeneration event would not cause an exceedance of the threshold during an emissions test. After such a recalibration, the emissions occurring during the regeneration event would be lower than before because the new ''threshold'' NO_X adsorber would have a slightly higher conversion efficiency. We are concerned that manufacturers may find themselves in a difficult iterative process calibrating such monitors that, in the end, will not be correspondingly more effective. We discuss this in more detail in our Summary and Analysis of Comments document contained in the docket for this rule.

5. Demonstrating Compliance With CARB Requirements

We did not propose that manufacturers be given the opportunity to demonstrate compliance with CARB OBD requirements for the purpose of satisfying federal OBD. We have long had such a provision in our OBD requirements for under 14,000 pound applications. For the final rule, we have included such a provision but want to make clear that this provision should not be interpreted as meaning that a CARB approval equates to an EPA approval.[20] We believe that CARB OBD requirements will be as stringent if not more so than EPA OBD requirements. As such, should a manufacturer demonstrate, and the Administrator determine, that an OBD system complies with the CARB requirements, it would be acceptable for EPA certification. We believe this will lead to an eventual national program.

6. Temporary Provisions To Address Hardship Due to Unusual Circumstances

We have added a new ''temporary hardship'' provision for the final rule.[21] Under this new provision, EPA may allow a manufacturer to sell non-compliant engines for a short time period provided the Administrator determines that the non-compliance is for reasons outside the manufacturer's control. Examples of such reasons may be fires in manufacturer or supplier plants, or ''acts of God'' such as floods, tornados, or hurricanes that have created unforeseen delays in a manufacturer's ability to comply.

This provision is meant to be used for only a limited time (e.g., one to three months) and permission to use the provision would not be granted for the purpose of delaying implementation for a model year. Further, the provision includes in it an expectation that non-compliances would be corrected as quickly as possible, and we would require that the manufacturer submit a plan detailing how the non-compliances will be corrected. The plan must be submitted in conjunction with any requests to make use of this provision and would be subject to Administrator approval. Note also that we fully intend to enforce the manufacturer's plan to ensure that any engines sold as non-compliant would be corrected.

B. Monitoring Requirements and Timelines for Diesel-Fueled/ Compression-Ignition Engines

Table II.B–1 summarizes the diesel fueled compression ignition emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC. Some of these thresholds—specifically, the NO_X aftertreatment and NO_X sensor thresholds for 2010 through 2012—differ from what was proposed. The differences serve to make the OBD threshold less stringent than proposed for the purpose of matching thresholds with technological capabilities.[22] We have also eliminated the NMHC catalyst thresholds. We discuss the reasons for these changes in brief in the sections that follow and in more detail in our Summary and Analysis of Comments document contained in the docket for this rule. More detail regarding the final monitoring requirements, implementation schedules, and liabilities can be found in the sections that follow.

TABLE II.B–1—EMISSIONS THRESHOLDS FOR DIESEL FUELED CI ENGINES OVER 14,000 POUNDS

Component/monitor	MY	NMHC	CO	NO_X	PM
NO_X catalyst system	2010–2012			+0.6	
	2013+			+0.3	
DPF system	2010–2012	2.5x			0.05/+0.04
	2013+	2x			0.05/+0.04
Air-fuel ratio sensors upstream	2010–2012	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	2x	2x	+0.3	0.03/+0.02
Air-fuel ratio sensors downstream	2010–2012	2.5x		+0.3	0.05/+0.04
	2013+	2x		+0.3	0.05/+0.04
NO_X sensors	2010–2012			+0.6	0.05/+0.04
	2013+			+0.3	0.05/+0.04
''Other monitors'' with emissions thresholds (see section II.B)	2010–2012	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	2x	2x	+0.3	0.03/+0.02

Notes: MY = Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard or family emissions limit (FEL); +0.3 means the standard or FEL plus 0.3; 0.05/+0.04 means an absolute level of 0.05 or an additive level of the standard or FEL plus 0.04, whichever level is higher; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

There are exceptions to the emissions thresholds shown in Table II.B–1 whereby a manufacturer can demonstrate that emissions do not exceed the threshold even when the component or system is non-functional at which point a functional check would be allowed.

Note that, in general, the monitoring strategies designed to meet the requirements should not involve the alteration of the engine control system or the emissions control system such that tailpipe emissions would increase. We do not want emissions to increase, even for short durations, for the sole purpose of monitoring the systems intended to control emissions. The Administrator will consider such monitoring strategies on a case-by-case

[20] See § 86.010–18(a)(5) which is new in the final regulations. Also see § 86.010–18(m)(3) which is new in the final regulations.

[21] See final § 86.010–18(a)(6).

[22] See proposed § 86.010–18(g), Table 1, and compare to final § 86.010–18(g), Table 1.

basis taking into consideration the emissions impact and duration of the monitoring event. However, much effort has been expended in recent years to minimize engine operation that results in increased emissions and we encourage manufacturers to develop monitoring strategies that do not require alteration of the basic control system.

The remaining discussion in Section II.B focuses solely on changes made to the monitoring requirements for the final rule relative to the proposed rule. We have not restated the rationale for each monitor, the monitoring requirements, or the expected monitoring strategies, etc. For such discussion, we refer the reader to our proposal (72 FR 3200).

1. Fuel System Monitoring

We proposed that fuel system malfunctions related to injection pressure, injection timing, injection quantity, and feedback control be individually detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that pressure and feedback related malfunctions be monitored continuously and that quantity and timing related malfunctions be monitored once per trip. For the final rule, we are requiring fuel system monitoring for CI engines be consistent with our proposal with a few exceptions.

We have added a new combined monitor option for fuel injection systems. Under this option, the three discrete malfunction criteria for unit injector systems (pressure, quantity, and timing) may be combined into one malfunction. The two discrete malfunction criteria for common rail systems (quantity and timing) may be combined into one malfunction. If choosing the combined monitoring option on either type system, the manufacturer must demonstrate with data that the combined monitoring strategy can detect a component failure by some combination of the individual monitors, a rationality check between the discrete monitors or the downstream effect of the failed component. For threshold monitoring, the manufacturer is expected to demonstrate with data that the combined monitor correctly detects the operating conditions of the fuel injector and indicates the component malfunction prior to exceeding the threshold level required by the regulation. The intent of the combined monitor is to effectively detect and indicate fuel system injector malfunctions although the direct cause of the failure (quantity, timing and/or pressure) is unknown.

For unit injector fuel systems, the final rule allows the fuel system pressure control, injection quantity, and injection pressure to be monitored using functional checks in lieu of monitoring for conditions that would cause emissions to exceed the OBD thresholds for model years 2010 through 2012. Threshold monitoring on unit injector fuel system injection pressure, quantity and timing will be required for model year 2013 and beyond. For common rail systems, the regulation remains unchanged with threshold detection required for fuel system pressure control, injection quantity, and injection pressure for model years 2010 and beyond.

Regarding monitoring conditions, the final rule remains unchanged on common rail systems from the proposal of once per drive cycle for injection pressure and quantity for model years 2010 to 2012 in addition to constant fuel pressure monitoring. On 2013 and later common rail fuel systems, we are requiring continuous monitoring of pressure control and, in a change from our proposal, injector quantity and injector timing monitoring must be done when conditions are met (rather than once per trip). On unit injector systems for model years 2010 to 2012, the monitors for fuel system pressure control, injection quantity, and injection timing are required once per drive cycle. For model years 2013 and beyond, unit injector systems are required to monitor pressure, injector quantity and injector timing when conditions are met.

We are making these fuel injection system monitoring changes because of the system monitoring capability differences between unit injector and common rail systems, while maintaining the intent of malfunction monitoring to indicate a failed component. We believe that the monitoring strategies manufacturers are expected to use in the interim time frame and future system design will result in robust monitoring of the fuel system without sacrificing malfunction detection. The fuel system strategies based on hardware diverge in model years 2010 to 2012 to account for the monitoring capabilities but again converge in model years 2013 for as much commonality as possible. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

2. Engine Misfire Monitoring

We proposed that, for 2010–2012, a continuous engine misfire be detected during engine idle. For 2013 and later, we proposed that engines equipped with combustion sensors monitor continuously for misfire during the full operating range and detect a malfunction prior to emissions exceeding the thresholds for ''other monitors.''

For the final rule, we have made only one change to the misfire monitoring requirements for CI engines. In the proposal, we stated that, if more than one cylinder is misfiring continuously, a separate DTC must be stored indicating that multiple cylinders are misfiring. In the final rule, we state that, if more than one cylinder is misfiring continuously or if more than one but less than half of the cylinders is misfiring continuously, a separate DTC must be stored indicating that multiple cylinders are misfiring.[23] To make use of this additional provision, the manufacturer must receive Administrator approval. We are making this change because we believe that, for some systems, a perfectly acceptable monitor can be developed without sacrificing malfunction detection.

3. Exhaust Gas Recirculation (EGR) System Monitoring

We proposed that malfunctions of the EGR system related to low flow, high flow, slow response, feedback control, and cooler performance be detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that flow and feedback related malfunctions be monitored continuously, response related malfunctions be monitored whenever conditions were met, and that cooler malfunctions be monitored once per trip.

For the final rule, we have not made any changes to the EGR requirements except to provide more clarity to the provisions allowing for temporary disablement of continuous monitoring.[24] This new provision allows the OBD system, with approval, to disable temporarily the EGR system monitor(s) under specific ambient conditions (e.g., when freezing may affect performance of the system) or during specific operating conditions (e.g., transients, extreme low or high flow conditions). Even then, the system must still maintain comprehensive component monitoring as required by the comprehensive component monitoring requirements.[25]

[23] See § 86.010–18(g)(2)(ii)(A) for diesel-fueled engines.

[24] See § 86.010–18(g)(3)(iii)(D) for diesel-fueled engines.

[25] See § 86.010–18(i)(3).

4. Turbo Boost Control System Monitoring

We proposed that malfunctions of the boost control system related to underboost, overboost, variable geometry slow response, feedback control, and undercooling be detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that underboost, overboost, and feedback related malfunctions be monitored continuously, that slow response related malfunctions be monitored whenever conditions were met, and that undercooling related malfunctions be monitored once per trip.

One change we have made to the turbo boost control system monitoring requirements for the final rule is to add the phrase, ''on engines so equipped'' or equivalent.[26] We have added this phrase to clarify that, for engines that do not control the turbo boost control system as suggested by the proposed requirements the provision would not apply or would apply differently. For example, our proposal required that the OBD system detect when the turbo boost control system was unable to achieve the commanded boost. However, some manufacturers use a system that does not in fact command a particular boost pressure (i.e., it is not a closed loop feedback system). For such systems, the final rule makes clear that the system must detect when the turbo boost control system is unable to achieve the commanded boost, or the expected boost for systems that do not control boost pressure. The change does not impact the intent behind the proposed requirements and only serves to provide clarity to manufacturers. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

We have also made a minor change to the turbo boost monitoring conditions. We have added a provision that provides clarity to the requirement to monitor continuously certain parameters. This provision does not change the intent of the proposed requirement, but only serves to provide clarity to the requirement.[27]

5. Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring

We proposed that malfunctions related to NMHC conversion efficiency be detected prior to emissions exceeding the thresholds for ''NMHC catalyst.'' We also proposed that, should the NMHC converting catalyst be used to assist other aftertreatment devices, that malfunctions be detected if that assistance is no longer occurring. Further, we proposed that conversion efficiency and aftertreatment assistance be monitoring once per trip.

For the final rule, we have eliminated the OBD thresholds associated with monitoring of NMHC converting catalysts (e.g., the diesel oxidation catalyst, or DOC). We have also eliminated the need to monitor the NMHC converting catalyst's ability to generate the proper feedgas for other aftertreatment devices. We have maintained, as was proposed, the requirements to monitor for some level of NMHC conversion and for the ability to generate and sustain the necessary exotherm for catalysts used as part of the regeneration strategy of other aftertreatment devices.[28] As part of this latter requirement, we have added a provision requiring the OBD system to detect when the NMHC converting catalyst is unable to generate a 100 degree Celsius temperature rise, or to achieve the necessary regeneration temperature, within 60 seconds of initiating a forced regeneration event. Further, the OBD system must detect the inability to sustain the necessary regeneration temperature for the duration of the regeneration event. We have also added a provision that the regeneration system be shut down (i.e., the forced regeneration must be aborted) in the event that the regeneration temperature cannot be attained or sustained. The manufacturer would be allowed to define the monitoring conditions for this monitor to ensure that a robust monitoring event would be possible. This requirement is meant to ensure that NMHC emissions will not be excessive during a prolonged and unsuccessful attempt at generating an exotherm for regeneration. As an alternative, the manufacturer may submit, for Administrator approval, their NMHC catalyst exotherm monitor strategy and, if equivalent in effectiveness, could use that strategy instead of the criteria described here. Lastly, we have added a provision whereby a manufacturer can ''test out'' of monitoring a NMHC catalyst located downstream of a DPF provided its failure will not cause NMHC emissions to exceed the applicable NMHC standard.

We have made these changes for the final rule because we have been convinced by manufacturers that there exists no robust method of detecting loss of NMHC conversion at the levels required for threshold monitoring. We believe that the primary function of the NMHC catalyst will be exotherm generation which is a monitoring requirement we have maintained and broadened. Further, we believe that the exotherm monitor will also serve to provide the detection of lost NMHC conversion and will do so in a more timely fashion than a direct monitoring of NMHC conversion via exhaust gas sensors since those sensors appear unlikely to be able to detect NMHC conversion loss until it is completely lost. Similar arguments exist for eliminating the feedgas monitoring requirement—we know of no robust method to detect this loss given today's sensor technology. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

6. Selective Catalytic Reduction (SCR) and Lean NO_X Catalyst Monitoring

We proposed that malfunctions related to conversion efficiency, active/intrusive reductant delivery, active/intrusive reductant quantity, active/intrusive reductant quality, and feedback control be detected prior to emissions exceeding the thresholds for ''NO_X catalyst system.'' Further, we proposed that conversion efficiency and reductant quality be monitored once per trip and that reductant delivery, quantity, and feedback control be monitored continuously.

We have made no changes to the SCR and/or lean NO_X catalyst monitoring requirements relative to our proposal except that we have increased the NO_X threshold at which malfunctions must be detected. We proposed a threshold of the NO_X FEL+0.3 g/bhp-hr and are finalizing a threshold of the NO_X FEL+0.6 g/bhp-hr. This revised threshold applies only to model years 2010 through 2012. As proposed, the threshold for model years 2013 and later remains the NO_X FEL+0.3 g/bhp-hr. We have made this change because the state of NO_X sensor technology expected for the 2010 model year is not sufficient for the proposed threshold. We expect that to improve for model years 2013 and later.[29] We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

[26] See § 86.010–18(g)(4)(ii) for diesel-fueled engines.

[27] See § 86.010–18(g)(4)(iii)(D) for diesel-fueled engines.

[28] See § 86.010–18(g)(5) for the final NMHC catalyst requirements for diesel-fueled engines.

[29] Please refer to our Final Technical Support Document contained in the docket for this rule (EPA420–R–08–019, Document ID No. EPA–HQ–OAR–2005–0047–0056) which contains our latest understanding of NO_X sensor technology.

7. NO_X Adsorber System Monitoring

We proposed that malfunctions related to adsorber system capability, active/intrusive reductant delivery, and feedback control be detected prior to emissions exceeding the thresholds for ''NO_X catalyst system.'' Further, we proposed that adsorber capability be monitored once per trip and that reductant delivery and feedback control be monitored continuously.

For the final rule, we have changed nothing with respect to the NO_X adsorber monitoring requirements with the exception of revising the NO_X threshold for model years 2010 through 2012 to the NO_X FEL+0.6 from the NO_X FEL+0.3. We have made this change for the same reasons noted above for SCR monitoring. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

8. Diesel Particulate Filter (DPF) System Monitoring

We proposed that malfunctions related to the DPF filtering performance, regeneration frequency, regeneration completion, NMHC conversion, active/intrusive reductant injection, and feedback control be detected prior to emissions exceeding the thresholds for ''DPF system.'' We also proposed that a missing DPF substrate be detected. Further, we proposed that all of these functions be monitored whenever conditions were met.

For the final rule, we have made two changes to the requirements for monitoring the DPF system. The first change is that we have added to the DPF filtering performance monitoring requirement an optional requirement whereby the OBD system can conduct, in effect, a functional check of the DPF. A system using this approach would be required to detect a change in the pressure drop across the DPF relative to the nominal pressure drop across a clean filter and a properly working device.[30] In effect, if the DPF substrate has been compromised, the failure must be detected if it results in a decrease in the expected pressure drop equal to or greater than a defined level, or detectable change in pressure drop, relative to a clean filter.[31]

We believe that such a requirement is, in effect, the same as a threshold requirement for most DPF systems to be certified in the 2010 through 2012 timeframe. Those systems are expected to use a delta pressure approach to DPF monitoring and we expect that manufacturers will design that monitor to detect the smallest hole feasible which, we believe, will result in a decrease in the expected pressure drop somewhere around the level we are requiring. Manufacturers would then determine the emissions impact associated with that hole and hope that it meets our threshold requirement. If it did not, we would probably certify the system with a deficiency presuming the manufacturer had made a good faith effort at compliance and the monitor met our deficiency requirements.[32] We would not want to refuse to certify it since it would be doing the maximum that the delta pressure approach could feasibly do. We would prefer to certify such a system to the decrease in pressure drop requirement without the deficiency than to certify it to a threshold with a deficiency. In the end, the same monitor is being approved.

Another change we have made is to eliminate the NMHC conversion monitoring over DPFs that have some NMHC conversion capacity.[33] We have eliminated this requirement for the same reasons as noted above for NMHC converting catalyst monitors. Note that we have retained an NMHC threshold for the DPF, but it is referenced in conjunction with the DPF regeneration frequency monitor consistent with our proposal.

Lastly, we have included some new monitoring requirements for those systems certified to our optional backpressure loss provision.[34] An important element of these new monitoring conditions is the distinction between conditions used for malfunction determinations versus subsequent passing determinations. The new provisions allow for a malfunction determination during any successful monitoring event. However, subsequent monitoring events are limited to operation following a successful DPF regeneration. This is to ensure that a confirmed leak will not ''fill up'' with PM and begin to look like an acceptable DPF. If monitoring events were allowed to occur as the leak filled up, the OBD system may inadvertently determine that the DPF substrate was not compromised. Limiting subsequent monitoring events (i.e., those following a malfunction determination) to operation following a complete regeneration of the DPF will ensure that no PM has filled up the crack or hole.

We discuss all of these changes in more detail in our Summary and Analysis of Comments document contained in the docket for this rule.

9. Exhaust Gas Sensor Monitoring

We proposed that malfunctions related to sensor performance be detected prior to emissions exceeding the applicable thresholds. We also proposed that malfunctions related to circuit integrity, feedback functions, monitoring functions, and heater performance and circuit integrity be detected prior to those functions being lost. Further, we proposed that sensor and heater performance be monitored once per trip, that monitoring functionality be monitored whenever conditions were met, and that circuit integrity and feedback functionality be monitored continuously.

For the final rule, we have changed nothing with respect to the exhaust gas sensor monitoring requirements with the exception of revising the NO_X sensor monitor NO_X threshold for model years 2010 through 2012 to the NO_X FEL+0.6 from the NO_X FEL+0.3. We have made this change for the same reasons noted above for the NO_X aftertreatment monitoring requirements. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

C. Monitoring Requirements and Timelines for Gasoline/Spark-Ignition Engines

Table II.C–1 summarizes the gasoline fueled spark ignition emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC.

[30] See § 86.010–18(g)(8)(ii)(A) for diesel-fueled engines.

[31] The detectable change in pressure drop is defined as 0.5 times the observed pressure drop on a nominal, clean filter when operating the engine at the 50% speed, 50% load operating point (as specified in test cycle and procedures for the supplemental emissions test (SET) in § 86.1360–2007.)

[32] See § 86.010–18(n).

[33] See proposed § 86.010–18(g)(8)(ii)(D).

[34] See § 86.010–18(g)(8)(iii) for diesel-fueled engines.

TABLE II.C–1—EMISSIONS THRESHOLDS FOR GASOLINE FUELED SI ENGINES OVER 14,000 POUNDS

Component/monitor	MY	NMHC	CO	NO_X
Catalytic converter system	2010+	1.75x		1.75x
"Other monitors" with emissions thresholds (see section II.C)	2010+	1.5x	1.5x	1.5x
Evaporative emissions control system	2010+	0.150 inch leak.		

Notes: MY=Model Year; 1.75x means a multiple of 1.75 times the applicable emissions standard; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4. The evaporative emissions control system threshold is not, technically, an emissions threshold but rather a leak size that must be detected; nonetheless, for ease we refer to this as the threshold.

Everything shown in Table II.C–1 is unchanged from our proposal. In fact, we have made only one change in our requirements specific to gasoline engines relative to our proposal.[35] That change is being made in response to requests from industry that would allow for Administrator approval of misfire monitoring disablement under certain conditions on engines with more than eight cylinders and/or in situations where the manufacturer can demonstrate that the best available monitoring strategy is not able to detect the misfire condition. The change we are making for our final rule is meant to align our disablement allowance, with approval, with similar allowances made in the California regulation.[36]

As proposed, there remain exceptions to the emissions thresholds shown in Table II.C–1 whereby a manufacturer can demonstrate that emissions do not exceed the threshold even when the component or system is non-functional at which point a functional check would be allowed.

Additionally, consistent with our proposal, the final gasoline monitoring requirements for engines over 14,000 pounds mirror those that are already in place for gasoline engines used in vehicles under 14,000 pounds. The HD gasoline industry—General Motors and Ford, as of today[37]—have told us that their preference is to use essentially the same OBD system on their engines used in both under and over 14,000 pound vehicles.[38] In general, we agree with the HD gasoline industry on this issue for three reasons:

- The engines used in vehicles above and below 14,000 pounds are the same which makes it easy for industry to use the same OBD monitors;
- The existing OBD requirements for engines used in vehicles below 14,000 pounds have proven effective; and
- The industry members have more than 10 years experience complying with the OBD requirements for engines used in vehicles below 14,000 pounds.

As a result, our final requirements should allow for OBD system consistency in vehicles under and over 14,000 pounds rather than mirroring the HD diesel requirements discussed in section II.B. Nonetheless, the final requirements are for engine-based OBD monitors only rather than monitors for the entire powertrain (which would include the transmission). We are doing this for the same reasons as done for the diesel OBD requirements in that certification of gasoline applications over 14,000 pounds, like their diesel counterparts, is done on an engine basis and not a vehicle basis.

D. Monitoring Requirements and Timelines for Other Diesel and Gasoline Systems

1. Variable Valve Timing and/or Control (VVT) System Monitoring

We proposed that VVT system malfunctions related to achieving the commanded valve timing and/or control within a crank angle and/or lift tolerance and slow system response be detected prior to emissions exceeding the thresholds for "other monitors." Further, we proposed that these malfunctions be monitored whenever conditions were met rather than once per trip.

The final requirements for VVT system monitoring are identical to the proposed requirements.[39]

2. Engine Cooling System Monitoring

We proposed that cooling system malfunctions related to proper thermostat function and engine coolant temperature (ECT) sensor readings be detected. Further, we proposed that malfunctions tied to the thermostat be monitored once per trip and that most ECT malfunctions be monitored once per trip except that circuit malfunctions must be monitored continuously.

For the final rule, we have changed the requirement surrounding the need to detect when the coolant temperature does not warm up to within 20 degrees F of the nominal thermostat regulating temperature. This change allows the OBD system to use a lower temperature (lower than 20 degrees below the nominal regulating temperature) provided the ambient temperature is between 20 degrees F and 50 degrees F. To do so, the manufacturer must present data justifying the new temperature to be reached at the lower ambient temperatures.[40]

3. Crankcase Ventilation System Monitoring

We proposed that the OBD system monitor the CV system on engines so equipped for system integrity. For diesel engines, we proposed that the manufacturer submit a plan for Administrator approval prior to OBD certification that describes the monitoring strategy, malfunction criteria, and monitoring conditions for CV system monitoring. Further, we proposed that the manufacturer may forego monitoring for a disconnection between the crankcase and the CV valve provided the CV system is designed such that it uses tubing connections between the CV valve and the crankcase that are resistant to failure. We also proposed that the manufacturer may forego monitoring for a disconnection between the CV valve and the intake manifold provided the CV system is designed such that any disconnection either causes the engine to stall immediately during idle operation, or is unlikely to occur due to a CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses).

The final requirements for crankcase ventilation system monitoring are

[35] There are some changes discussed in section II.D that pertain to both gasoline and diesel applications.

[36] See CCR 1971.1(f)(2.3.4)(D) and CCR 1971.1(f)(2.3.5) and compare to § 86.010–18(h)(2)(iii)(D) and § 86.010(h)(2)(iii)(E), respectively.

[37] This is true according to our certification database for the 2004, 2005, and 2006 model years. Other manufacturers certify engines that use the Otto cycle, but those engines do not burn gasoline and instead burn various alternative fuels.

[38] "EMA Comments on Proposed HDOBD Requirements for HDGE," bullet items 3 and 4; April 28, 2005, Docket ID# EPA–HQ–OAR–2005–0047–0003.

[39] See § 86.010–18(g)(10) for diesel-fueled engines and § 86.010–18(h)(9) for gasoline-fueled engines.

[40] See § 86.010–18(i)(1) for the final cooling system monitoring requirements.

identical to the proposed requirements.[41]

4. Comprehensive Component Monitors

We proposed that, in general, the OBD system must detect a malfunction of any electronic engine component or system that either provides input to or receives commands from the onboard computer(s). Further, we proposed that malfunctions related to circuit continuity and/or out-of-range values be monitored continuously and that malfunctions related to input data rationality and/or output component functional response be monitored whenever conditions were met.

For the final rule, we have made several changes to the proposed requirements for comprehensive component monitoring. The first of those changes is to revise the provisions concerning the emission effect that determines what must be monitored as a comprehensive component. In the proposed rule, we provided a general set of parameters that fit within the comprehensive component concept. For example, components that provide input to or received commands from the engine computer along with specific examples of such components.[42] We then stated that any such component that could effect emissions over any reasonable driving condition must be monitored. For the final rule, we have changed these emission impacts slightly by stating that any such component that could cause emissions to exceed emissions standards must be monitored.[43] We have made this change because we believe it to be consistent with the Clean Air Act which states that OBD systems should monitor components that could cause or result in failure of the vehicles to comply with emission standards established for such vehicles (see Section I.C.3 above).

The second change we have made to the comprehensive component monitoring requirements is the change to the MIL circuit check and the wait-to-start lamp circuit check. These changes were discussed in Section II.A.2 above.

We have also changed the requirements for monitoring of glow plugs in the 2010 through 2012 model years. During those model years, glow plugs must be monitored for circuit checks only. For model years 2013 and later, we have not made any changes to our proposal (functional checks must be done).[44] We are making this change for the 2010 through 2012 model years because we do not believe that the time available for 2010 implementation is sufficient for all manufacturers to make the changes necessary to conduct functional checks, but we believe that such checks are important and should be done for 2013 and later.

5. Other Emissions Control System Monitoring

We proposed monitoring of other emission control systems that are not otherwise specifically addressed and that the manufacturer submit a plan for Administrator approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production engine.

The final requirements for other emission control system monitoring are identical to the proposed requirements.

6. Exceptions to Monitoring Requirements

We proposed that certain monitors could be disabled under specific conditions related generally to ambient conditions. Further, we proposed that most such disablements be approved by the Administrator.

The final requirements for exceptions to monitoring are identical to the proposed requirements.

E. A Standardized Method To Measure Real World Monitoring Performance

As was noted in section II.A.3, manufacturers determine the most appropriate times to run the non-continuous OBD monitors. This way, they are able to make their OBD evaluation either at the operating condition when an emissions control system is active and its operational status can best be evaluated, and/or at the operating condition when the most accurate evaluation can be made (e.g., highly transient conditions or extreme conditions can make evaluation difficult). Importantly, manufacturers are prohibited from using a monitoring strategy that is so restrictive such that it rarely or never runs. To help protect against monitors that rarely run, we proposed an ''in-use monitor performance ratio'' requirement. The final rule contains the same requirement without changes.[45]

The set of operating conditions that must be met so that an OBD monitor can run are called the ''enable criteria'' for that given monitor. These enable criteria are often different for different monitors and may well be different for different types of engines. A large diesel engine intended for use in a Class 8 truck would be expected to see long periods of relatively steady-state operation while a smaller engine intended for use in an urban delivery truck would be expected to see a lot of transient operation. Manufacturers will need to balance between a rather loose set of enable criteria for their engines and vehicles given the very broad range of operation HD highway engines see and a tight set of enable criteria given the desire for greater monitor accuracy. Manufacturers would be required to design these enable criteria so that the monitor:

- Is robust (i.e., accurate at making pass/fail decisions);
- Runs frequently in the real world; and
- In general, also runs during the FTP heavy-duty transient cycle.

If designed incorrectly, these enable criteria may be either too broad and result in inaccurate monitors, or overly restrictive thereby preventing the monitor from executing frequently in the real world.

Since the primary purpose of an OBD system is to monitor for and detect emission-related malfunctions while the engine is operating in the real world, a standardized methodology for quantifying real world performance would be beneficial to both EPA and manufacturers. Generally, in determining whether a manufacturer's monitoring conditions are sufficient, a manufacturer would discuss the proposed monitoring conditions with EPA staff. The finalized conditions would be included in the certification applications and submitted to EPA staff who would review the conditions and make determinations on a case-by-case basis based on the engineering judgment of the staff. In cases where we are concerned that the documented conditions may not be met during reasonable in-use driving conditions, we would most likely ask the manufacturer for data or other engineering analyses used by the manufacturer to determine that the conditions would occur in-use. In requiring a standardized methodology for quantifying real world performance, we believe this review process can be done more efficiently than would occur otherwise. Furthermore, it would serve to ensure that all manufacturers are held to the same standard for real world performance. Lastly, we want review procedures that will ensure that monitors operate properly and frequently in the field.

[41] See § 86.010–18(i)(2) for the final CV system monitoring requirements.

[42] See proposed and/or final § 86.010–18(i)(3)(i).

[43] See final § 86.010–18(i)(3)(i)(A) and compare to proposed § 86.010–18(i)(3)(i)(A).

[44] See § 86.010–18(i)(3)(iii)(D).

[45] This requirement can be found in § 86.010–18(d).

Therefore, manufacturers will be required to use a standardized method for determining real world monitoring performance and will be liable if monitoring occurs less frequently than a minimum acceptable level, expressed as minimum acceptable in-use performance ratio.[46] We are also requiring that manufacturers implement software in the onboard computer to track how often several of the major monitors (e.g., catalyst, EGR, CDPF, other diesel aftertreatment devices) execute during real world driving. The onboard computer must keep track of how many times each of these monitors has executed and how much the engine has been operated. By measuring both of these values, the ratio of monitor operation relative to engine operation can be calculated to determine monitoring frequency.

The minimum acceptable frequency requirement will apply to many but not all of the OBD monitors. We are requiring that monitors operate either continuously, once per drive cycle, or, in a few cases, multiple times per drive cycle (i.e., whenever the proper monitoring conditions are present). For components or systems that are more likely to experience intermittent failures or failures that can routinely happen in distinct portions of an engine's operating range (e.g., only at high engine speed and load, only when the engine is cold or hot), monitors are required to operate continuously. Examples of continuous monitors include most electrical/circuit continuity monitors. For components or systems that are less likely to experience intermittent failures or failures that only occur in specific vehicle operating regions or for components or systems where accurate monitoring can only be performed under limited operating conditions, monitors would be required to run once per drive cycle. Examples of once per drive cycle monitors typically include gasoline catalyst monitors, evaporative system leak detection monitors, and output comprehensive component functional monitors. For components or systems that are routinely used to perform functions that are crucial to maintaining low emissions but may still require monitoring under fairly limited conditions, monitors are required to run each and every time the manufacturer-defined enable conditions are present. Examples of multiple times per drive cycle monitors typically include input comprehensive component rationality monitors and some exhaust aftertreatment monitors.

Monitors required to run continuously, by definition, would always be running thereby making a minimum frequency requirement moot. The new frequency requirement essentially applies only to those monitors that are designated as once per drive cycle or multiple times per drive cycle monitors. For all of these monitors, manufacturers are required to define monitoring conditions that ensure adequate frequency in-use. Specifically, the monitors need to run often enough so that the measured monitor frequency on in-use engines will exceed the minimum acceptable frequency. However, even though the minimum frequency requirement applies to nearly all once per drive cycle and multiple times per drive cycle monitors, manufacturers are only required to implement software to track and report the in-use frequency for a few of the major monitors. These few monitors generally represent the major emissions control components and the ones with the most limited enable criteria.

We believe that OBD monitors should run frequently to ensure early detection of emissions-related malfunctions and, consequently, to maintain low emissions. Allowing malfunctions to continue undetected and unrepaired for long periods of time allows emissions to increase unnecessarily. Frequent monitoring can also help to ensure detection of intermittent emissions-related malfunctions (i.e., those that are not continuously present but occur sporadically for days and even weeks at a time). The nature of mechanical and electrical systems is that intermittent malfunctions can and do occur. The less frequent the monitoring, the less likely these malfunctions will be detected and repaired. Additionally, for both intermittent and continuous malfunctions, earlier detection is equivalent to preventative maintenance in that the original malfunction can be detected and repaired prior to it causing subsequent damage to other components. This can help vehicle operators avoid more costly repairs that could have resulted had the first malfunction gone undetected.

Infrequent monitoring can also have an impact on the service and repair industry. Specifically, monitors that have unreasonable or overly restrictive enable conditions could hinder vehicle repair services. In general, upon completing an OBD-related repair to an engine, a technician will attempt to verify that the repair has indeed fixed the problem. Ideally, a technician will operate the vehicle in a manner that will exercise the appropriate OBD monitor and allow the OBD system to confirm that the malfunction is no longer present. This affords a technician the highest level of assurance that the repair was indeed successful. However, OBD monitors that operate infrequently are difficult to exercise and, therefore, technicians may not be able (or may not be likely) to perform such post-repair evaluations. Despite the service information availability requirements we are promulgating—requirements that manufacturers make all of their service and repair information available to all technicians, including the information necessary to exercise OBD monitors—technicians would still find it difficult to exercise monitors that require infrequently encountered engine operating conditions (e.g., abnormally steady constant speed operation for an extended period of time). Additionally, to execute OBD monitors in an expeditious manner or to execute monitors that would require unusual or infrequently encountered conditions, technicians may be required to operate the vehicle in an unsafe manner (e.g., at freeway speeds on residential streets or during heavy traffic). If unsuccessful in executing these monitors, technicians may even take shortcuts in attempting to validate the repair while maintaining a reasonable cost for customers. These shortcuts would likely not be as thorough in verifying repairs and could increase the chance that improperly repaired engines would be returned to the vehicle owner or additional repairs would be performed just to ensure the problem is fixed. In the end, monitors that operate less frequently can result in unnecessary costs and inconvenience to both vehicle owners and technicians.

1. Description of Software Counters To Track Real World Performance

As stated above, manufacturers are required to track monitor performance by comparing the number of monitoring events (i.e., how often each monitor has run) to the number of driving events (i.e., how often has the vehicle been operated). Our final rule contains this requirement as did our proposal. In general, we have not changed the requirements associated with determination of this minimum performance ratio. However, we have made some minor changes.

The first of these is the way in which the denominator of the ratio is determined for diesel engines. The ratio

[46] This minimum acceptable ratio applies in model years 2013 and later, as was proposed.

of these two numbers would give an indication of how often the monitor is operating relative to vehicle operation. In equation form, this can be stated as:

$$In\text{-}Use\ Performance\,(Ratio) = \frac{Number\ of\ Monitoring\ Events\,(Numerator)}{Number\ of\ Driving\ Events\,(Denominator)}$$

Specifically, we have changed the denominator provisions which stated that the denominator would be incremented if, on a single key start, the following criteria were satisfied while ambient temperature remained above 20 degrees Fahrenheit and altitude remained below 8,000 feet:

- Minimum engine run time of 10 minutes;
- Minimum of 5 minutes, cumulatively, of operation at vehicle speeds greater than 25 miles-per-hour for gasoline engines or calculated load greater than 15 percent for diesel engines; and
- At least one continuous idle for a minimum of 30 seconds encountered.

For the final rule, the second bullet has been changed to read:

- Minimum of 5 minutes, cumulatively, of operation at vehicle speeds greater than 25 miles-per-hour for gasoline engines or engine speeds greater than 1,150 rotations per minute (RPM) for diesel engines. We are also allowing diesel engines to employ the gasoline criteria for the years 2010 through 2012 but not thereafter.[47]

We have made this change because we believe that the 1,150 RPM criterion is a better measure of work than the 15% load criterion. The purpose of the time at load (i.e., 5 minutes of engine load above 15%) was to have criteria that would represent that an engine had been doing work for at least 5 minutes (300 seconds). After consideration, we have decided that engine speed above 1,150 RPM for 5 minutes is a better measure of engine work.

2. Performance Tracking Requirements

a. In-Use Monitoring Performance Ratio Definition

For monitors required to meet the in-use performance tracking requirements,[48] we are requiring that the incrementing of numerators and denominators and the calculation of the in-use performance ratio be done in accordance with the following specifications. These specifications have not changed from the proposal.

The numerator(s) are defined as a measure of the number of times a vehicle has been operated such that all monitoring conditions necessary for a specific monitor to detect a malfunction have been encountered. Except for systems using alternative statistical MIL illumination protocols, the numerator is to be incremented by an integer of one. The numerator(s) may not be incremented more than once per drive cycle. The numerator(s) for a specific monitor would be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle:

- Every monitoring condition necessary for the monitor of the specific component to detect a malfunction and store a pending DTC has been satisfied, including enable criteria, presence or absence of related DTCs, sufficient length of monitoring time, and diagnostic executive priority assignments (e.g., diagnostic ''A'' must execute prior to diagnostic ''B''). For the purpose of incrementing the numerator, satisfying all the monitoring conditions necessary for a monitor to determine that the component is passing may not, by itself, be sufficient to meet this criteria.
- For monitors that require multiple stages or events in a single drive cycle to detect a malfunction, every monitoring condition necessary for all events to have completed must be satisfied.
- For monitors that require intrusive operation of components to detect a malfunction, a manufacturer would be required to request Administrator approval of the strategy used to determine that, had a malfunction been present, the monitor would have detected the malfunction. Administrator approval of the request would be based on the equivalence of the strategy to actual intrusive operation and the ability of the strategy to determine accurately if every monitoring condition was satisfied as necessary for the intrusive event to occur.
- For the secondary air system monitor, the three criteria above are satisfied during normal operation of the secondary air system. Monitoring during intrusive operation of the secondary air system later in the same drive cycle solely for the purpose of monitoring may not, by itself, be sufficient to meet these criteria.

The third bullet item above requires explanation. There may be monitors designed to use what could be termed a two stage or two step process. The first step is usually a passive and/or short evaluation that can be used to ''pass'' a properly working component where ''pass'' refers to evaluating the component and determining that it is not malfunctioning. The second step is usually an intrusive and/or longer evaluation that is necessary to ''fail'' a malfunctioning component or ''pass'' a component nearing the point of failure. An example of such an approach might be an evaporative leak detection monitor that uses an intrusive vacuum pull-down/bleed-up evaluation during highway cruise conditions. If the evaporative system is sealed tight, the monitor ''passes'' and is done with testing for the given drive cycle. If the monitor senses a leak close to the required detection limit, the monitor does not ''pass'' and an internal flag is stored that will trigger the second stage of the test during the next cold start when a more accurate evaluation can be conducted. On the next cold start, provided the internal flag is set, an intrusive vacuum pull-down/bleed up monitor might be conducted during engine idle a very short time after the cold start. This second evaluation stage, being at idle and cold, gives a more accurate indication of the evaporative system's integrity and provides for a more accurate decision regarding the presence and size of a leak.

In this example, the second stage of this monitor would run less frequently in real use than the first stage since it is activated only on those occasions where the first stage suggests that a leak may be present (which most cars will not have). The rate-based tracking requirements are meant to give a measure of how often a monitor could detect a malfunction. To know the right answer, we need to know how often the first stage is running and could ''fail'', thus triggering the second stage, and then how often the second stage is completing. If we track only the first stage, we would get a false indication of

[47] See § 86.010–18(d)(4).

[48] These monitors, as presented in section II.A.3 (also see 86.010–18(e)(1)), are, for diesel engines: The NMHC catalyst, the CDPF system, the NO_X adsorber system, the NO_X converting catalyst system, and the boost system; and, for gasoline engines: The catalyst, the evaporative system, and the secondary air system; and, for all engines, the exhaust gas sensors, the EGR system, and the VVT system.

how often the monitor could really detect a leak. But, if we track only the second stage, most cars would never increment the counter since most cars do not have leaks and would not trigger stage two.

In considering this, we see two possible solutions: (1) Always activate the second stage evaluation in which case there would be an intrusive monitor being performed that does not really need to be performed; or, (2) implement a ''ghost'' monitor that pretends that the first stage evaluation triggers the second stage evaluation and then also looks for when the second stage evaluation could have completed had it been necessary. The third bullet item in the list above requires that, if a manufacturer intends to implement a two stage monitor and intends to implement such a ''ghost'' monitor as described here for rate based tracking, great care must be taken to ensure that it is being done correctly and properly.

For monitors that can generate results in a ''gray zone'' or ''non-detection zone'' (i.e., results that indicate neither a passing system nor a malfunctioning system) or in a ''non-decision zone'' (e.g., monitors that increment and decrement counters until a pass or fail threshold is reached), the manufacturer is responsible for incrementing the numerator appropriately. In general, the numerator should not be incremented when the monitor indicates a result in the ''non-detection zone'' or prior to the monitor reaching a decision. When necessary, the manufacturer will be expected to have data and/or engineering analyses demonstrating the expected frequency of results in the ''non-detection zone'' and the ability of the monitor to determine accurately, had an actual malfunction been present, whether or not the monitor would have detected a malfunction instead of a result in the ''non-detection zone.'' [49]

For monitors that run or complete their evaluation with the engine off, the numerator must be incremented either within 10 seconds of the monitor completing its evaluation in the engine off state, or during the first 10 seconds of engine start on the subsequent drive cycle.

Manufacturers using alternative statistical MIL illumination protocols for any of the monitors that require a numerator would be required to increment the numerator(s) appropriately. The manufacturer may be required to provide supporting data and/or engineering analyses demonstrating both the equivalence of their incrementing approach to the incrementing specified above for monitors using the standard MIL illumination protocol, and the overall equivalence of their incrementing approach in determining that the minimum acceptable in-use performance ratio has been satisfied.

Regarding the denominator(s), defined as a measure of the number of times a vehicle has been operated, we are requiring that it also be incremented by an integer of one.[50] The denominator(s) may not be incremented more than once per drive cycle. The general denominator and the denominators for each monitor would be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle during which ambient temperature remained at or above 20 degrees Fahrenheit and altitude remained below 8,000 feet:

- Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds (10 minutes);
- Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1,150 RPM, either of which occurs for greater than or equal to 300 seconds (5 minutes); and
- Continuous engine operation at idle (e.g., accelerator pedal released by the driver, engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed less than or equal to one mile per hour) for greater than or equal to 30 seconds.

In addition to the requirements above, the evaporative system monitor denominator(s) must be incremented if and only if:

- Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds (10 minutes) while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and
- Engine cold start occurs with engine coolant temperature at engine start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.

In addition to the requirements above, the denominator(s) for the following monitors must be incremented if and only if the component or strategy is commanded ''on'' for a time greater than or equal to 10 seconds:

- Gasoline secondary air system;
- Cold start emission reduction strategy;
- Components or systems that operate only at engine start-up (e.g., glow plugs, intake air heaters) and are subject to monitoring under ''other emission control systems'' or comprehensive component output components.

For purposes of determining this commanded ''on'' time, the OBD system may not include time during intrusive operation of any of the components or strategies later in the same drive cycle solely for the purposes of monitoring.

In addition to the requirements above, the denominator(s) for the monitors of the following output components (except those operated only at engine start-up as outlined above) must be incremented if and only if the component is commanded to function (e.g., commanded ''on'', ''open'', ''closed'', ''locked'') two or more times during the drive cycle or for a time greater than or equal to 10 seconds, whichever occurs first:

- Variable valve timing and/or control system
- ''Other emission control systems''
- Comprehensive component (output component only, e.g., turbocharger waste-gates, variable length manifold runners)

For monitors of the following components, the manufacturer may use alternative or additional criteria to that set forth above for incrementing the denominator. To do so, the manufacturer would need to be able to demonstrate that the criteria would be equivalent to the criteria outlined above at measuring the frequency of monitor operation relative to the amount of engine operation:

- Engine cooling system input components
- ''Other emission control systems''
- Comprehensive component input components that require extended monitoring evaluation (e.g., stuck fuel level sensor rationality), and temperature sensor rationality monitors
- DPF regeneration frequency

For monitors of the following components or other emission controls that experience infrequent regeneration events, the manufacturer may use alternative or additional criteria to that set forth above for incrementing the denominator. To do so, the manufacturer would need to ensure that the criteria would be equivalent to the criteria outlined above at measuring the frequency of monitor operation relative to the amount of engine operation:

- NMHC converting catalysts
- Diesel particulate filters

For hybrid engine systems, engines that employ alternative engine start hardware or strategies (e.g., integrated starter and generators), or alternative

[49] See 86.010–18(d)(3)(iii).

[50] See 86.010–18(d)(4) for details on the denominator.

fueled engines (e.g., dedicated, bi-fuel, or dual-fuel applications), the manufacturer may request Administrator approval to use alternative criteria to that set forth above for incrementing the denominator. In general, approval would not be given for alternative criteria that only employ engine shut off at or near idle/vehicle stationary conditions. Approval of the alternative criteria would be based on the equivalence of the alternative criteria at determining the amount of engine operation relative to the measure of conventional engine operation in accordance with the criteria above.

The numerators and denominators may need to be disabled at some times.[51] To do this, within 10 seconds of a malfunction being detected (i.e., a pending, MIL-on, or active DTC being stored) that disables a monitor required to meet the performance tracking requirements,[52] the OBD system must disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the malfunction is no longer detected (e.g., the pending DTC is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators should resume within 10 seconds. Also, within 10 seconds of the start of a power takeoff unit (PTO) that disables a monitor required to meet the performance tracking requirements, the OBD system should disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators should resume within 10 seconds. The OBD system must disable further incrementing of all numerators and denominators within 10 seconds if a malfunction has been detected in any component used to determine if: Vehicle speed/calculated load; ambient temperature; elevation; idle operation; engine cold start; or, time of operation has been satisfied, and the corresponding pending DTC has been stored. Incrementing of all numerators and denominators should resume within 10 seconds when the malfunction is no longer present (e.g., pending DTC erased through self-clearing or by a scan tool command).

The in-use performance monitoring ratio itself is defined as the numerator for the given monitor divided by the denominator for that monitor.

b. Standardized Tracking and Reporting of Monitor Performance

Consistent with our proposal, we are requiring that the OBD system separately report an in-use monitor performance numerator and denominator for each of the following components:[53]

- For diesel engines: NMHC catalyst bank 1, NMHC catalyst bank 2, NO_X catalyst bank 1, NO_X catalyst bank 2, exhaust gas sensor bank 1, exhaust gas sensor bank 2, EGR/VVT system, DPF system, turbo boost control system, and the NO_X adsorber. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format discussed below and in section II.F.5.
- For gasoline engines: catalyst bank 1, catalyst bank 2, oxygen sensor bank 1, oxygen sensor bank 2, evaporative leak detection system, EGR/VVT system, and secondary air system. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format specified below and in section II.F.5.

The OBD system will be required to report a separate numerator for each of the components listed in the above bullet lists. For specific components or systems that have multiple monitors that are required to be reported—e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics—the OBD system should separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator should be reported for the specific component. The numerator(s) must be reported as discussed in section II.F.5.[54]

The OBD system will also be required to report a separate denominator for each of the components listed in the above bullet lists. The denominator(s) must be reported as discussed in section II.F.5.[55]

Similarly, for the in-use performance ratio, determining which corresponding numerator and denominator to report as required for specific components or systems that have multiple monitors that are required to be reported—e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics—the ratio should be calculated as discussed in section II.F.5.[56]

The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced. The ignition cycle counter must also be reported as discussed in section II.F.5.[57] The ignition cycle counter, when incremented, should be incremented by an integer of one. The ignition cycle counter may not be incremented more than once per ignition cycle. The ignition cycle counter should be incremented within 10 seconds if and only if the engine exceeds an engine speed of 50 to 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission) for at least two seconds plus or minus one second. The OBD system should disable further incrementing of the ignition cycle counter within 10 seconds if a malfunction has been detected in any component used to determine if engine speed or time of operation has been satisfied and the corresponding pending DTC has been stored. The ignition cycle counter may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter should resume within 10 seconds after the malfunction is no longer present (e.g., pending DTC erased through self-clearing or by a scan tool command).

F. Standardization Requirements

Consistent with our proposal, the final regulation includes requirements for manufacturers to standardize certain features of the OBD system.[58] Effective standardization assists all repair technicians in diagnosing and repairing malfunctions by providing equal access to essential repair information, and requires structuring the information in a common format from manufacturer to manufacturer. Additionally, the standardization will help to facilitate the potential use of OBD checks in heavy-duty inspection and maintenance programs.

The features that will be standardized include:

[51] See 86.010–18(d)(5).

[52] These monitors, as presented in section II.A.3, are, for diesel engines: the NMHC catalyst, the CDPF system, the NO_X adsorber system, the NO_X converting catalyst system, and the boost system; and, for gasoline engines: the catalyst, the evaporative system, and the secondary air system; and, for all engines, the exhaust gas sensors, the EGR system, and the VVT system.

[53] See § 86.010–18(e)(1).

[54] See § 86.010–18(e)(2).

[55] See § 86.010–18(e)(3).

[56] See § 86.010–18(e)(4).

[57] See § 86.010–18(e)(5).

[58] See § 86.010–18(k).

• The diagnostic connector, the computer communication protocol (beginning in model year 2013 as we proposed);
• The hardware and software specifications for tools used by service technicians;
• The information communicated by the onboard computer and the methods for accessing that information;
• The numeric designation of the DTCs stored when a malfunction is detected; and
• The terminology used by manufacturers in their service manuals.

Also consistent with our proposal, only a certain minimum set of emissions-related information must be made available through the standardized format, protocol, and connector. We are not limiting engine manufacturers as to what protocol they use for engine control, communication between onboard computers, or communication to manufacturer-specific scan tools or test equipment. Further, we are not prohibiting engine manufacturers from equipping the vehicle with additional diagnostic connectors or protocols as required by other suppliers or purchasers. For example, fleets that use data logging or other equipment that requires the use of SAE J1587 communication and connectors could still be installed and supported by the engine and vehicle manufacturers. The OBD rules only require that engine manufacturers also equip their vehicles with a specific connector and communication protocol that meet the standardized requirements to communicate a minimum set of emissions-related diagnostic, service and, potentially, inspection information.

1. Reference Documents

We are requiring that OBD systems comply with the provisions laid out in certain Society of Automotive Engineers (SAE) and/or International Organization of Standards (ISO) documents that are incorporated by reference (IBR) into federal regulation. Details regarding these SAE and ISO documents can be found in § 86.1(b) and in § 86.010–18(k).

Notably, we are requiring that OBD systems on engines placed in over 14,000 pound vehicles use either the SAE J1939 or the ISO 15765–4:2005(E) communication protocols. Note that some manufacturers have expressed interest in the ISO 27145 standard. As of this writing, that standard is not available. Should it become available in time for model year 2013 and later implementation, we will consider allowing that standard and may issue a technical amendment, direct final rule, or proposed rule to address it.

2. Diagnostic Connector Requirements

We have made no substantive changes relative to our proposal with respect to the diagnostic data link connector. The one change we have made is simply to allow the Administrator to approve alternative locations for the connector. We have made this change to accommodate certain applications such as buses in which the required location would not work well. Note that the requirements for model years 2013 and later now appear in § 86.010–18 rather than § 86.013–18 as in our proposal.[59]

3. Communications to a Scan Tool

In light-duty OBD, manufacturers are allowed to use one of four protocols for communication between a generic scan tool and the vehicle's onboard computer. A generic scan tool automatically cycles through each of the allowable protocols until it hits upon the proper one with which to establish communication with the particular onboard computer. While this has generally worked successfully in the field, some communication problems have arisen.

In an effort to address these problems, CARB has made recent changes to their light-duty OBDII regulation that require all light-duty vehicle manufacturers to use only one communication protocol by the 2008 model year. In making these changes, CARB staff argued that their experience with standardization under the OBD II regulation showed that having a single set of standards used by all vehicles would be desirable. CARB staff argued that a single protocol offers a tremendous benefit to both scan tool designers and service technicians. Scan tool designers could focus on added feature content and could expend much less time and money validating basic functionality of their product on all the various permutations of protocol interpretations that are implemented. In turn, technicians would likely get a scan tool that works properly on all vehicles without the need for repeated software updates that incorporate ''work-arounds'' or other patches to fix bugs or adapt the tool to accommodate slight variances in how the multiple protocols interact with each other or are implemented by various manufacturers. Further, a single protocol should also be beneficial to fleet operators that use add-on equipment such as data loggers, and for vehicle manufacturers that integrate parts from various engine and component suppliers all of which must work together.

[59] See proposed §§ 86.010–18(k)(2) and 86.013–18(k)(2) and compare to final § 86.010–18(k)(2).

Based on our similar experiences at the federal level with communication protocols giving rise to service and inspection/maintenance program issues, we initially wanted to propose a single communication protocol for engines used in over 14,000 pound vehicles. However, the affected industry has been divided over which single protocol should be required and has strongly argued for more than one protocol to be allowed. Therefore, for vehicles with diesel engines, we proposed and are allowing manufacturers use either the standards set forth in SAE J1939, or those set forth in the 500 kbps baud rate version of ISO 15765. For vehicles with gasoline engines, we are requiring that manufacturers use the 500 kbps baud rate version of ISO 15765.[60] Manufacturers would be required to use only one standard to meet all the standardization requirements on a single vehicle; that is, a vehicle must use only one protocol for all OBD modules on the vehicle.

As noted above, some manufacturers have expressed interest in the ISO 27145 standard. That standard is being developed as part of the Worldwide Harmonized Heavy-duty OBD global technical regulation (WWH–OBD).[61] As of this writing, that ISO standard is not available. Should it become available in time for model year 2013 and later implementation, we will consider allowing that standard and may issue a technical amendment, direct final rule, or proposed rule to address it.

4. Required Emissions Related Functions

We have made only a few changes in the final rule relative to our proposal. We believe that all of these changes are minor and serve to ease the burden on manufacturers without sacrificing our OBD program. The first change is that made to the permanent DTC erasure provisions.[62] The final provisions provide more clarity and flexibility to manufacturers in cases where stored DTC information has been erased via scan tool or battery disconnect. These changes are consistent with changes made to CARB's OBDII regulation in 2007 and changes we believe CARB will make when revising their HDOBD regulation (expected in 2009).

[60] See § 86.010–18(k)(3).

[61] Global Technical Regulation Number 5: Technical Requirements for On-board Diagnostic Systems for Road Vehicles; ECE/TRANS/180/Add.5; 23 January 2007, see *http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.html.*

[62] See proposed § 86.010–18(b)(3)(iii) and compare to the final § 86.010–18(b)(3)(iii).

We have also made a slight change to the definition of idle where we require that the OBD system track engine run-time and track the amount of time operating in idle mode. The provision removes the phrase ''vehicle speed less than 1 mph'' and replaces it with ''engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed less than 1 mph.'' We have made this change to be consistent with industry request, and because we believe it does not sacrifice our intent in any way.[63]

We have also made minor changes to the CAL ID and CVN requirements.[64] These changes allow for multiple CAL IDs per diagnostic or emission critical control unit. Our proposal allowed for only one. We would prefer that there be only one for the sake of minimizing confusion. Manufacturers would be required to get Administrator approval to use multiple CAL IDs and would also be required to communicate these to the scan tool in order of priority which should minimize if not eliminate possible confusion. We have made a corresponding change to the CVN requirements for systems using the multiple CAL ID provision.

5. In-Use Performance Ratio Tracking Requirements

To separately report an in-use performance ratio for each applicable monitor as discussed in sections II.B through II.D, we proposed that manufacturers be required to implement software algorithms to report a numerator and denominator in a standardized format. We have made no changes to those requirements in the final rule, with the exception of the minor change to the definition of idle from ''vehicle speed less than one mile per hour'' to ''engine speed less than or equal to 200 rpm above normal warmed-up idle and vehicle speed less than or equal to one mile per hour.''[65]

6. Exceptions to Standardization Requirements

For alternative-fueled engines derived from a diesel-cycle engine, we are allowing the standardized requirements discussed in this section that are applicable to diesel engines rather than meeting the requirements applicable to gasoline engines.

G. Implementation Schedule, In-Use Liability, and In-Use Enforcement

1. Implementation Schedule and In-Use Liability Provisions

Table II.G–1 summarizes the implementation schedule for the OBD monitoring requirements, the certification requirements, and the in-use liabilities. This implementation schedule is identical to the proposed schedule. More detail regarding the implementation schedule and liabilities can be found in the sections that follow.

TABLE II.G–1—OBD CERTIFICATION REQUIREMENTS AND IN-USE LIABILITY FOR DIESEL FUELED AND GASOLINE FUELED ENGINES OVER 14,000 POUNDS

Model year	Applicability	Certification requirement	In-use liability
2010–2012	Parent rating within 1 compliant engine family.[a]	Full liability to thresholds according to certification demonstration procedures.[b]	Full liability to 2x thresholds.[c]
	Child ratings within the compliant engine family.	Certification documentation only (i.e., no certification demonstration); no liability to thresholds.	Liability to monitor and detect as noted in certification documentation.
	All other engine families and ratings	None	None.
2013–2015	Parent rating from 2010–2012 and parent rating within 1–2 additional engine families.	Full liability to thresholds according to certification demonstration procedures.	Full liability to 2x thresholds.
	Child ratings from 2010–2012 and parent ratings from any remaining engine families or OBD groups.[d]	Full liability to thresholds but certification documentation only.	Full liability to 2x thresholds.
	Additional engine ratings	Certification documentation only; no liability to thresholds.	Liability to monitor and detect as noted in certification documentation.
2016–2018	One rating from 1–3 engine families and/or OBD groups.	Full liability to thresholds according to certification demonstration procedures.	Full liability to thresholds.
	Remaining ratings	Full liability to thresholds but certification documentation only.	Full liability to 2x thresholds.
2019+	One rating from 1–3 engine families and/or OBD groups.	Full liability to thresholds according to certification demonstration procedures.	Full liability to thresholds.
	Remaining ratings	Full liability to thresholds but certification documentation only.	Full liability to thresholds.

Notes: (a) Parent and child ratings are defined in section II.G; which rating(s) serves as the parent rating and which engine families must comply is not left to the manufacturer, as discussed in section II.G. (b) The certification demonstration procedures and the certification documentation requirements are discussed in section VII. (c) Where in-use liability to thresholds and 2x thresholds is noted, manufacturer liability to monitor and detect as noted in their certification documentation is implied. (d) OBD groups are groupings of engine families that use similar OBD strategies and/or similar emissions control systems, as described in the text.

As we proposed, for the 2010 through 2012 model years, manufacturers are required to implement OBD on one engine family. All other 2010 through 2012 engine families are not subject to any OBD requirements unless otherwise required to do so (e.g., to demonstrate that SCR equipped vehicles will not be operated without urea). For 2013, manufacturers are required to implement OBD on all engine families.

We are setting this implementation schedule for several reasons. First, industry has made credible arguments that their resources are stretched to the limit developing and testing strategies for compliance with the 2007/2010 heavy-duty highway emissions standards. We do not want to jeopardize their success toward that goal by being too aggressive with our OBD program.

[63] See proposed § 86.010–18(k)(6)(i)(B) and compare to final § 86.010–18(k)(6)(i)(B).

[64] See proposed § 86.010–18(k)(4)(vi) and (k)(4)(vii)(A) and compare to final § 86.010–18(k)(4)(vi) and (k)(4)(vii)(A).

[65] See final §§ 86.010–18(k)(5) and 86.010–18(k)(6).

Second, OBD is a complex and difficult regulation with which to comply. We believe that our implementation schedule would give industry the opportunity to introduce OBD systems on a limited number of engines giving them and us very valuable learning experience. Should mistakes or errors in regulatory interpretation occur, the ramifications would be limited to only a subset of the new vehicle fleet rather than the entire new vehicle fleet. Lastly, the OBD requirements and the production vehicle evaluation provisions (discussed in Section VII), reflect 10 to 20 years of learning by EPA, CARB, and industry (primarily the light-duty gasoline industry) as to what works and what does not work. This is, perhaps, especially true for those OBD elements that involve the interface between the OBD system and service and I/M inspection personnel. Gasoline manufacturers have had the ability to evolve their OBD systems along with this learning process. However, diesel engine manufacturers have not really been involved in this learning process and, as a result, 100 percent implementation in 2010 would be analogous to implementing 10 to 20 years of OBD learning in one implementation step. We believe that implementing slowly rather than one big step will benefit everyone involved.

Table II.G–1 makes reference to ''parent'' and ''child'' ratings. In general, engine manufacturers certify an engine family that consists of several ratings having slightly different horsepower and/or torque characteristics but no differences large enough to require a different engine family designation. For emissions certification, the parent rating—i.e., the rating for which emissions data are submitted to EPA for the purpose of demonstrating emissions compliance—is defined as the ''worst case'' rating. This worst case rating is the rating considered as having the worst emissions performance and, therefore, its compliance demonstrates that all other ratings within the family must comply. For OBD purposes, we want to limit the burden on industry—hence the requirement for only one compliant engine family in 2010—yet maximize the impact of the OBD system. Therefore, for model years 2010 through 2012, we are defining the OBD parent rating as the rating having the highest weighted projected sales within the engine family having the highest weighted projected sales, with sales being weighted by the useful life of the engine rating. We have added a new provision that allows the Administrator to approve an alternative rating as the parent rating than that described by this text and this represents a slight departure from the proposal.[66] Table II.G–2 presents a hypothetical example for how this would work absent Administrator approval to do otherwise. Using this approach, the OBD compliant engine family in 2010 would be the engine family projected to produce the most in-use emissions (based on sales weighted by expected miles driven). Likewise, the fully liable parent OBD rating would be the rating within that family projected to produce the most in-use emissions.

TABLE II.G–2—HYPOTHETICAL EXAMPLE OF HOW THE OBD PARENT AND CHILD RATINGS WOULD BE DETERMINED

OBD group	Engine family	Rating	Projected sales	Certified useful life	OBD weighting—engine rating [a] (billions)	OBD weighting—engine family [b] (billions)
I	A	1	10,000	285,000	2.85	14.25
		2	40,000	285,000	11.4	
	B	1	10,000	435,000	4.35	21.60
		2	20,000	435,000	8.70	
		3	30,000	285,000	8.55	
II	C	1	20,000	110,000	2.20	7.70
		2	50,000	110,000	5.50	

Notes: (a) For engine family A, rating 1, 10,000 × 285,000/1 billion = 2.85. (b) For engine family A, 2.85 + 11.4 = 14.25.

In the example shown in Table II.G–2, the compliant engine family in 2010 would be engine family B and the parent OBD rating within that family would be rating 2. The other OBD compliant ratings within engine family B would be dubbed the ''child'' ratings. For model years 2013 through 2015, the parent ratings would be those ratings having the highest weighted projected sales within each of the one to three engine families having the highest weighted projected sales, with sales being weighted by the useful life of the engine rating. In the example shown in Table II.G–2, the parent ratings would be rating 2 of engine family A, rating 2 of engine family B, and rating 2 of engine family C (Note that this is only for illustration purposes since the regulations would not require that a manufacturer with only three engine families have three parent ratings and instead would require only one).

The manufacturer does not need to submit test data demonstrating compliance with the emissions thresholds for the child ratings. We would fully expect these child ratings to use OBD calibrations—i.e., malfunction trigger points—that are identical or nearly so to those used on the parent rating. However, we would allow manufacturers to revise the calibrations on their child ratings where necessary so as to avoid unnecessary or inappropriate MIL illumination. Such revisions to OBD calibrations have been termed ''extrapolated'' OBD calibrations and/or systems. The revisions to the calibrations on child ratings and the rationale for them will need to be very clearly described in the certification documentation.

For the 2013 and later model years, we are requiring that manufacturers certify one to three parent ratings. The actual number of parent ratings would depend upon the manufacturer's fleet and would be based on both the emissions control system architectures present in their fleet and the similarities/differences of the engine families in their fleet. For example, a manufacturer that uses a DPF with NO_X adsorber on each of the engines would have only one system architecture. Another manufacturer that uses a DPF with NO_X adsorber on some engines and a DPF with SCR on others would have

[66] See § 86.010–18(o)(1)(i) and (o)(2)(ii)(B) to see this new provision.

at least two architectures. We expect that manufacturers will group similar architectures and similar engine families into so called "OBD groups." These OBD groups would consist of a combination of engines, engine families, or engine ratings that use the same OBD strategies and similar calibrations. The manufacturer will be required to submit details regarding their OBD groups as part of their certification documentation that shows the engine families and engine ratings within each OBD group for the coming model year. While a manufacturer may end up with more than three OBD groups, we do not intend to require a parent rating for more than three OBD groups. Therefore, in the example shown in Table II.G–2, rather than submitting test data for the three parent ratings as suggested above, the OBD grouping would result in the parent ratings being rating 2 of engine family B and rating 2 of engine family C. These parents would represent OBD groups I and II, and the manufacturer's product line. For 2013 through 2015, we will allow the 2010 parent to again act as a parent rating and, provided no significant changes had been made to the engine or its emissions control system, complete carryover would be possible. However, for model years 2016 and beyond, we would work closely with CARB staff and the manufacturer to determine the parent ratings so that the same ratings are not acting as the parents every year. In other words, our definitions for the OBD parent ratings as discussed here apply only during the years 2010 through 2012 and again for the years 2013 through 2015.

Also consistent with our proposal are the relaxations for in-use liability during the 2010 through 2018 model years. The first such relaxation is higher interim in-use compliance standards for those OBD monitors calibrated to specific emissions thresholds. For the 2010 through 2015 model years, an OBD monitor on an in-use engine will not be considered non-compliant (i.e., subject to enforcement action) unless emissions exceed twice the OBD threshold without detection of a malfunction. For example, for an EGR monitor on an engine with a NO_X FEL of 0.2 g/bhp–hr and an OBD threshold of 0.5 g/bhp–hr (i.e., the NO_X FEL+0.3), a manufacturer would not be subject to enforcement action unless emissions exceed 1.0 g/bhp–hr NO_X without a malfunction being detected. For the model years 2016 through 2018, parent ratings will be liable to the certification emissions thresholds, but child ratings and other ratings would be liable to twice the certification thresholds. Beginning in the 2019 model year, all families and all ratings would be liable to the certification thresholds.

The second in-use relaxation is a limitation in the number of engines that will be liable for in-use compliance with the OBD emissions thresholds. Consistent with our proposal, for 2010 through 2012, we are requiring that manufacturers be fully liable in-use to twice the thresholds for only the OBD parent rating. The child ratings within the compliant engine family would have liability for monitoring in the manner described in the certification documentation, but would not have liability for detecting a malfunction at the specified emissions thresholds. For example, a child rating's DPF monitor designed to operate under conditions X, Y, and Z and calibrated to detect a backpressure within the range A to B would be expected to do exactly that during in-use operation. However, if the tailpipe emissions of the child engine were to exceed the applicable OBD in-use thresholds (i.e., 2x the certification thresholds during 2010–2015), despite having a backpressure within range A to B under conditions X, Y, and Z, there would be no in-use OBD failure nor cause for enforcement action. In fact, we would expect the OBD monitor to determine that the DPF was functioning properly since its backpressure was in the acceptable range. For model years 2013 through 2015, this same in-use relaxation will apply to those engine families that do not lie within an engine family for which a parent rating has been certified. For 2016 and later model years, all engines will have some in-use liability to thresholds, either the certification thresholds or twice those thresholds.

These in-use relaxations are meant to provide ample time for manufacturers to gain experience without an excessive level of risk for mistakes. They also allow manufacturers to fine-tune their calibration techniques over a six to ten year period.

We are also requiring a specific implementation schedule for the standardization requirements discussed in section II.F. We initially intended to require that any compliant OBD engine family would be required to implement all of the standardization requirements. However, we became concerned that, during model years 2010 through 2012, we could have a situation where OBD compliant engines from manufacturer A might be competing against non-OBD engines from manufacturer B for sales in the same truck. In such a case, the truck builder would be placed in a difficult position of needing to design their truck to accommodate OBD compliant engines—along with a standardized MIL, a specific diagnostic connector location specification, etc.—and non-OBD engines. After consideration of this almost certain outcome, we decided to limit the standardization requirements that must be met during the 2010 through 2012 model years. Beginning in 2013, all engines will be OBD compliant and this would become a moot issue. Table II.G–3 shows the implementation schedule for standardization requirements.

TABLE II.G–3—OBD STANDARDIZATION REQUIREMENTS FOR DIESEL FUELED AND GASOLINE FUELED ENGINES OVER 14,000 POUNDS

Model year	Applicability	Required standardization features	Waived standardization features
2010–2012	Parent and Child ratings within 1 compliant engine family [a].	Emissions related functions (II.F.4) except for the requirement to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications. MIL activation and deactivation.[b] Performance tracking—calculation of numerators, denominators, ratios.	Standardized connector (II.F.2). Dedicated (i.e., regulated OBD-only) MIL. Communication protocols (II.F.3). Emissions related functions (II.F.4) with respect to the requirement to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications.
	Other engine families	None	All.
2013+	All engine families and ratings	All	None.

Notes: [a] Parent and child ratings are defined in section II.G; which rating serves as the parent rating and which engine families must comply is not left to the manufacturer, as discussed in section II.G. [b] There would be no requirement for a dedicated MIL and no requirement to use a specific MIL symbol, only that a MIL be used and that it use the specified activation/deactivation logic.

2. In-Use Enforcement

When conducting our in-use enforcement investigations into OBD systems, we intend to use all tools we have available to analyze the effectiveness and compliance of the system. These tools may include on-vehicle emission testing systems such as the portable emissions measurement systems (PEMS). We may also use scan tools and data loggers to analyze the data stream information to compare real world operation to the documentation provided at certification.

Importantly, we do not intend to pursue enforcement action against a manufacturer for not detecting a failure mode that could not have been reasonably predicted or otherwise detected using monitoring methods known at the time of certification. For example, we are imposing a challenging set of requirements for monitoring of DPF systems. As of today, engine manufacturers are reasonably confident in their ability to detect certain DPF failure modes at or near the final thresholds—e.g., a leaking DPF resulting from a cracked substrate—but are not confident in their ability to detect some other DPF failure modes—e.g., a leaking DPF resulting from a partially melted substrate. If a partially melted substrate indeed cannot be detected and this is known during the certification process, we cannot expect such a failure to be detected on an in-use vehicle.[67] This provision is consistent with our proposal.

We also want to make it clear who would be the responsible party should we pursue any in-use enforcement action with respect to OBD. We are very familiar with the heavy-duty industry and its tendency toward separate engine and component suppliers. This contrasts with the light-duty industry which tends toward a more vertically integrated structure. The non-vertically integrated nature of the heavy-duty industry can present unique difficulties for OBD implementation and for OBD enforcement. With the complexity of OBD systems, especially those meeting today's requirements, we expect the interactions between the various parties involved—engine manufacturer, transmission manufacturer, vehicle manufacturer, etc.—to be further complicated. Nonetheless, in the end the vast majority of the OBD requirements apply directly to the engine and its associated emission controls, and the engine manufacturer will have complete responsibility to ensure that the OBD system performs properly in-use. Given the central role the engine and engine control unit plays in the OBD system, we are requiring that the party certifying the engine and OBD system (typically, the engine manufacturer) be the responsible party for in-use compliance and enforcement actions. In this role, the certifying party will be our sole point of contact for potential noncompliances identified during in-use or enforcement testing. We will leave it to the engine manufacturer to determine the ultimate party responsible for the potential noncompliance (e.g., the engine manufacturer, the vehicle manufacturer, or some other supplier). In cases where remedial action such as an engine recall would be required, the certifying party would take on the responsibility of arranging to bring the engines or OBD systems back into compliance. Given that heavy-duty engines are already subject to various emission requirements including engine emission standards, labels, and certification, engine manufacturers currently impose restrictions via signed agreements with engine purchasers to ensure that their engines do not deviate from their certified configuration when installed. We expect the OBD system's installation to be part of such agreements in the future.

H. Changes to the Existing 8,500 to 14,000 Pound Diesel OBD Requirements

We are also making final certain changes to our OBD requirements for diesel engines used in heavy-duty vehicles under 14,000 pounds (see 40 CFR 86.007–17 for engine-based requirements and 40 CFR 86.1806–05 for vehicle or chassis-based requirements). Table II.H–1 summarizes the changes to under 14,000 pound heavy-duty diesel vehicle emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC. Table II.H–2 summarizes the changes for diesel engines used in heavy-duty applications under 14,000 pounds. The changes are meant to maintain consistency with the diesel OBD requirements for over 14,000 pound applications.

TABLE II.H–1—NEW AND/OR CHANGES TO EXISTING, EMISSIONS THRESHOLDS FOR DIESEL FUELED CI HEAVY-DUTY VEHICLES UNDER 14,000 POUNDS (G/MI)

Component/monitor	MY	NMHC	CO	NO_X	PM
NMHC catalyst system	2010–2012	2.5x	....	....	....
	2013+	2x	....	....	....
NO_X catalyst system	2007–2009	....	....	4x	....
	2010–2012	....	....	+0.6	....
	2013+	....	....	+0.3	....
DPF system	2010–2012	....	....	....	4x
	2013+	....	....	....	+0.04
Air-fuel ratio sensors upstream	2007–2009	2.5x	2.5x	3x	4x
	2010–2012	2.5x	2.5x	+0.3	+0.02
	2013+	2x	2x	+0.3	+0.02
Air-fuel ratio sensors downstream	2007–2009	2.5x	....	3x	4x
	2010–2012	2.5x	....	+0.3	4x
	2013+	2x	....	+0.3	+0.04
NO_X sensors	2007–2009	....	....	4x	5x
	2010–2012	....	....	+0.6	4x
	2013+	....	....	+0.3	+0.04
"Other monitors" with emissions thresholds	2007–2009	2.5x	2.5x	3x	4x
	2010–2012	2.5x	2.5x	+0.3	4x
	2013+	2x	2x	+0.3	+0.02

Notes: MY=Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard; +0.3 means the standard plus 0.3; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

[67] See, for example, § 86.010–18(p)(1)(iv).

TABLE II.H–2—NEW AND/OR CHANGES TO EXISTING, EMISSIONS THRESHOLDS FOR DIESEL FUELED CI ENGINES USED IN HEAVY-DUTY VEHICLES UNDER 14,000 POUNDS (G/BHP-HR)

Component/monitor	MY	Std/FEL	NMHC	CO	NO_X	PM
NMHC catalyst system	2010–2012	All	2.5x	....	....	....
	2013+	All	2x	....	....	....
NO_X catalyst system	2007–2009	>0.5 NO_X	....	....	1.75x	....
	2007–2009	<=0.5 NO_X	....	....	+0.6	....
	2010–2012	All	....	....	+0.6	....
	2013+	All	....	....	+0.3	....
DPF system	2010–2012	All	....	....	....	0.05/+0.04
	2013+	All	....	....	....	0.05/+0.04
Air-fuel ratio sensors upstream	2007–2009	>0.5 NO_X	2.5x	2.5x	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x	2.5x	+0.5	0.05/+0.04
	2010–2012	All	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	All	2x	2x	+0.3	0.03/+0.02
Air-fuel ratio sensors downstream	2007–2009	>0.5 NO_X	2.5x	....	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x	....	+0.5	0.05/+0.04
	2010–2012	All	2.5x	....	+0.3	0.05/+0.04
	2013+	All	2x	....	+0.3	0.05/+0.04
NO_X sensors	2007–2009	>0.5 NO_X	....	....	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	....	....	+0.6	0.05/+0.04
	2010–2012	All	....	....	+0.6	0.05/+0.04
	2013+	All	....	....	+0.3	0.05/+0.04
"Other monitors" with emissions thresholds	2007–2009	>0.5 NO_X	2.5x	2.5x	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x	2.5x	+0.5	0.05/+0.04
	2010–2012	All	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	All	2x	2x	+0.3	0.03/+0.02

Notes: MY=Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard or family emissions limit (FEL); +0.3 means the standard or FEL plus 0.3; 0.05/+0.04 means an absolute level of 0.05 or an additive level of the standard or FEL plus 0.04, whichever level is higher; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

1. NO_X Aftertreatment Monitoring

We are requiring that the 8,500 to 14,000 pound NO_X aftertreatment monitoring requirements mirror those for engines used in vehicles over 14,000 pounds. The current regulations require detection of a NO_X catalyst malfunction before emissions exceed 1.5x the emissions standards. We do not believe that such a tight threshold level is appropriate for diesel SCR and lean NO_X catalyst systems. The final thresholds are less stringent than proposed until the 2013 model year where they are consistent with our proposal. We have made the thresholds less stringent for the same reasons as discussed in section II.B. The required monitoring conditions with respect to performance tracking (discussed in section II.B.6.c) would not apply for under 14,000 pound heavy-duty applications since we do not have performance tracking requirements for under 14,000 pound applications. We are proposing this change for the 2007 model year.

2. Diesel Particulate Filter System Monitoring

We are requiring that the 8,500 to 14,000 pound DPF monitoring requirements mirror those discussed in section II.B.8. Our current regulations require detection of a catastrophic failure only. The proposed monitoring requirements contained emissions thresholds like those proposed for over 14,000 pound OBD. The final PM thresholds remain unchanged from the proposal. We have eliminated the proposed NMHC thresholds for the same reasons we have eliminated the requirement to monitor NMHC conversion of the DPF in the over 14,000 pound applications. The required monitoring conditions with respect to performance tracking (discussed in section II.B.8.c) would not apply for under 14,000 pound heavy-duty applications since we do not have performance tracking requirements for under 14,000 pound applications. We are requiring no new DPF monitoring requirements in the 2007 to 2009 model years because there is not sufficient lead time for manufacturers to develop a new monitor. The new, more stringent monitoring requirements would begin in the 2010 model year. Also, for 2010 through 2012, we are providing the option to monitor and detect a decrease in the expected pressure drop across the DPF, consistent with the provisions for over 14,000 pound applications. This option is being made available only to the engine certified systems since the requirement is based on the engine certification procedure.

3. NMHC Converting Catalyst Monitoring

The final requirements for NMHC converting catalyst monitoring are identical to those we proposed. However, we have added the option to monitor the ability of the NMHC catalyst to generate a 100 degree C temperature rise, or to reach the necessary regeneration temperature, within 60 seconds of initiating a regeneration event. We have added other criteria for this optional monitoring approach to ensure that the necessary regeneration temperature is being sustained and that the regeneration attempt be aborted should the regeneration temperature not be reached or sustained properly. This makes the 8,500 to 14,000 pound provisions consistent with the over 14,000 pound provisions.

4. Other Monitors

The final requirements for "other monitors" are identical to those we proposed, except that we have revised the NO_X sensor monitor NO_X threshold to +0.6 to be consistent with changes made for other monitors discussed above.

5. CARB OBDII Compliance Option and Deficiencies

We are also making final the proposed changes to our deficiency provisions for vehicles and engines meant for vehicles under 14,000 pounds. We have included specific mention of air-fuel ratio sensors and NO_X sensors where we had long referred only to oxygen sensors. We have also updated the referenced CARB OBDII document that can be used to satisfy the federal OBD requirements.[68]

III. How Have the Service Information Availability Requirements Changed for This Final Rule?

A. What is the Important Background Information for the Provision Being Finalized for Service Information Availability?

Section 202(m)(5) of the CAA directs EPA to promulgate regulations requiring OEMs to provide to:

> Any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, and the Administrator for use by any such persons, * * * any and all information needed to make use of the [vehicle's] emission control diagnostic system * * * and such other information including instructions for making emission-related diagnoses and repairs.

Such regulations are subject to the requirements of section 208(c) regarding protection of trade secrets; however, no such information may be withheld under section 208(c) if that information is provided (directly or indirectly) by the manufacturer to its franchised dealers or other persons engaged in the repair, diagnosing or servicing of motor vehicles.

On June 27, 2003 EPA published a final rulemaking (68 FR 38428) which set forth the Agency's service information regulations for light- and heavy-duty vehicles and engines below 14,000 pounds GVWR. These regulations, in part, required each covered Original Equipment Manufacturer (OEM) to do the following: (1) OEMs must make full text emissions-related service information available via the World Wide Web. (2) OEMs must provide equipment and tool companies with information that allows them to develop pass-through recalibration tools. (3) OEMs must make available enhanced diagnostic information to equipment and tool manufacturers and to make available OEM-specific diagnostic tools for sale. These requirements were finalized to ensure that aftermarket service and repair facilities have access to the same emission-related service information, in the same or similar manner, as that provided by OEMs to their franchised dealerships.

In the NPRM, we proposed several provisions related to the availability of service information. We proposed to require that each heavy-duty Original Equipment Manufacturer (OEM) do the following: (1) Make full text emissions-related service information available via the World Wide Web; (2) provide equipment and tool companies with information that allows them to develop pass-through reprogramming tools; (3) make available enhanced diagnostic information to equipment and tool manufacturers and to make available OEM-specific diagnostic tools for sale; (4) make available emissions-related training information. EPA has carefully considered the comments we have received on our proposed requirements. The service information provisions finalized in today's action provide maximum flexibility to engine manufacturers while still meeting the intent of the Clean Air Act to ensure fair and reasonable access by aftermarket service providers to service information and tools needed to service and repairs emissions-related problems on heavy-duty engines.

B. What Provisions are Being Finalized for Service Information Availability?

1. What Information is the OEM Required to Make Available?

Today's action requires OEMs to make available to any person engaged in the repairing or servicing of heavy-duty motor vehicles or motor vehicle engines above 14,000 pounds all information necessary to make use of the OBD systems and any information for making emission-related repairs, including any emissions-related information that is provided by the OEM to franchised dealers, beginning generally with MY2010, though for the provisions related to scan tool availability, we are allowing manufacturers until MY2013 to comply. This information includes, but is not limited to, the following:

(1) Manuals, technical service bulletins (TSBs), diagrams, and charts (the provisions for training materials, including videos and other media are discussed in Sections III.A.3 and III.A.4 below).

(2) A general description of the operation of each monitor, including a description of the parameter that is being monitored.

(3) A listing of all typical OBD diagnostic trouble codes associated with each monitor.

(4) A description of the typical enabling conditions for each monitor to execute during vehicle operation, including, but not limited to, minimum and maximum intake air and engine coolant temperature, vehicle speed range, and time after engine startup. A listing and description of all existing monitor-specific drive cycle information for those vehicles that perform misfire, fuel system, and comprehensive component monitoring.

(5) A listing of each monitor sequence, execution frequency and typical duration.

(6) A listing of typical malfunction thresholds for each monitor.

(7) For OBD parameters that deviate from the typical parameters, the OBD description shall indicate the deviation for the vehicles it applies to and provide a separate listing of the typical values for those vehicles.

(8) Identification and scaling information necessary to interpret and understand data available to a generic scan tool through Diagnostic Message 8 pursuant to SAE Recommended Practice J1939–73 (revised September 2006).

(9) Any information related to the service, repair, installation or replacement of parts or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships.

(10) Any information on other systems that can directly effect the emission system within a multiplexed system (including how information is sent between emission-related system modules and other modules on a multiplexed bus),

(11) Any information regarding any system, component, or part of a vehicle monitored by the OBD system that could in a failure mode cause the OBD system to illuminate the malfunction indicator light (MIL).

(12) Any other information relevant to the diagnosis and completion of an emissions-related repair. This information includes, but is not limited to, information needed to start the vehicle when the vehicle is equipped with an anti-theft or similar system that disables the engine described below in paragraph (13). This information also includes any OEM-specific emissions-related diagnostic trouble codes (DTCs) and any related service bulletins, trouble shooting guides, and/or repair procedures associated with these OEM-specific DTCs.

(13) Information regarding how to obtain the information needed to perform reinitialization of any computer or anti-theft system following an emissions-related repair. OEMs are not required to make this information available on the OEM's Web site unless they choose to do so. However, the OEM's Web site shall contain information on alternate means for obtaining the information and/or ability to perform reintialization. Beginning with the 2013 model year, we require that all OEM systems will be designed in such a way that no special tools or

[68] See 13 CCR 1968.2, approved November 9, 2007, Docket ID# EPA–HQ–OAR–2005–0047–0045.

processes will be necessary to perform reinitialization.

2. What are the Requirements for Web-based Delivery of the Required Information?

a. OEM Web Sites

Today's action finalizes a provision that requires OEMs to make available in full-text all of the information outlined above, on individual OEM Web sites. The only exceptions to the full-text requirements are training information, anti-theft information, and indirect information. Provisions for the availability of training information are discussed in Section III.B.4 of this document. Today's action requires that each OEM launch their individual Web sites with the required information by July 1, 2010 for all 2010 and later model year vehicles.

b. Timeliness and Maintenance of Information on OEM Web Sites

Today's action finalizes a provision that requires OEMs to make available the required information on their Web site within six months of model introduction. After this six month period, the required information for each model must be available and updated on the OEM Web site at the same time it is available by any means to their dealers.

EPA is also finalizing a provision that, beginning with the 2010 model year, OEMs maintain the required information in full text for at least 15 years after model introduction. After this fifteen-year period, OEMs can archive the required service information, but it must be made available upon request, in a format of the OEM's choice (e.g., CD–ROM).

c. Accessibility, Reporting and Performance Requirements for OEM Web Sites

Performance reports that adequately demonstrate that their individual Web sites meets the requirements outlined in § 86.010–38(j)(18) will be submitted to the Administrator annually or upon request by the Administrator. These reports shall also indicate the performance and effectiveness of the Web sites by using commonly used Internet statistics (e.g., successful requests, frequency of use, number of subscriptions purchased, etc.) EPA will issue additional direction in the form of official manufacturer guidance to further specify the process for submitting reports to the Administrator. In addition, EPA is finalizing a provision that requires OEMs to launch Web sites that meet the following performance criteria:

(1) OEM Web sites shall possess, sufficient server capacity to allow ready access by all users and have sufficient downloading capacity to assure that all users may obtain needed information without undue delay;

(2) Any reported broken Web links shall be corrected or deleted weekly.

(3) Web site navigation does not require a user to return to the OEM home page or a search engine in order to access a different portion of the site.

(4) Any manufacturer-specific acronym or abbreviation shall be defined in a glossary webpage which, at a minimum, is hyperlinked by each webpage that uses such acronyms and abbreviations. OEMs may request Administrator approval to use alternate methods to define such acronyms and abbreviations. The Administrator shall approve such methods if the motor vehicle manufacturer adequately demonstrates that the method provides equivalent or better ease-of-use to the website user.

(5) Indicates the minimum hardware and software specifications required for satisfactory access to the Web site(s).

d. Structure and Cost of OEM Web Sites

OEMs must implement Web sites that offer a range of time periods for on-line access and/or the amount of information purchased.

For any time ranges approved by the Administrator, OEMs must make their entire site accessible for the respective period of time and price. In other words, an OEM may not limit any or all ranges to just one make or one model.

Prior to the official launch of OEM Web sites, each OEM will also be required to present to the Administrator a specific outline of what will be charged for access to each of the tiers. OEMs must justify these charges, and submit to the Administrator information on the following parameters, which include but are not limited to, the following:

(1) The price the manufacturer currently charges their branded dealers for service information. At a minimum, this must include the direct price charged that is identified exclusively as being for service information, not including any payment that is incorporated in other fees paid by a dealer, such as franchise fees. In addition, we are requiring that the OEM must describe the information that is provided to dealers, including the nature of the information (e.g., the complete service manual), etc.; whether dealers have the option of purchasing less than all of the available information, or if purchase of all information is mandatory; the number of branded dealers who currently pay for this service information; and whether this information is made available to any persons at a reduced or no cost, and if so, identification of these persons and the reason they receive the information at a reduced cost.

(2) The price the manufacturer currently charges persons other than branded dealers for service information. The OEM must describe the information that is provided, including the nature of the information (e.g., the complete service manual, emissions control service manual), etc.; and the number of persons other than branded dealers to whom the information is supplied.

(3) The estimated number of persons to whom the manufacturer would be expected to provide the service information following implementation of today's requirements.

A complete list of the criteria for establishing reasonable cost can be found in the regulatory language for this final rule.[69] We are also finalizing a provision that, subsequent to the launch of the OEM Web sites, OEMs would be required to notify the Administrator upon the increase in price of any one or all of their approved time ranges of twenty percent or more accounting for inflation or that sets the charge for end-user access over the established price guidelines discussed above, including a justification based on the criteria for reasonable cost as established by this regulation.

e. Hyperlinking to and From OEM Web Sites

Today's action finalizes a provision that requires OEMs to allow direct simple hyperlinking to their Web sites from government Web sites and from all automotive-related Web sites, such as aftermarket service providers, educational institutions, and automotive associations.

f. Administrator Access to OEM Web Sites

Today's action finalizes a provision that requires that the Administrator shall have access to each OEM Web site at no charge to the Agency. The Administrator shall have access to the site, reports, records and other information as provided by sections 114 and 208 of the Clean Air Act and other provisions of law.

g. Other Media

We are finalizing a provision that require OEMs to make available for ordering the required information in some format approved by the

[69] See § 86.010–38(j)(8).

Administrator directly from their Web site after the full-text window of 15 years has expired. OEMs shall index their available information with a title that adequately describes the contents of the document to which it refers. In the alternate, OEMs may allow for the ordering of information directly from their Web site, or from a Web site hyperlinked to the OEM Web site. OEMs are required to list a phone number and address where aftermarket service providers can call or write to obtain the desired information. OEMs must also provide the price of each item listed, as well as the price of items ordered on a subscription basis. To the extent that any additional information is added or changed for these model years, OEMs shall update the index as appropriate. OEMs will be responsible for ensuring that their information distributors do so within three business day of receiving the order.

h. Small Volume Provisions for OEM Web Sites

Manufacturers with total annual sales of less than 5,000 engines shall have until July 1, 2011 to launch their individual Web sites as discussed in Section III.B.2. Manufacturers with total annual sales of less than 1,000 engines may, in lieu of meeting the requirement for web-based delivery of service information, request the Administrator to approve an alternative method by which the required emissions-related information can be obtained.

These small-volume flexibilities are limited to the distribution and availability of service information via the World Wide Web under § 86.010–38 (j)(4) of the regulations. All OEMs, regardless of volume, must comply with all other provisions as finalized in this rulemaking.

3. What are the Requirements for Service Information for Third Party Information Providers?

Today's action finalizes a provision that will require OEMs who currently have, or in the future engage in, licensing or business arrangements with third party information providers, as defined in the regulations, to provide information to those parties in an electronic format in English that utilizes non-proprietary software. Any OEM licensing or business arrangements with third party information providers are subject to fair and reasonable cost requirements. We expect that OEMs will develop pricing structures for access to this information that make it affordable to any third party information providers with which they do business. This provision takes effect January 1, 2011 and will apply for model year 2010 and later engines.

4. What are the Requirements for the Availability of Training Information?

Today's action finalizes two provisions for access to OEM training on OEM Web sites. First, OEMs will be required to make available for purchase on their Web sites the following items: Training manuals, training videos, and interactive, multimedia CD's or similar training tools available to franchised dealerships. Second, we are finalizing a provision requiring OEMs who transmit emissions-related training via satellite or the Internet to tape these transmissions and make them available for purchase on their Web sites within 30 days after the first transmission to franchised dealerships. Manufacturers shall not be required to duplicate transmitted emissions-related training courses if anyone engaged in the repairing or servicing of heavy-duty engines has the opportunity to receive the Internet or satellite transmission, even if there is a cost associated with the equipment required to receive the transmission. Further, all of the items included in this provision must be shipped within 3 business days of the order being placed and are to be made available at a reasonable price. These requirements apply for 2010 and later model year vehicles beginning July 1, 2010. For subsequent model years, the required information must be made available for purchase within three months of model introduction, and then be made available at the same time it is made available to franchised dealerships.

5. What are the Requirements for Recalibration of Vehicles?

Today's action finalizes two options for pass-thru recalibration. We are finalizing a provision that heavy-duty OEMs must comply with SAE J2534–1 (Revised December 2004) beginning with the 2013 model year. In the alternative, heavy-duty OEMs may comply with the Technology and Maintenance Council's Recommended Practice RP1210B, ''Windows™ Communication API,'' (Revised June 2007) beginning in the 2013 model year. We are also finalizing a provision that will require that recalibration information be made available within 3 months of vehicle introduction for new models.

6. What are the Requirements for the Availability of Enhanced Information for Scan Tools for Equipment and Tool Companies?

a. Description of Information That Must Be Provided

Today's action finalizes a provision that requires OEMs to make available to equipment and tool companies all generic and enhanced information, including bi-directional control and data stream information. In addition, OEMs must make available the following information.

(i) The physical hardware requirements for data communication (e.g., system voltage requirements, cable terminals/pins, connections such as RS232 or USB, wires, etc.).

(ii) ECU data communication (e.g., serial data protocols, transmission speed or baud rate, bit timing requirements, etc.).

(iii) Information on the application physical interface (API) or layers (i.e., processing algorithms or software design descriptions for procedures such as connection, initialization, and termination).

(iv) Vehicle application information or any other related service information such as special pins and voltages or additional vehicle connectors that require enablement and specifications for the enablement.

(v) Information that describes which interfaces, or combinations of interfaces, from each of the categories as described in § 86.010–38(j)(14)(ii)(A) through (D) of the regulatory language.

Manufacturers are not required to make available to equipment and tool companies any information related to reconfiguration capabilities or any other information that would make permanent changes to existing engine configurations.

The requirements to release the information to equipment and tool companies takes effect on July 1, 2013 [for model year 2013 engines], and within 3 months of model introduction for all new model years.

b. Distribution of Enhanced Diagnostic Information

Today's action finalizes a provision that will require the above information for generic and enhanced diagnostic information be provided to aftermarket tool and equipment companies with whom appropriate licensing, contractual, and confidentiality agreements have been arranged. This information shall be made available in electronic format using common document formats such as Microsoft Excel, Adobe Acrobat, Microsoft Word, etc. Further, any OEM licensing or business arrangements with equipment and tool companies are subject to a fair and reasonable cost determination.

7. What are the Requirements for the Availability of OEM-Specific Diagnostic Scan Tools and Other Special Tools?

a. Availability of OEM-Specific Diagnostic Scan Tools

Today's action finalizes a provision that OEMs must make available for sale to interested parties the same OEM-specific scan tools that are available to franchised dealerships, except as discussed below. These tools shall be made available at a fair and reasonable price. These tools shall also be made available in a timely fashion either through the OEM Web site or through an OEM-designated intermediary.

Upon Administrator approval, manufacturers will not be required to make available manufacturer-specific tools with reconfiguration capabilities if they can demonstrate to the satisfaction of the Administrator that these tools are not essential to the completion of an emissions-related repair, such as recalibration. In addition, as a condition of purchase, manufacturers may request that the purchaser take all necessary training offered by the engine manufacturer, provided that those training requirements are outlined in § 86.010–38(j)(15) of the regulations.

8. Which Reference Materials are Being Incorporated by Reference?

We are requiring that service information requirements comply with the provisions laid out in certain Society of Automotive Engineers (SAE) and/or Truck Maintenance Council (TMC) documents that are incorporated by reference (IBR) into federal regulation. Details regarding these SAE and TMC documents can be found in § 86.1(b) and in § 86.010–38(j).

IV. What Are the Emissions Reductions Associated With the OBD Requirements?

In the 2007HD highway rule, we estimated the emissions reductions we expected to occur as a result of the emissions standards being made final in the rule. Since the OBD requirements contained in today's rule are considered by EPA to be an important element of the 2007HD highway program and its ultimate success, rather than a new element being included as an addition to that program, we are not estimating emissions reductions associated with OBD. Instead, we consider the new 2007/2010 tailpipe emissions standards and fuel standards to be the drivers of emissions reductions and HDOBD to be part of the assurance we all have that those emissions reductions are indeed realized. Therefore, this analysis presents the emissions reductions estimated for the 2007HD highway program. Inherent in those estimates is an understanding that, while emissions control systems sometimes malfunction, they presumably are repaired in a timely manner. Today's OBD requirements would provide substantial tools to assure that our presumption will be realized by helping to ensure that emission control systems continue to operate properly throughout their life. We believe that the OBD requirements will lead to more repairs of malfunctioning or deteriorating emission control systems, and may also lead to emission control systems that are more robust throughout the life of the engine and less likely to trigger illumination of MILs. The requirements would therefore provide greater assurance that the emission reductions expected from the Clean Diesel Trucks and Buses program will actually occur. Viewed from another perspective, while the OBD requirements will not increase the emission reductions that we estimated for the 2007HD highway rule, they would be expected to lead to actual emission reductions in-use compared with a program with no OBD system.

The costs associated with HDOBD were not fully estimated in the 2007HD highway rule. Those costs are more fully considered in section V of this preamble. These newly developed HDOBD costs are added to those costs estimated for the 2007/2010 standards and a new set of costs for those standards are presented in section VI. Section VI also calculates a new set of costs per ton associated with the 2007/2010 standards which include the previously estimated costs and emissions reductions for the 2007/2010 standards and the newly estimated costs associated with today's HDOBD rule.

Here we present the emission benefits we anticipate from heavy-duty vehicles as a result of our 2007/2010 NO_X, PM, and NMHC emission standards for heavy-duty engines. The graphs and tables that follow illustrate the Agency's projection of future emissions from heavy-duty vehicles for each pollutant. The baseline case represents future emissions from heavy-duty vehicles at present standards (including the MY2004 standards). The controlled case represents the future emissions from heavy-duty vehicles once the new 2007/2010 standards are implemented. A detailed analysis of the emissions reductions associated with the 2007/2010 HD highway standards is contained in the Regulatory Impact Analysis for that final rule.[70] The results of that analysis are presented in Table IV.A–1 and in Figures IV.A–1 through IV.A–3.

TABLE IV.A–1—ANNUAL EMISSIONS REDUCTIONS ASSOCIATED WITH THE 2007HD HIGHWAY PROGRAM

[Thousand short tons]

Year	NO_X	PM	NMHC
2007	58	11	2
2010	419	36	21
2015	1,260	61	54
2020	1,820	82	83
2030	2,570	109	115

[70] Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; EPA420–R–00–026; December 2000.

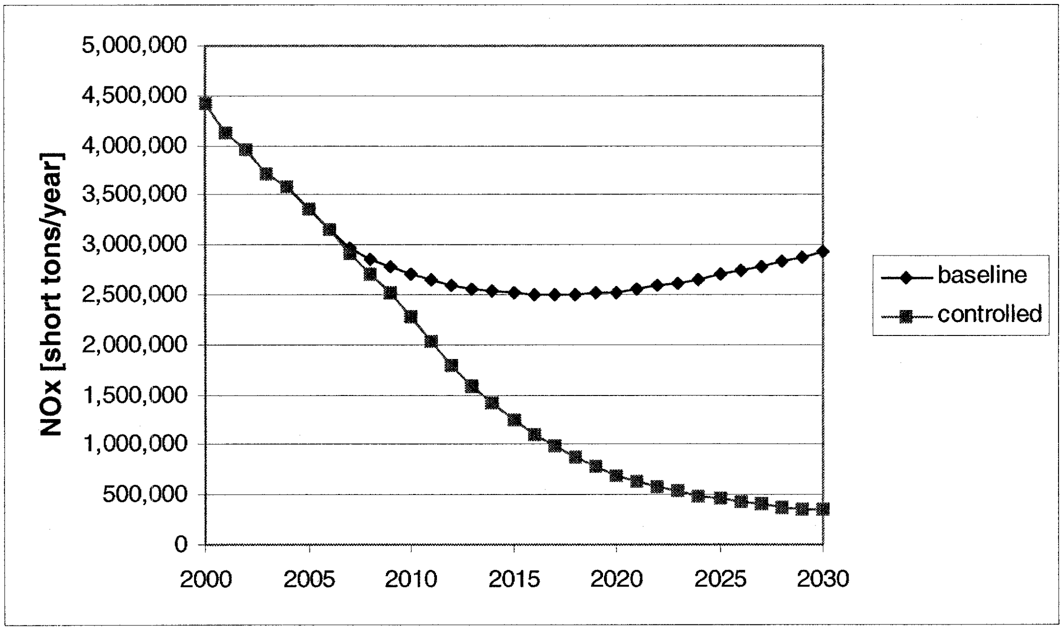


Figure IV.A-1: Projected Nationwide Heavy-Duty Vehicle NOx Emissions; Control Case Represents the 2007/2010 Emissions Standards

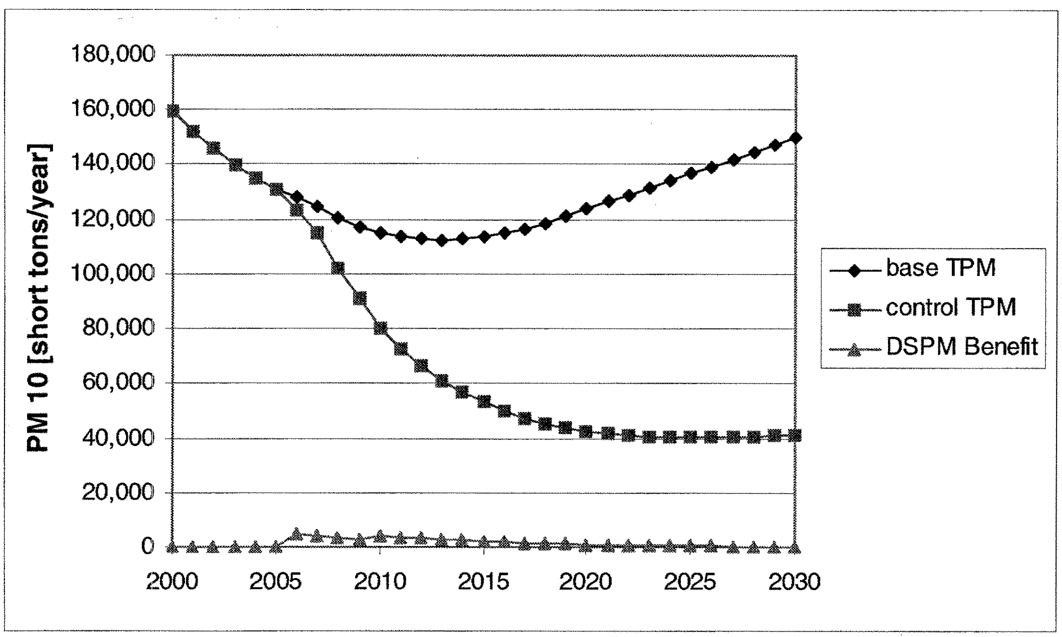


Figure IV.A-2: Projected Nationwide Heavy-Duty Vehicle PM Emissions and Direct Sulfate PM Emission Reductions; Control Case Represents the 2007/2010 Emissions Standards

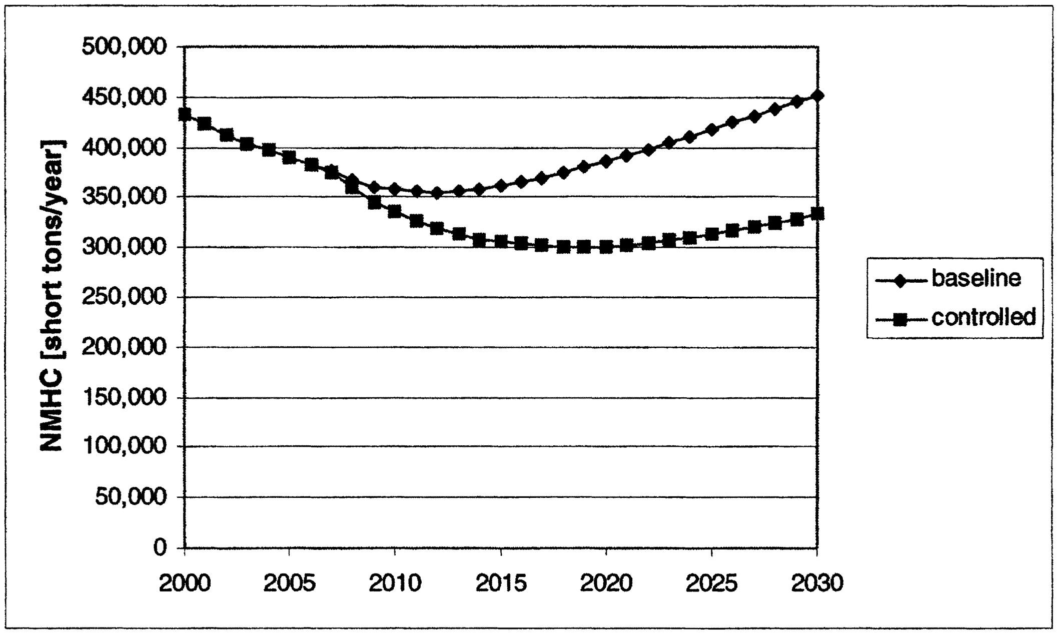


Figure IV.A-3: Projected Nationwide Heavy-Duty Vehicle NMHC Emissions; Control Case Represents the 2007/2010 Emissions Standards

There were additional estimated emissions reductions associated with the 2007HD highway rule—namely CO, SO_x, and air toxics. We have not presented those additional emissions reductions here since, while HDOBD will identify malfunctions and hasten their repair with the result of reducing all emissions constituents, these additional emissions are not those specifically targeted by OBD systems.

V. What Are the Costs Associated With the OBD Requirements?

The costs estimated for the final OBD requirements are identical to those estimated for the proposed OBD requirements with three notable exceptions. First, we have included costs for aging limit parts to their OBD thresholds. We inadvertently did not include those costs in the draft analysis. Discussion of this can be found in the Summary and Analysis of Comments document in Section VI.B. These newly added costs are also presented in detail in Section 3.1.2.b of the final technical support document.[71] Both of these documents can be found in the docket for this rule. Second, while in the proposal we estimated lower warranty costs beginning in 2013, we have delayed that until 2016 in the final rule. This is discussed in Section VI.A of the Summary and Analysis of Comments document and in Section 3.1.1 of the final technical support document. Third, we have adjusted all costs to 2007 dollars—the draft analysis used 2004 dollars—by using the Consumer Price Index. As a result, all costs presented here are slightly higher than in the draft analysis although we have not changed the analysis with the exception of this adjustment for inflation and, as mentioned previously, the addition of costs for aging of limit parts and delay of lower warranty costs.

Here we present the updated tables that appeared in our preamble to the proposed regulations.[72] Please refer to the final technical support document contained in the docket for the details of the analysis behind these cost estimates.

A. Variable Costs for Engines Used in Vehicles Over 14,000 Pounds

The variable costs we have estimated represent those costs associated with various sensors that we believe will be added to the engine to provide the required OBD monitoring capability. For the 2010 model year, we believe that upgraded computers and the new sensors needed for OBD would result in costs to the buyer of $43 and $53 for diesel and gasoline engines, respectively. For the 2013 model year, we have included costs associated with the dedicated MIL and its wiring resulting in a hardware cost to the buyer of $60 and $70 for both diesel and gasoline engines, respectively. In 2016, these costs become $57 and $66 for diesel and gasoline, respectively, due to a reduction in warranty costs. By multiplying these costs per engine by the projected annual sales we get annual costs of around $45–55 million for diesel engines and $3–4 million for gasoline engines, depending on sales. The 30-year net present value of the annual variable costs would be $737 million and $391 million at a three percent and a seven percent discount rate, respectively. These costs are summarized in Table V.A–1.

[71] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

[72] See 72 FR 3273, Section VI.

TABLE V.A–1—OBD VARIABLE COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions except per engine costs; 2007 dollars]

	Diesel	Gasoline	Total
Cost per engine (2010–2012)	$43	$53	n/a
Cost per engine (2013–2015)	60	70	n/a
Cost per engine (2016+)	57	66	n/a
Annual Variable Costs in 2010 [a]	15	1	$16
Annual Variable Costs in 2013 [a]	44	3	47
Annual Variable Costs in 2016 [a]	43	3	47
Annual Variable Costs in 2030 [a]	53	4	57
30 year NPV at a 3% discount rate	686	51	737
30 year NPV at a 7% discount rate	364	27	391

[a] Annual variable costs increase as projected sales increase.

B. Fixed Costs for Engines Used in Vehicles Over 14,000 Pounds

We have estimated fixed costs for research and development (R&D), certification, and production evaluation testing. The R&D costs include the costs to develop the computer algorithms required to diagnose engine and emission control systems, and the costs for applying the developed algorithms to each engine family and to each variant within each engine family. R&D costs also include the testing time and effort needed to develop and apply the OBD algorithms. The certification costs include the costs associated with testing of durability engines (i.e., the OBD parent engines), the costs associated with generating the ''limit'' parts that are required to demonstrate OBD detection at or near the applicable emissions thresholds, and the costs associated with generating the necessary certification documentation. Production evaluation testing costs included the costs associated with the three types of production testing: Standardization features, monitor function, and performance ratios.

Table V.B–1 summarizes the R&D, certification, and production evaluation testing costs that we have estimated. The R&D costs we have estimated were totaled and then spread over the four year period prior to implementation of the requirements for which the R&D is conducted. By 2013, all of the R&D work would be completed in advance of 100 percent compliance in 2013; hence, R&D costs are zero by 2013. Certification costs are higher in 2013 than in 2010 because 2010 requires one engine family to comply while 2013 requires all engine families to comply. The 30 year net present value of the annual fixed costs would be $475 million and $352 million at a three percent and a seven percent discount rate, respectively.

TABLE VI.B–1—OBD FIXED COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions; 2007 dollars]

	Diesel			Gasoline			Total
	R&D	Certification & PE testing	Subtotal	R&D	Certification & PE testing	Subtotal	
Annual OBD Fixed Costs in given years							
2010	$56	$0.2	$56	$1.0	<$0.1	$1.0	$57
2013	0	0.4	0.4	0	<0.1	<0.1	0.4
2030	0	35	35	0	<0.1	<0.1	35
30 year NPV at the given discount rate							
3%	287	176	463	11.1	0.4	11.4	475
7%	243	99.6	342	9.7	0.2	9.9	352

C. Total Costs for Engines Used in Vehicles Over 14,000 Pounds

The total OBD costs for engines used in vehicles over 14,000 pounds are summarized in Table V.C–1. As shown in the table, the 30 year net present value cost is estimated at $1.2 billion and $743 million at a three percent and a seven percent discount rate, respectively. These costs are much lower than the 30 year net present value costs estimated for gasoline and diesel engines meeting the 2007HD highway emissions standards which were $30 billion and $18 billion at a three percent and a seven percent discount rate, respectively (in 2007 dollars). Including the cost for the diesel fuel changes resulted in 30 year net present value costs for that rule of $88 billion and $53 billion at a three percent and a seven percent discount rate, respectively (in 2007 dollars). See section VI for more details regarding the cost estimates from the 2007HD highway final rule.

TABLE V.C–1—OBD TOTAL COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions; 2007 dollars]

	Diesel	Gasoline	Total
Annual OBD Total Costs in given years			
2010	$71	$2	$67
2013	44	3	47
2030	89	4	93
30 year NPV at the given discount rate			
3%	1,150	63	1,212
7%	706	37	743

D. Costs for Diesel Heavy-Duty Vehicles and Engines Used in Heavy-Duty Vehicles Under 14,000 Pounds

The total OBD costs for 8,500 to 14,000 pound diesel applications are summarized in Table V.D–1. As shown in the table, the 30 year net present value cost is estimated at $16 million and $12 million at a three percent and a seven percent discount rate, respectively. These costs represent the incremental costs of the additional OBD requirements, as compared to our current OBD requirements, for 8,500 to 14,000 pound diesel applications and do not represent the total costs for 8,500 to 14,000 pound diesel OBD. We are making no changes to the 8,500 to 14,000 pound gasoline requirements so, therefore, have estimated no costs for gasoline vehicles. Details behind these estimated costs can be found in the final technical support document contained in the docket for this rule.[73]

TABLE V.D–1—TOTAL OBD COSTS FOR 8,500 TO 14,000 POUND DIESEL APPLICATIONS

[All costs in $millions; 2007 dollars]

	Diesel	Gasoline	Total
Annual OBD Total Costs in given years			
2010	$0.1	$0	$0.1
2013	0	0	0
2030	2	0	2
30 year NPV at the given discount rate			
3%	16	0	16
7%	12	0	12

VI. What are the Updated Annual Costs and Costs per Ton Associated With the 2007/2010 Heavy-Duty Highway Program?

In the 2007HD highway rule, we estimated the costs we expected to occur as a result of the emissions standards being made final in that rule. As noted in section IV, we consider the OBD requirements contained in today's rule to be an important element of the 2007HD highway program and its ultimate success and not a new element being included as an addition to that program. In fact, without the OBD requirements we would not expect the emissions reductions associated with the 2007/2010 standards to be fully realized because emissions control systems cannot be expected to operate without some need for repair which, absent OBD, may well never be done. However, as noted in section V, because we did not include an OBD program in the 2007HD highway program, we did not estimate OBD related costs at that time. We have now done so and those costs are presented in section V.

Here we present the OBD costs as part of the greater 2007HD highway program. To do this, we present both the costs developed for that program and the additional OBD costs presented in section V. We also calculate a new set of costs per ton associated with the 2007/2010 standards which include the previously estimated costs and emissions reductions for the 2007/2010 standards and the newly estimated costs associated with today's HDOBD rule.

Note that the costs estimates associated with the 2007HD highway program were done using 1999 dollars. We have adjusted those costs to 2007 dollars using the Consumer Price Index.[74]

A. Updated 2007 Heavy-Duty Highway Rule Costs Including OBD

Table VI.A–1 shows the 2007HD highway program costs along with the estimated OBD related costs.

[73] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

[74] *http://www.bls.gov/cpi*; U.S. city average, all items, not seasonally adjusted.

TABLE VI.A–1—UPDATED 2007HD HIGHWAY PROGRAM COSTS INCLUDING NEW OBD-RELATED COSTS NET PRESENT VALUE OF ANNUAL COSTS FOR THE YEARS 2006–2035

[All costs in $millions; 2007 dollars]

Discount rate	2007 HD highway final rule				Final HD OBD	Updated total program costs
	Diesel engine costs	Gasoline engine & vehicle costs	Diesel fuel costs	Original total costs		
3%	$29,500	$1,880	$56,240	$87,600	$1,230	$88,900
7%	17,900	1,090	33,560	52,500	755	53,300

B. Updated 2007 Heavy-Duty Highway Rule Costs per Ton Including OBD

Table VI.B–1 shows the 2007HD highway program costs per ton of pollutant reduced. These numbers are from the 2007HD highway final rule—updated to 2007 dollars—which contains the details regarding the split between NO_X+NMHC and PM related costs.

TABLE VI.B–1—ORIGINAL 2007HD HIGHWAY PROGRAM COSTS, EMISSIONS REDUCTIONS, AND $/TON REDUCED NET PRESENT VALUES ARE FOR ANNUAL COSTS FOR THE YEARS 2006–2035

[Monetary values in 2007 dollars]

Discount rate	Pollutant	30 year NPV cost ($billions)	30 year NPV reduction (million tons)	$/ton
3%	NO_X+NMHC	68.0	30.6	$2,220
	PM	19.9	1.4	14,750
7%	NO_X+NMHC	43.4	16.2	2,680
	PM	12.8	0.8	17,090

Table VI.B–2 shows the updated 2007HD highway program costs per ton of pollutant reduced once the new OBD costs have been included. For the split between NO_X+NMHC and PM related OBD costs, we have used a 50/50 allocation. As shown in Table VI.B–2, the OBD costs associated with the final OBD requirements have little impact on the overall costs and costs per ton of emissions reduced within the context of the 2007HD highway program.

TABLE VI.B–2—UPDATED 2007HD HIGHWAY PROGRAM COSTS, EMISSIONS REDUCTIONS, AND $/TON REDUCED INCLUDING OBD RELATED COSTS NET PRESENT VALUES ARE FOR ANNUAL COSTS FOR THE YEARS 2006–2035

[Monetary values in 2007 dollars]

Discount rate	Pollutant	30 year NPV cost ($billions)	30 year NPV reduction (million tons)	$/ton
3%	NO_X+NMHC	68.6	30.6	$2,240
	PM	20.5	1.4	15,210
7%	NO_X+NMHC	43.8	16.2	2,700
	PM	13.2	0.8	17,600

VII. How Have the Proposed Requirements for Engine Manufacturers Changed for This Final Rule?

A. Documentation Requirements

The OBD system certification requirements require manufacturers to submit OBD system documentation that represents each engine family. The certification documentation must contain all of the information needed to determine if the OBD system meets the OBD requirements. The regulation lists the information that is required as part of the certification package. If any of the information in the certification package is the same for all of a manufacturer's engine families (e.g., the OBD system general description), the manufacturer is required to submit one set of documents each model year for such items that cover all of its engine families.

While the majority of the OBD requirements apply to the engine and are incorporated by design into the engine control module by the engine manufacturer, a portion of the OBD requirements would apply to the vehicle and not be self-contained within the engine. Examples include the requirements to have a MIL in the instrument cluster and a diagnostic connector in the cab compartment. As is currently done by the engine manufacturers, a build specification is provided to vehicle manufacturers detailing mechanical and electrical specifications that must be adhered to for proper installation and use of the engine (and to maintain compliance with emissions standards). We expect engine manufacturers will continue to follow this practice so that the vehicle manufacturer would be able to maintain compliance with the OBD regulations. Installation specifications would be expected to include instructions regarding the location, color, and display icon of the MIL (as well as electrical connections to ensure proper illumination), location and type of diagnostic connector, and electronic VIN access. During the certification process, in addition to submitting the details of all of the diagnostic strategies and other information required, engine manufacturers are required to submit a copy of the OBD-relevant installation specifications provided to vehicle manufacturers and a description of the method used by the engine manufacturer to ensure vehicle manufacturers adhere to the provided installation specifications (e.g., required audit procedures or signed agreements to adhere to the requirements). We are requiring that this information be submitted to us to provide a reasonable level of verification that the OBD requirements will indeed be satisfied. In summary, engine manufacturers are responsible for submitting a certification package that includes:

• A detailed description of all OBD monitors, including monitors on signals or messages coming from other modules upon which the engine control unit relies to perform other OBD monitors; and,

• A copy of the OBD-relevant installation specifications provided to vehicle manufacturers/chassis builders and the method used to reasonably ensure compliance with those specifications.

As was discussed in the context of our implementation schedule (see section II.G.1), the regulations would allow engine manufacturers to establish OBD groups consisting of more than one engine family with each having similar OBD systems. The manufacturer could then submit only one set of representative OBD information from each OBD group. We anticipate that the representative information would normally consist of an application from a single representative engine rating within each OBD group. In selecting the engine ratings to represent each OBD group, consideration should be given to the exhaust emission control components for all engine families and ratings within an OBD group. For example, if one engine family within an OBD group has additional emission control devices relative to another family in the group (e.g., the first family has a DPF+SCR while the second has only a DPF), the representative rating should probably come from the first engine family. Manufacturers seeking to consolidate several engine families into one OBD group would be required to get approval of the grouping prior to submitting the information for certification.

Two of the most important parts of the certification package would be the OBD system description and summary table. The OBD system description would include a complete written description for each monitoring strategy outlining every step in the decision-making process of the monitor, including a general explanation of the monitoring conditions and malfunction criteria. This description should include graphs, diagrams, and/or other data that would help our compliance staff understand how each monitor works and interacts. The OBD summary table would include specific parameter values. This table would provide a summary of the OBD system specifications, including: the component/system, the DTC identifying each related malfunction, the monitoring strategy, the parameter used to detect a malfunction and the malfunction criteria limits against which the parameter is evaluated, any secondary parameter values and the operating conditions needed to run the monitor, the time required to execute and complete a monitoring event for both a pass decision and a fail decision, and the criteria or procedure for illuminating the MIL. In these tables, manufacturers are required to use a common set of engineering units to simplify and expedite the review process.

We are also requiring that the manufacturer submit a logic flowchart for each monitor that would illustrate the step-by-step decision process for determining malfunctions. Additionally, we would need any data that supports the criteria used to determine malfunctions that cause emissions to exceed the specified malfunction thresholds (see Tables II.B–1 and II.C–1). The manufacturer would have to include data that demonstrates the probability of misfire detection by the misfire monitor over the full engine speed and load operating range (for gasoline engines only) or the capability of the misfire monitor to correctly identify a ‘‘one cylinder out’’ misfire for each cylinder (for diesel engines only), a description of all the parameters and conditions necessary to begin closed-loop fuel control operation (for gasoline engines only), closed-loop EGR control (for diesel engines only), closed-loop fuel pressure control (for diesel engines only), and closed-loop boost control (for diesel engines only). We also need a listing of all electronic powertrain input and output signals (including those not monitored by the OBD system) that identifies which signals are monitored by the OBD system, and the emission data from the OBD demonstration testing (as described below). Lastly, the manufacturer will be expected to provide any other OBD-related information necessary to determine the OBD compliance status of the manufacturer’s product line.

The only change to the final documentation requirements relative to the proposed requirements is a new provision applicable to those OBD systems designed to the CARB HDOBD requirements. Any such system must have detailed documentation describing how the system meets the full intent behind the requirements of § 86.010–18.[75] It will not be sufficient for a manufacturer to submit OBD documentation and a statement that it is a California HDOBD system or even a California approved OBD system. The certification documentation must include details about how the system compares to the requirements of § 86.010–18 to ensure that we can be comfortable approving that system for certification.

B. Catalyst Aging Procedures

For purposes of determining the catalyst malfunction criteria for diesel NMHC converting catalysts, SCR catalysts, and lean NO_X catalysts, and for gasoline catalysts (i.e., for generating OBD threshold parts, or limit parts), where those catalysts are monitored individually, the manufacturer must use a catalyst deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning engine operating conditions. For purposes of determining the catalyst malfunction criteria for diesel NMHC converting catalysts, SCR catalysts, and lean NO_X catalysts, and for gasoline catalysts, where those catalysts are monitored in combination with other catalysts, the manufacturer must submit their catalyst system aging and monitoring plan to the Administrator as part of their certification documentation package. The plan must include the description, emission control purpose, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the applicable malfunction criteria including the deterioration/aging process.

C. Demonstration Testing

While the certification documentation requirements discussed above require manufacturers to submit technical details of each monitor (e.g., how each

[75] See section 86.010–18(m)(3) which is new in the final regulations. Also see § 86.010–18(a)(5) which is new in the final regulations. Also see section II.A.5, above.

monitor worked, when the monitor would run), we still need some assurance that the manufacturer's OBD monitors are indeed calibrated correctly and are able to detect a malfunction before an emissions threshold is exceeded. Thus, we are requiring that manufacturers conduct certification demonstration testing of the major monitors to verify the malfunction threshold values. This testing will be required on one to three demonstration engines per year. Before receiving a certificate of compliance, the manufacturer must submit documentation and emissions data demonstrating that the major OBD monitors are able to detect a malfunction when emissions exceed the emissions thresholds. On each demonstration engine, this testing would consist of the following two elements:

- Testing the OBD system with ''threshold'' components (i.e., components that are deteriorated or malfunctioning right at the threshold required for MIL illumination); and,
- Testing the OBD system with ''worst case'' components. This element of the demonstration test must be done for the DPF and any NO_X aftertreatment system only.

By testing with both threshold components (i.e., the best performing malfunctioning components) and with worst case components (i.e., the worst performing malfunctioning components), we will be better able to verify that the OBD system should perform as expected regardless of the level of deterioration of the component. This could become increasingly important with new technology aftertreatment devices that could be subject to complete failure (such as DPFs) or even to tampering by vehicle operators looking to improve fuel economy or vehicle performance. We believe that, given the likely combinations of emissions control hardware, a diesel engine manufacturer would likely need to conduct 8 to 10 emissions tests per demonstration engine to satisfy these requirements and a gasoline engine manufacturer would likely need to conduct five to seven emissions tests per demonstration engine.[76]

1. Selection of Test Engines

To minimize the test burden on manufacturers, we are requiring that this testing be done on only one to three demonstration engines per year per manufacturer rather than requiring that all engines be tested. Such an approach should still allow us to be reasonably sure that manufacturers have calibrated their OBD systems correctly on all of their engines. This also spreads the test burden over several years and allows manufacturers to better utilize their test cell resources. This approach is consistent with our approach to demonstration testing to existing emissions standards where a parent engine is chosen to represent each engine family and emissions test data for only that parent engine are submitted to EPA.[77]

The number of demonstration engines manufacturers must test will be aligned with the phase-in of OBD in the 2010 and 2013 model years and based on the year and the total number of engine families the manufacturer will be certifying for that model year. Specifically, for the 2010 model year when a manufacturer is only required to implement OBD on a single engine family, demonstration testing will be required on only one engine (a single engine rating within the one engine family). This will be the OBD parent rating as discussed in section II.G. For the 2013 model year, manufacturers will be required to conduct demonstration testing on one to three engines per year (i.e., one to three OBD parent ratings). The number of parent ratings would be chosen depending on the total number of engine families certified by the manufacturer. A manufacturer certifying one to five engine families in the given year would be required to test one demonstration engine. A manufacturer certifying six to ten engine families in the given year would be required to test two demonstration engines, and a manufacturer certifying more than ten engine families in the given year will be required to test three demonstration engines. For the 2016 and subsequent model years, we intend to work closely with CARB staff and the manufacturer to determine the parent ratings so that the same ratings are not acting as the parents every year. In other words, our definitions for the OBD parent ratings as discussed here apply only during the years 2010 through 2012 and again for the years 2013 through 2015.

Given the difficulty and expense in removing an in-use engine from a vehicle for engine dynamometer testing, this demonstration testing will likely represent nearly all of the OBD emission testing that would ever be done on these engines. Requiring a manufacturer who is fully equipped to do such testing, and already has the engines on engine dynamometers for emission testing, to test one to three engines per year would be a minimal testing burden that provides invaluable and, in a practical sense, otherwise unobtainable proof of compliance with the OBD emissions thresholds.

Regarding the selection of which engine ratings will have to be demonstrated, manufacturers are required to submit descriptions of all engine families and ratings planned for the upcoming model year. We will review the information and make the selection(s) in consultation with CARB staff and the manufacturer. For each engine family and rating, the information submitted by the manufacturer will need to identify engine model(s), power ratings, applicable emissions standards or family emissions limits, emissions controls on the engine, and projected engine sales volume. Factors that would be used in selecting the one to three engine ratings for demonstration testing include, but are not limited to, new versus old/carryover engines, emissions control system design, possible transition point to more stringent emissions standards and/or OBD emissions thresholds, and projected sales volume.

2. Required Testing

Regarding the actual testing, the manufacturer will be required to perform ''single fault'' testing using the applicable test procedure and with the appropriate components/systems set at the manufacturer defined malfunction criteria limits for the following monitors:

- For diesel engines: Fuel system; misfire; EGR; turbo boost control; NMHC catalyst; SCR catalyst/NO_X catalyst/adsorber; DPF; exhaust gas sensors; VVT; and any other monitor that would fall within the discussion of section II.D.5.
- For gasoline engines: Fuel system; misfire; EGR; cold start strategy; secondary air; catalyst; exhaust gas sensors; VVT; and any other monitor that would fall within the discussion of section II.D.5.

Such ''single fault'' testing requires that, when performing a test for a

[76] For diesel engines these would include: The fuel system; misfire (HCCI engines); EGR, turbo boost control, DPF, NO_X adsorber or SCR system, NMHC catalyst, exhaust gas sensors, VVT, and possible other emissions controls (see section II.D.5). For gasoline engines these would include: The fuel system, misfire, EGR, cold start strategy, secondary air system, catalyst, exhaust gas sensors, VVT, and possible other emissions controls (see section II.D.5). Some of these may require more than one emissions test while others may not require any due to the use of a functional monitor rather than an emissions threshold monitor.

[77] For over 14,000 pound OBD, we have a different definition of a ''parent'' engine than is used for emissions certification. This is discussed at length in section II.G.

specific parameter, that parameter must be operating at the malfunction criteria limit while all other parameters would be operating within normal characteristics (unless the malfunction prohibits some other parameter from operating within its normal characteristics). Also, the manufacturer will be allowed to use computer modifications to cause the specific parameter to operate at the malfunction limit provided the manufacturer can demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction. Lastly, for each of these testing requirements, wherever the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested component/system can result in an engine's emissions exceeding the applicable emissions thresholds, the manufacturer will not be required to perform a demonstration test. In such cases, the manufacturer can simply provide the data and/or engineering analysis used to determine that only a functional test of the component/system is required.

Manufacturers that are required to submit data from more than one engine rating will be granted some flexibility by allowing the data to be collected under less rigorous testing requirements than the official FTP or SET certification test. That is, for the possible second and third engine ratings required for demonstration testing, manufacturers will be allowed to submit data using internal sign-off test procedures that are representative of the official FTP or SET in lieu of running the official test. Commonly used procedures include the use of engine emissions test cells with less rigorous quality control procedures than those required for the FTP or SET or the use of forced cool-downs to minimize time between tests. Manufacturers will still be liable for meeting the OBD emissions thresholds on FTPs and/or SETs conducted in full accordance with the Code of Federal Regulations. Nonetheless, this latitude will allow them to use some short-cut methods that they have developed to assure themselves that the system is calibrated to the correct level without incurring the additional testing cost and burden of running the official FTP or SET on every demonstration engine.

For the demonstration engine(s), a manufacturer will be required to use an engine(s) aged for a minimum of 125 hours plus exhaust aftertreatment devices aged in a manner representative of full useful life. We are allowing for rapid aging using a process approved by the Administrator. Manufacturers would be expected to use, subject to approval, an aging process that ensures that deterioration of the exhaust aftertreatment devices is stabilized sufficiently such that it properly represents the performance of the devices at the applicable point in their useful life. Note that, should the 2010 model year engine be carried over for 2013 model year certification (which we fully expect most manufacturers to do), we would not require any new demonstration aging or testing.

3. Testing Protocol

We have made no changes in the final rule relative to the proposal as regards testing protocol. We are allowing the manufacturer to use any applicable test cycle for preconditioning test engines prior to conducting each of the emissions tests discussed above. Additional preconditioning can be done if the manufacturer can provide data and/or engineering analyses that demonstrate that additional preconditioning is necessary.

The manufacturer will then set the system or component of interest at the criteria limit(s) prior to conducting the applicable preconditioning cycle(s). If more than one preconditioning cycle is being used, the manufacturer may adjust the system or component of interest prior to conducting the subsequent preconditioning cycle. However, the manufacturer may not replace, modify, or adjust the system or component of interest following the last preconditioning cycle.

After preconditioning, the test engine will be operated over the applicable test cycle to allow for the initial detection of the tested system or component malfunction. This test cycle may be omitted from the testing protocol if it is unnecessary. If required by the designated monitoring strategy, a cold soak may be performed prior to conducting this test cycle. The test engine will then be operated over the applicable exhaust emission test.

A manufacturer required to test more than one test engine may use internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain this emissions test data for all but one of the required test engines. However, the manufacturer should use sound engineering judgment to ensure that the data generated using such alternative test/sign-off procedures are good data because manufacturers would still be responsible for meeting the malfunction criteria when emissions tests are performed in accordance with official test procedures.

Manufacturers will be allowed to use alternative testing protocols, even chassis testing, for demonstration of MIL illumination if the engine dynamometer emissions test cycle does not allow all of a monitor's enable conditions to be satisfied. A manufacturer wanting to do so will be required to demonstrate the technical necessity for using their alternative test cycle and that using it demonstrates that the MIL will illuminate during in-use operation with the malfunctioning component.

4. Evaluation Protocol

We have made no changes in the final rule relative to the proposal as regards evaluation protocol. For all demonstration tests on parent engines, we will expect the MIL to activate upon detecting the malfunctioning system or component, and that it will occur before the end of the first engine start portion of the emissions test. If the MIL activates prior to emissions exceeding the applicable malfunction criteria, no further demonstration will be required. With respect to the misfire monitor demonstration test, if the manufacturer has elected to use the minimum misfire malfunction criterion of one percent (as is allowed), then no further demonstration would be required provided the MIL illuminates during a test with an implanted misfire of one percent.

If the MIL does not activate when the system or component being tested is set at its malfunction criteria limits, then the criteria limits or the OBD system would not be considered acceptable. Retesting would be required with more tightly controlled criteria limits (i.e., recalibrated limits) and/or another suitable system or component that would result in MIL activation. If the criteria limits are recalibrated, the manufacturer would be required to confirm that the systems and components that were tested prior to recalibration would still function properly and as required.

5. Confirmatory Testing

We have made no changes in the final rule relative to the proposal as regards confirmatory testing. We may choose to confirmatory test a demonstration engine to verify the emissions test data submitted by the manufacturer. Any such confirmatory testing would be limited to the engine rating represented by the demonstration engine(s) (i.e., the parent engine(s)). To do so, we, or our designee, would install appropriately deteriorated or malfunctioning components (or simulate a deteriorated or malfunctioning component) in an otherwise properly functioning engine of the same engine family and rating as the demonstration engine. Such confirmatory testing would be done on those OBD monitors for which demonstration testing had been conducted as described in this section. The manufacturer would be required to make available, upon Administrator request, a test engine and all test equipment—e.g., malfunction simulators, deteriorated components—necessary to duplicate the manufacturer's testing. As with our emission certification program, any failure to pass confirmatory testing means that no certificate would be issued until the cause of the noncompliance is fixed.

D. Deficiencies

Our under 14,000 pound OBD requirements have contained a deficiency provision for years. The OBD deficiency provision was first introduced on March 23, 1995 (60 FR 15242), and was revised on December 22, 1998 (63 FR 70681). Consistent with that provision, we proposed and are finalizing a deficiency provision for over 14,000 pound OBD. We believe that, like has occurred and even still occurs with under 14,000 pound OBD, some manufacturers will encounter unforeseen and generally last minute problems with some of their OBD monitoring strategies despite having made a good faith effort to comply with the requirements. Therefore, we are providing a provision that would permit certification of an over 14,000 pound OBD system with ''deficiencies'' in cases where a good faith effort to fully comply has been demonstrated. In making deficiency determinations, we will consider the extent to which the OBD requirements have been satisfied overall based on our review of the certification application, the relative performance of the given OBD system compared to systems that truly are fully compliant with the OBD requirements, and a demonstrated good-faith effort on the part of the manufacturer to both meet the requirements in full and come into full compliance as expeditiously as possible.

We believe that having the deficiency provision is important because it facilitates OBD implementation by allowing for certification of an engine despite having a relatively minor shortfall. Note that we do not expect to certify engines with OBD systems that have more than one deficiency, or to allow carryover of any deficiency to the following model year unless it can be demonstrated that correction of the deficiency requires hardware and/or software modifications that cannot be accomplished in the time available, as determined by the Administrator.[78] Nonetheless, we recognize that there may be situations where more than one deficiency is necessary and appropriate, or where carry-over of a deficiency or deficiencies for more than one year is necessary and appropriate. In such situations, more than one deficiency, or carry-over for more than one year, may be approved, provided the manufacturer has demonstrated an acceptable level of effort toward full OBD compliance. Most importantly, the deficiency provisions cannot be used as a means to avoid compliance or delay implementation of any OBD monitors or as a means to compromise the overall effectiveness of the OBD program.

There has often been some confusion by manufacturers regarding what CARB has termed ''retroactive'' deficiencies. The CARB rule states that, ''During the first 6 months after commencement of normal production, manufacturers may request that the Executive Officer grant a deficiency and amend an engine's certification to conform to the granting of the deficiencies for each aspect of the monitoring system: (a) Identified by the manufacturer (during testing required by section (l)(2) or any other testing) to be functioning different than the certified system or otherwise not meeting the requirements of any aspect of section 1971.1; and (b) reported to the Executive Officer.'' [79] We have never had and did not propose any such retroactive deficiency provision. We have regulations in place that govern situations, whether they be detected by EPA or by the manufacturer, where in-use vehicles or engines are determined to be functioning differently than the certified system.[80] We refer to these regulations as our defect reporting requirements and manufacturers are required to comply with these regulations, even for situations deemed by CARB to be ''retroactive'' deficiencies, unless the defect is corrected prior to the sale of engines to an ultimate purchaser. In other words, a retroactive deficiency granted by the Executive Officer does not preclude a manufacturer from complying with our defect reporting requirements.

[78] The CARB HDOBD rulemaking has a provision to charge fees associated with OBD deficiencies 13 CCR 1971.1(k)(3), Docket ID# EPA–HQ–OAR–2005–0047–0006. We have never had and will continue not to have any such fee provision.

[79] See 13 CCR 1971.1(k)(6), Docket ID# EPA–HQ–OAR–2005–0047–0006.

[80] See 40 CFR 85.1903.

E. Production Evaluation Testing

We have made no changes in the final rule relative to the proposal as regards production evaluation testing. The OBD system is a complex software and hardware system, so there are many opportunities for unintended interactions that can result in certain elements of the system not working as intended. We have seen many such mistakes in the under 14,000 pound arena ranging from OBD systems that are unable to communicate any information to a scan tool to monitors that are unable to store a DTC and illuminate the MIL. While over 14,000 pound heavy-duty vehicles are very different from light-duty vehicles in terms of emission controls and OBD monitoring strategies, among other things, these types of problems do not depend on these differences and, as such, are as likely to occur with over 14,000 pound OBD as they are with under 14,000 pound OBD. Additionally, we believe that there is great value in having manufacturers self-test actual production end products that operate on the road, as opposed to pre-production products, where errors can be found in individual subsystems that may work fine by themselves but not when integrated into a complete product (e.g., due to mistakes like improper wiring).

Therefore, we are requiring that manufacturers self-test a small fraction of their product line to verify compliance with the OBD requirements. The test requirements are divided into three distinct sections with each section representing a test for a different portion of the OBD requirements. These three sections being: compliance with the applicable SAE and/or ISO standardization requirements; compliance with the monitoring requirements for proper DTC storage and MIL illumination; and, compliance with the in-use monitoring performance ratios.

1. Verification of Standardization Requirements

An essential part of the OBD system is the requirement for standardization. The standardization requirements include items as simple as the location and shape of the diagnostic connector (where technicians can ''plug in'' a scan tool to the onboard computer) to more complex subjects concerning the manner and format in which DTC information is accessed by technicians via a ''generic'' scan tool. Manufacturers must meet these standardization requirements to facilitate the success of the OBD program because they ensure consistent access by all repair technicians to the stored information in the onboard computer. The need for consistency is even greater when considering the potential use of OBD system checks in inspection and maintenance (I/M) programs for heavy-duty. Such OBD based I/M checks would benefit from having access to the diagnostic information in the onboard computer via a single ''generic'' scan tool instead of individual tools for every make and model of truck that might be inspected. For OBD based inspections to work effectively and efficiently, all engines/vehicles must be designed and built to meet all of the applicable standardization requirements.

While we anticipate that the vast majority of vehicles would comply with all of the standardization requirements, some problems involving the communication between vehicles and ''generic'' scan tools are likely to occur in the field. The cause of such problems could range from differing interpretations of the existing standardization requirements to possible oversights by design engineers or hardware inconsistencies or even last-minute production changes on the assembly line.

To minimize the chance for such problems on future over 14,000 pound trucks, we are requiring that engine manufacturers test a sample of production vehicles from the assembly line to verify that the vehicles have indeed been designed and built to the required specifications for communication with a ''generic'' scan tool. We are requiring that manufacturers test complete vehicles to ensure that they comply with some of the basic ''generic'' scan tool standardization requirements, including those that are essential for proper inspection in an I/M setting. Ideally, manufacturers would test one vehicle for each truck and engine model combination that is introduced into commerce. However, for a large engine manufacturer, this can be in the neighborhood of 5,000 to 10,000 unique combinations making it unreasonable to require testing of every combination. Therefore, we are requiring that manufacturers test 10 such combinations per engine family. Given that a typical engine family has roughly five different engine ratings, this works out to testing only around two vehicles per engine rating.

More specifically, manufacturers must test one vehicle per software ''version'' released by the manufacturer. With proper demonstration, manufacturers will be allowed to group different calibrations together to be demonstrated by a common vehicle. Prior to acquiring these data, the engine manufacturer must submit for approval a test plan verifying that the vehicles scheduled for testing will be representative of all vehicle configurations (e.g., each engine control module variant coupled with and without the other available vehicle components that could affect scan tool communication such as automatic transmission or hybrid powertrain control modules). The plan must include details on all the different applications and configurations that will be tested.

As noted, manufacturers will be required to conduct this testing on actual production vehicles, not stand-alone engines. This is important since controllers that work properly in a stand alone setting (e.g., the engine before it is installed in a vehicle) may have interaction problems when installed and attempting to communicate with other vehicle controllers (e.g., the transmission controller). In such a case, separate testing of the controllers would be blind to the problem. Since heavy-duty engine manufacturers are expected to sell the same engine (with the same calibration) to various vehicle manufacturers who would put them in different final products (e.g., with different transmission control modules), the same communication problem would be expected in each final product.

This testing should occur soon enough in the production cycle to provide manufacturers with early feedback regarding the existence of any problems and time to resolve the problem prior to the entire model year's products being introduced into the field. We are requiring that the testing be done and the data submitted to us within either three months of the start of normal engine production or one month of the start of vehicle production, whichever is later.

To be sure that all manufacturers are testing vehicles to the same level of stringency, we are requiring that engine manufacturers submit documentation outlining the testing equipment and methods they intend to use to perform this testing. We anticipate that engine manufacturers and scan tool manufacturers will probably develop a common piece of hardware and software that could be used by all engine manufacturers at the end of the vehicle assembly line to meet this requirement. Two different projects (SAE J1699 and LOC3T) have developed such equipment in response to California OBD II requirements.[81] The equipment is currently being used to test 2005 and 2006 model year vehicles under 14,000 pounds. We believe that similar equipment could be developed for vehicles over 14,000 pounds in time for the 2013 model year. Ideally, the equipment and the test procedure would verify each and every requirement of the communication specifications including the various physical layers, message structure, response times, and message content. Presumably, any such verification equipment would not replace the function of existing ''generic'' scan tools used by repair technicians or I/M inspectors. The equipment would likely be custom-designed and be used for the express purpose of this assembly line testing (i.e., it would not include all of the necessary diagnostic features needed by repair technicians).

2. Verification of Monitoring Requirements

As noted above, the OBD system is a complex software and hardware system, so there are many opportunities for unintended interactions that can result in certain elements of the system not working as intended. The causes of possible problems vary from simple typing errors in the software code to component supplier hardware changes late in development or just prior to start of production. Given the complexity of OBD monitors and their associated algorithms, there can be thousands of lines of software code required to meet the diagnostic requirements. Implementing that code without interfering with the software code required for normal operation is and will be a very difficult task with many opportunities for human error. We expect that manufacturers will conduct some validation testing on end products to ensure that there are no problems that would be noticed by the vehicle operator. We believe that manufacturers should include in such verification testing an evaluation of the OBD system (e.g., does the MIL illuminate as intended in response to a malfunction?).

Therefore, we are requiring that engine manufacturers perform a thorough level of validation testing on at least one production vehicle and up to two more production engines per model year. The production vehicles/engines required for testing would have to be equipped with/be from the same engine families and ratings as used for the certification demonstration testing described in section VII.C. If a manufacturer demonstrated one, two, or three engines for certification, then at least one production vehicle and perhaps an additional one to two

[81] 13 CCR 1968.2, August 11, 2006, Docket ID# EPA–HQ–OAR–2005–0047–0005.

engines would have to be tested, respectively. We will work with the manufacturer and CARB staff to determine the actual vehicles and engines to test.

The testing itself will consist of implanting or simulating malfunctions to verify that virtually every single engine-related OBD monitor on the vehicle correctly identifies the malfunction, stores an appropriate DTC, and illuminates the MIL. Manufacturers will not be required to conduct any emissions testing. Instead, for those malfunctions designed against an emissions threshold, the manufacturer would simply implant or simulate a malfunction and verify detection, DTC storage, and MIL illumination. Actual ''threshold'' parts will not be needed for such testing. Implanted malfunctions could use severely deteriorated parts if desired by the manufacturer since the point of the testing is to verify detection, DTC storage, and MIL illumination. Upon submitting the data to the Administrator, the manufacturer will be required to also provide a description of the testing and the methods used to implant or simulate each malfunction. Note that testing of specific monitors will not be required if the manufacturer can show that no possible test exists that could be done on that monitor without causing physical damage to the production vehicle. We are requiring that the testing be completed and reported to us within six months after the manufacturer begins normal engine production. This should provide early feedback on the performance of every monitor on the vehicle prior to too many entering production. Upon good cause, we may extend the time period for testing.

Note that, in their HDOBD rule,[82] CARB allows, as an incentive to perform a thorough validation test, a manufacturer to request that any problem discovered during this self-test be treated as a ''retroactive'' deficiency. As discussed in section VII.D, we do not have a provision for retroactive deficiencies. Importantly, a retroactive deficiency granted by the Executive Officer does not preclude a manufacturer from complying with our defect reporting requirements. This issue was discussed in more detail in section VII.D.

3. Verification of In-Use Monitoring Performance Ratios

We are requiring that manufacturers track the performance of several of the most important monitors on the engine to determine how often they are monitoring during in-use operation. These requirements are discussed in more detail in section II.E. To summarize that discussion, monitors are expected to execute in the real world and meet a minimum acceptable performance level determined as the ratio of the number of good monitoring events to the number of actual trips. The ratio required is 10 percent, meaning that monitors should execute during at least 10 percent of the trips taken by the engine/vehicle. Monitors that perform below the minimum ratio will be subject to remedial action and possibly recall. However, the minimum ratio is not effective until the 2013 and later model years. For the 2010 through 2012 model year engines certified to today's OBD requirements, we are requiring that the data be collected even though the minimum ratio is not yet effective. The data gathered on these engines will help to determine whether the 10 percent ratio is appropriate for all applications and, if not, we intend to propose a change to the requirement to reflect that learning.

We are requiring that the engine manufacturer gather these data on production vehicles rather than engines. Since not every vehicle can be evaluated, we are requiring that manufacturers generate groups of engine/vehicle combinations to ensure adequate representation of the fleet. Specifically, manufacturers will be required to separate production vehicles into monitoring performance groups based on the following criteria and submit performance ratio data representative of each group:

• Emission control system architecture type—All engines that use the same or similar emissions control system architecture and associated monitoring system would be in the same emission architecture category. By architecture we mean engines with EGR + DPF + SCR, or EGR + DPF + NO_X Adsorber, or EGR + DPF-only, etc.

• Application type—Within an emission architecture category, engines would be separated by vehicle application. The separate application categories would be based on three classifications: engines intended primarily for line-haul chassis applications, engines intended primarily for urban delivery chassis applications, and all other engines.

We are requiring that these data be submitted to us within 12 months of the production vehicles entering the market. Upon submitting the collected data to us, the manufacturer must also provide a detailed description of how the data were gathered, how vehicles were grouped to represent sales of their engines, and the number of engines tested per monitoring performance group. Manufacturers will be required to submit performance ratio data from a sample of at least 15 vehicles per monitoring performance group. For example, a manufacturer with two emission control system architectures sold into each of the line-haul, urban delivery, and ''other'' groupings, will be required to submit data on up to 90 vehicles (i.e., $2 \times 3 \times 15$). We are requiring that these data be collected every year. Some manufacturers may find it easiest to collect data from vehicles that come in to its authorized repair facilities for routine maintenance or warranty work during the time period required, while others may find it more advantageous to hire a contractor to collect the data. Upon good cause, we may extend the time period for testing.

As stated before, the data collected under this program are intended primarily to provide an early indication that the systems are working as intended in the field, to provide information to ''fine-tune'' the requirement to track the performance of monitors, and to provide data to be used to develop a more appropriate minimum ratio for future regulatory revisions. The data are not intended to substitute for testing that we would perform for enforcement reasons to determine if a manufacturer is complying with the minimum acceptable performance ratios. In fact, the data collected would not likely meet all the required elements for testing to make an official determination that the system is noncompliant. As such, we believe the testing will be of most value to manufacturers since monitor performance problems can be corrected prior to EPA conducting a full enforcement action that could result in a recall.

VIII. What Are the Issues Concerning Inspection and Maintenance Programs?

In the preamble to our proposal, we included a discussion of issues surrounding potential future HDOBD-based I/M programs. However, while we sought comment on these issues, we did not make any formal proposals regarding HDOBD-based I/M. We received a fair amount of comment and have summarized those comments in the Summary and Analysis document contained in the docket for this rule.[83] We are taking no final action regarding HDOBD-based I/M at this time. We refer

[82] 13 CCR 1971.1, Docket ID# EPA–HQ–OAR–2005–0047–0006.

[83] Summary and Analysis of Comments document, HDOBD final rule, EPA420–R–08–018, Docket ID# EPA–HQ–OAR–2005–0047–0055.

the reader to the proposal for our discussion of the issues, and our Summary and Analysis document for a summary of the comments we received.

IX. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

This action is not a ''significant regulatory action'' under the terms of Executive Order (EO) 12866 (58 FR 51735, October 4, 1993) and is, therefore, not subject to review under the EO.

EPA prepared an analysis of the potential costs associated with this action. This analysis is contained in the technical support document.[84] A copy of the analysis is available in the docket and was summarized in section V of this preamble.

B. Paperwork Reduction Act

The information collection requirements for this action have been submitted for approval to the Office of Management and Budget (OMB) under the *Paperwork Reduction Act,* 44 U.S.C. 3501 *et seq.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 1684.13. Under Title II of the Clean Air Act (42 U.S.C. 7521 *et seq.*; CAA), EPA is charged with issuing certificates of conformity for those engines that comply with applicable emission standards. Such a certificate must be issued before engines may be legally introduced into commerce. EPA uses certification information to verify that the proper engine prototypes have been selected and that the necessary testing has been performed to assure that each engine complies with emission standards. In addition, EPA also has the authority under Title II of the Clean Air to ensure compliance by require in-use testing of vehicles and engines. EPA is requiring additional information at the time of certification to ensure that the on-board diagnostic (OBD) requirements are being met. EPA is also requiring that manufacturers conduct and report the results of in-use testing of the OBD systems to demonstrate that they are performing properly. Therefore, EPA is requiring 207 hours of annual burden per each of the 12 respondents to conduct the OBD certification, compliance, and in-use testing requirements required by this action. EPA estimates that the total of the of the 2484 hours of annual cost burden will be $16,018 per respondent for a total annual industry cost burden for the 12 respondents of $1,236,481.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency; technology and systems for the purposes of collecting, validating, and verifying. This includes the time needed to review instructions; develop, acquire, install, and utilize information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9.

C. Regulatory Flexibility Act (RFA), as Amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 U.S.C. 601 et seq.

The Regulatory Flexibility Act (RFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of this action on small entities, small entity is defined as: (1) A small businesses defined by the Small Business Administration's (SBA) regulations at 13 DFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impacts of this action on small entities, I certify that this final action will not have a significant economic impact on a substantial number of small entities. This action will not impose any requirements on small entities. This action places new requirements on manufacturers of large engines meant for highway use. These are large manufacturers. This action also changes existing requirements on manufacturers of passenger car and smaller heavy-duty engines meant for highway use. These changes place no meaningful new requirements on those manufacturers.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104–4, establishes requirements for federal agencies to assess the effects of their regulatory actions on state, local, and tribal governments, and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with ''Federal mandates'' that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more for any single year. Before promulgating a rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and to adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative that is not the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation of why such an alternative was not adopted.

Before EPA establishes any regulatory requirement that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

This rule contains no federal mandates (under the regulatory provisions of Title II of the UMRA) for State, local, or tribal governments or the private sector. The rule imposes no enforceable duties on any of these entities. Nothing in the rule would significantly or uniquely affect small governments. We have determined that this rule does not contain a federal

[84] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

mandate that may result in estimated expenditures of more than $100 million to the private sector in any single year. Therefore, this action is not subject to the requirements of sections 202 or 205 of the UMRA. Further, this action is also not subject to the requirements of section 203 of UMRA.

E. Executive Order 13132: Federalism

Executive Order 13132, entitled ''Federalism'' (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure ''meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.'' ''Policies that have federalism implications'' is defined in the Executive Order to include regulations that have ''substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.''

This action does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This action places new requirements on manufacturers of large engines meant for highway use and changes existing requirements on manufacturers of passenger car and smaller heavy-duty engines meant for highway use. These changes do not affect States or the relationship between the national government and the States. Thus, Executive Order 13132 does not apply to this rule.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled ''Consultation and Coordination with Indian Tribal Governments'' (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure ''meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.'' This action does not have tribal implications, as specified in Executive Order 13175. This action does not uniquely affect the communities of American Indian tribal governments since the motor vehicle requirements for private businesses in this action would have national applicability. Furthermore, this action does not impose any direct compliance costs on these communities and no circumstances specific to such communities exist that would cause an impact on these communities beyond those discussed in the other sections of this document. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

Executive Order 13045, ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997) applies to any rule that: (1) Is determined to be ''economically significant'' as defined under Executive Order 12866; and, (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This action is not subject to the Executive Order because it is not an economically significant regulatory action as defined by Executive Order 12866, and because the Agency does not have reason to believe the environmental health or safety risks addressed by this action present a disproportionate risk to children.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not subject to Executive Order 13211 (66 FR 28355 (May 22, 2001)), because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Section 12(d) of Public Law 104–113, directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This final rule references technical standards. The technical standards are listed in § 86.1 of the regulatory text, and directions for how they may be obtained are provided in § 86.1.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this final rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This action applies to all newly produced engines nationwide once implemented without regard for where those engines are ultimately used. EPA believes that all segments of society will benefit equally as a result of today's action and that no one will suffer adverse human health or environmental effects.

K. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A Major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not a ''major rule'' as defined by 5 U.S.C. 804(2). This rule will be effective April 27, 2009.

X. Statutory Provisions and Legal Authority

Statutory authority for today's final rule is found in the Clean Air Act, 42 U.S.C. 7401 *et seq.*, in particular, sections 202 and 206 of the Act, 42 U.S.C. 7521, 7525. This rule is being promulgated under the administrative and procedural provisions of Clean Air Act section 307(d), 42 U.S.C. 7607(d).

List of Subjects

40 CFR Part 86

Environmental protection, Administrative practice and procedure, Incorporation by reference, Motor vehicle pollution.

40 CFR Part 89

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements, Research, Vessels, Warranty.

40 CFR Part 90

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Reporting and recordkeeping requirements, Research, Warranty.

40 CFR Part 1027

Environmental protection, Administrative practice and procedure, Air pollution control, Imports, Reporting and recordkeeping requirements.

40 CFR Part 1033

Environmental protection, Administrative practice and procedure, Confidential business information, Incorporation by reference, Labeling, Penalties, Railroads, Reporting and recordkeeping requirements.

40 CFR Part 1042

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Vessels, Reporting and recordkeeping requirements, Warranties.

40 CFR Parts 1048, 1054, and 1060

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 1065

Environmental protection, Administrative practice and procedure, Incorporation by reference, Reporting and recordkeeping requirements, Research.

40 CFR Part 1068

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Incorporation by reference, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements, Warranties.

Dated: December 4, 2008.

Stephen L. Johnson,

Administrator.

■ For the reasons set out in the preamble, title 40 chapter I of the Code of Federal Regulations is amended as follows:

PART 86—CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

■ 1. The authority citation for part 86 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

■ 2. Section 86.1 is revised to read as follows:

§ 86.1 Reference materials.

(a) The documents in paragraph (b) of this section have been incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, a notice of change must be published in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* Also, the material is available for inspection at the Air Docket, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Air Docket is 202–566–1742. Copies are also available from the sources listed below.

(b) The following paragraphs set forth the material that has been incorporated by reference in this part.

(1) *ASTM material.* Copies of these materials may be obtained from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428–2959, or by calling 610–832–9585, or at *http://www.astm.org.*

(i) ASTM D 975–04c, Standard Specification for Diesel Fuel Oils, IBR approved for §§ 86.1910, 86.213–11.

(ii) ASTM D1945–91, Standard Test Method for Analysis of Natural Gas by Gas Chromatography, IBR approved for §§ 86.113–94, 86.513–94, 86.1213–94, 86.1313–94.

(iii) ASTM D2163–91, Standard Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography, IBR approved for §§ 86.113–94, 86.1213–94, 86.1313–94.

(iv) ASTM D2986–95a, Reapproved 1999, Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Dioctyl Phthalate) Smoke Test, IBR approved for §§ 86.1310–2007.

(v) ASTM D5186–91, Standard Test Method for Determination of Aromatic Content of Diesel Fuels by Supercritical Fluid Chromatography, IBR approved for §§ 86.113–07, 86.1313–91, 86.1313–94, 86.1313–98, 1313–2007.

(vi) ASTM E29–67, Reapproved 1980, Standard Recommended Practice for Indicating Which Places of Figures Are To Be Considered Significant in Specified Limiting Values, IBR approved for § 86.1105–87.

(vii) ASTM E29–90, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications, IBR approved for §§ 86.609–84, 86.609–96, 86.609–97, 86.609–98, 86.1009–84, 86.1009–96, 86.1442, 86.1708–99, 86.1709–99, 86.1710–99, 86.1728–99.

(viii) ASTM E29–93a, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications, IBR approved for §§ 86.098–15, 86.004–15, 86.007–11, 86.007–15, 86.1803–01, 86.1823–01, 86.1824–01, 86.1825–01, 86.1837–01.

(ix) ASTM F1471–93, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air-Filter System, IBR approved § 86.1310–2007.

(2) *SAE material.* Copies of these materials may be obtained from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA 15096–0001, or by calling 724–776–4841, or at *http://www.sae.org.*

(i) SAE J1151, December 1991, Methane Measurement Using Gas Chromatography, 1994 SAE Handbook—SAE International Cooperative Engineering Program, Volume 1: Materials, Fuels, Emissions, and Noise; Section 13 and page 170

(13.170), IBR approved for §§ 86.111–94; 86.1311–94.

(ii) SAE J1349, June 1990, Engine Power Test Code—Spark Ignition and Compression Ignition, IBR approved for §§ 86.094–8, 86.096–8.

(iii) SAE J1850, July 1995, Class B Data Communication Network Interface, IBR approved for §§ 86.099–17, 86.1806–01.

(iv) SAE J1850, Revised May 2001, Class B Data Communication Network Interface, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(v) SAE J1877, July 1994, Recommended Practice for Bar-Coded Vehicle Identification Number Label, IBR approved for §§ 86.095–35, 86.1806–01.

(vi) SAE J1892, October 1993, Recommended Practice for Bar-Coded Vehicle Emission Configuration Label, IBR approved for §§ 86.095–35, 86.1806–01.

(vii) SAE J1930, Revised May 1998, Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(viii) SAE J1930, Revised April 2002, Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms—Equivalent to ISO/TR 15031–2: April 30, 2002, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(ix) SAE J1937, November 1989, Engine Testing with Low Temperature Charge Air Cooler Systems in a Dynamometer Test Cell, IBR approved for §§ 86.1330–84, 86.1330–90.

(x) SAE J1939, Revised October 2007, Recommended Practice for a Serial Control and Communications Vehicle Network, IBR approved for §§ 86.010–18.

(xi) SAE J1939–11, December 1994, Physical Layer—250K bits/s, Shielded Twisted Pair, IBR approved for §§ 86.005–17, 86.1806–05.

(xii) SAE J1939–11, Revised October 1999, Physical Layer—250K bits/s, Shielded Twisted Pair, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xiii) SAE J1939–13, July 1999, Off-Board Diagnostic Connector, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xiv) SAE J1939–13, Revised March 2004, Off-Board Diagnostic Connector, IBR approved for § 86.010–18.

(xv) SAE J1939–21, July 1994, Data Link Layer, IBR approved for §§ 86.005–17, 86.1806–05.

(xvi) SAE J1939–21, Revised April 2001, Data Link Layer, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xvii) SAE J1939–31, Revised December 1997, Network Layer, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xviii) SAE J1939–71, May 1996, Vehicle Application Layer, IBR approved for §§ 86.005–17, 86.1806–05.

(xix) SAE J1939–71, Revised August 2002, Vehicle Application Layer—J1939–71 (through 1999), IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xx) SAE J1939–71, Revised January 2008, Vehicle Application Layer (Through February 2007), IBR approved for § 86.010–38.

(xxi) SAE J1939–73, February 1996, Application Layer—Diagnostics, IBR approved for §§ 86.005–17, 86.1806–05.

(xxii) SAE J1939–73, Revised June 2001, Application Layer—Diagnostics, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xxiii) SAE J1939–73, Revised September 2006, Application Layer—Diagnostics, IBR approved for §§ 86.010–18, 86.010–38.

(xxiv) SAE J1939–81, July 1997, Recommended Practice for Serial Control and Communications Vehicle Network Part 81—Network Management, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xxv) SAE J1939–81, Revised May 2003, Network Management, IBR approved for § 86.010–38.

(xxvi) SAE J1962, January 1995, Diagnostic Connector, IBR approved for §§ 86.099–17, 86.1806–01.

(xxvii) SAE J1962, Revised April 2002, Diagnostic Connector Equivalent to ISO/DIS 15031–3; December 14, 2001, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxviii) SAE J1978, Revised April 2002, OBD II Scan Tool—Equivalent to ISO/DIS 15031–4; December 14, 2001, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxix) SAE J1979, July 1996, E/E Diagnostic Test Modes, IBR approved for §§ 86.099–17, 86.1806–01.

(xxx) SAE J1979, Revised September 1997, E/E Diagnostic Test Modes, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxi) SAE J1979, Revised April 2002, E/E Diagnostic Test Modes—Equivalent to ISO/DIS 15031–5; April 30, 2002, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(xxxii) SAE J1979, Revised May 2007, (R) E/E Diagnostic Test Modes, IBR approved for § 86.010–18, 86.010–38.

(xxxiii) SAE J2012, July 1996, Recommended Practice for Diagnostic Trouble Code Definitions, IBR approved for §§ 86.099–17, 86.1806–01.

(xxxiv) SAE J2012, Revised April 2002, (R) Diagnostic Trouble Code Definitions Equivalent to ISO/DIS 15031–6: April 30, 2002, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxxv) SAE J2284–3, May 2001, High Speed CAN (HSC) for Vehicle Applications at 500 KBPS, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxvi) SAE J2403, Revised August 2007, Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature—Truck and Bus, IBR approved for §§ 86.007–17, 86.010–18, 86.010–38, 86.1806–05.

(xxxvii) SAE J2534, February 2002, Recommended Practice for Pass-Thru Vehicle Programming, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxviii) SAE J2534–1, Revised December 2004, (R) Recommended Practice for Pass-Thru Vehicle Programming, IBR approved for § 86.010–38.

(3) *ANSI material*. Copies of these materials may be obtained from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, or by calling 212–642–4900, or at *http://www.ansi.org*.

(i) ANSI/AGA NGV1–1994, Standard for Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices, IBR approved for §§ 86.001–9, 86.004–9, 86.098–8, 86.099–8, 86.099–9, 86.1810–01.

(ii) [Reserved]

(4) *California regulatory requirements*. Copies of these materials may be obtained from U.S. EPA, see paragraph (a) of this section, or from the California Air Resources Board by calling 916–322–2884, or at *http://www.arb.ca.gov*.

(i) California Regulatory Requirements Applicable to the ''LEV II'' Program, including:

(A) California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-duty Truck and Medium-duty Vehicle Classes, August 5, 1999, IBR approved for §§ 86.1806–01, 86.1811–04, 86.1844–01.

(B) California Non-Methane Organic Gas Test Procedures, August 5, 1999, IBR approved for §§ 86.1803–01, 86.1810–01, 86.1811–04.

(ii) California Regulatory Requirements Applicable to the National Low Emission Vehicle

Program, October 1996, IBR approved for §§ 86.113–04, 86.612–97, 86.1012–97, 86.1702–99, 86.1708–99, 86.1709–99, 86.1717–99, 86.1735–99, 86.1771–99, 86.1775–99, 86.1776–99, 86.1777–99, Appendix XVI, Appendix XVII.

(iii) California Regulatory Requirements known as On-board Diagnostics II (OBD–II), Approved on April 21, 2003, Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD–II), IBR approved for § 86.1806–05.

(iv) California Regulatory Requirements known as On-board Diagnostics II (OBD–II), Approved on November 9, 2007, Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD–II), IBR approved for §§ 86.007–17, 86.1806–05.

(5) *ISO material*. Copies of these materials may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland, or by calling 41–22–749–01–11, or at *http://www.iso.org*.

(i) ISO 9141–2, February 1, 1994, Road vehicles—Diagnostic systems—Part 2: CARB requirements for interchange of digital information, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(ii) ISO 14230–4:2000(E), June 1, 2000, Road vehicles—Diagnostic systems—KWP 2000 requirements for Emission-related systems, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(iii) ISO 15765–4.3:2001, December 14, 2001, Road Vehicles—Diagnostics on Controller Area Networks (CAN)—Part 4: Requirements for emissions-related systems, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(iv) ISO 15765–4:2005(E), January 15, 2005, Road Vehicles—Diagnostics on Controller Area Networks (CAN)—Part 4: Requirements for emissions-related systems, IBR approved for §§ 86.007–17, 86.010–18, 86.1806–05.

(6) *NIST material*. NIST publications are sold by the Government Printing Office (GPO) and by the National Technical Information Service (NTIS). To purchase a NIST publication you must have the order number. Order numbers are available from the NIST Public Inquiries Unit at (301) 975–NIST. Mailing address: NIST Public Inquiries, NIST, 100 Bureau Drive, Stop 3460, Gaithersburg, Md., 20899–3460. If you have a GPO stock number, you can purchase printed copies of NIST publications from GPO. Orders should be sent to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402–9325. For more information, or to place an order, call (202) 512–1800, fax: (202) 512–2250. More information can also be found at *http://www.nist.gov*.

(i) NIST Special Publication 811, 1995 Edition, Guide for the Use of the International System of Units (SI), IBR approved for § 86.1901.

(ii) [Reserved]

(7) *Truck and Maintenance Council material*. Copies of these materials may be obtained from the Truck and Maintenance Council, 950 North Glebe Road, Suite 210, Arlington, VA 22203–4181, or by calling 703–838–1754.

(i) TMC RP 1210B, Revised June 2007, WINDOWS™ COMMUNICATION API, IBR approved for § 86.010–38.

(ii) [Reserved]

■ 3. Section 86.007–17 is added to Subpart A to read as follows:

§ 86.007–17 On-board Diagnostics for engines used in applications less than or equal to 14,000 pounds GVWR.

(a) *General*.

(1) All heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must be equipped with an on-board diagnostic (OBD) system capable of monitoring all emission-related engine systems or components during the applicable useful life. Heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must meet the OBD requirements of this section according to the phase-in schedule in paragraph (k) of this section. All monitored systems and components must be evaluated periodically, but no less frequently than once per applicable certification test cycle as defined in Appendix I, paragraph (f), of this part, or similar trip as approved by the Administrator.

(2) An OBD system demonstrated to fully meet the requirements in § 86.1806–05 may be used to meet the requirements of this section, provided that the Administrator finds that a manufacturer's decision to use the flexibility in this paragraph (a)(2) is based on good engineering judgment.

(b) *Malfunction descriptions*. The OBD system must detect and identify malfunctions in all monitored emission-related engine systems or components according to the following malfunction definitions as measured and calculated in accordance with test procedures set forth in subpart N of this part (engine-based test procedures) excluding the test procedure referred to as the ''Supplemental emission test; test cycle and procedures'' contained in § 86.1360, and excluding the test procedure referred to as the ''Not-To-Exceed Test Procedure'' contained in § 86.1370, and excluding the test procedure referred to as the ''Load Response Test'' contained in § 86.1380.

(1) *Catalysts and particulate filters*.

(i) *Otto-cycle*. Catalyst deterioration or malfunction before it results in an increase in NMHC (or NO_X+NMHC, as applicable) emissions 1.5 times the NMHC (or NO_X+NMHC, as applicable) standard or family emission limit (FEL), as compared to the NMHC (or NO_X+NMHC, as applicable) emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel*.

(A) If equipped, reduction catalyst deterioration or malfunction before it results in exhaust NO_X emissions exceeding, for model years 2007 through 2012, either 1.75 times the applicable NO_X standard for engines certified to a NO_X family emission limit (FEL) greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr. If equipped, diesel oxidation catalyst (DOC) deterioration or malfunction before it results in exhaust NMHC emissions exceeding, for model years 2010 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard. These catalyst monitoring requirements need not be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold. As an alternative, oxidation catalyst deterioration or malfunction before it results in an inability to achieve a temperature rise of 100 degrees C, or to reach the necessary diesel particulate filter (DPF) regeneration temperature, within 60 seconds of initiating an active DPF regeneration. Further, oxidation catalyst deterioration or malfunction when the DOC is unable to sustain the necessary regeneration temperature for the duration of the regeneration event. The OBD or control system must abort the regeneration if the regeneration temperature has not been reached within five minutes of initiating an active regeneration event, and if the regeneration temperature cannot be sustained for the duration of the regeneration event.

(B) If equipped with a DPF for model years 2007 through 2009, catastrophic failure of the device must be detected. Any DFP whose complete failure results in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC (or NO_X+NMHC, as applicable) or PM must be monitored for such catastrophic failure. This monitoring need not be done if the manufacturer can demonstrate that a catastrophic failure of the system will not result in exceedance of the threshold. If equipped with a DPF for model years 2010 and later, DPF deterioration or malfunction before it results in exhaust emissions exceeding the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher. As an alternative to this requirement for 2010 through 2012, the OBD system can be designed to detect a malfunction based on a detectable decrease in the expected pressure drop across the DPF for a period of 5 seconds or more, whenever the engine is speed is greater than or equal to 50% (as defined in § 1065.610, Eq. 1065.610–3) and engine load, or torque, is greater than or equal to 50% of the maximum available at that speed under standard emission test conditions. For purposes of this paragraph, the detectable change in pressure drop is defined by operating the engine at its 50% speed and 50% load point under standard emission test conditions, observing the pressure drop on a clean DPF, and multiplying the observed pressure drop by 0.5. The detectable change in pressure drop shall be reported in units of kilopascals (kPa). At time of certification, manufacturers shall provide the detectable change in pressure drop value along with OBD engine data parameters recorded at the following nine engine speed/load operating points with a clean DPF: 50% speed, 50% load; 50% speed, 75% load, 50% speed, 100% load; 75% speed, 50% load; 75% speed, 75% load; 75% speed, 100% load; 100% speed, 50% load; 100% speed, 75% load; and 100% speed, 100% load. The OBD engine data pararmeters to be reported are described in § 86.010–18(k)(4)(ii) and shall include the following: engine speed; calculated load; air flow rate from mass air flow sensor (if so equipped); fuel rate; and DPF delta pressure. On all engines so equipped, catastrophic failure of the particulate trap must also be detected. In addition, the absence of the particulate trap or the trapping substrate must be detected.

(2) *Engine misfire.*

(i) *Otto-cycle.* Engine misfire resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X (or NO_X+NMHC, as applicable) or CO; and any misfire capable of damaging the catalytic converter.

(ii) *Diesel.* Lack of cylinder combustion must be detected.

(3) *Exhaust gas sensors.*

(i) *Oxygen sensors and air-fuel ratio sensors downstream of aftertreatment devices.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: The applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or, the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2010 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard.

(ii) *Oxygen sensors and air-fuel ratio sensors upstream of aftertreatment devices.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: for model years 2007 through 2009, the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher and, for model years 2010 and later, the applicable PM FEL+0.02 g/bhp-hr or 0.03 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr ; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard.

(iii) *NO_X sensors.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr; or, the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr.

(4) *Evaporative leaks.* If equipped, any vapor leak in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice; an absence of evaporative purge air flow from the complete evaporative emission control system. Where fuel tank capacity is greater than 25 gallons, the Administrator may, following a request from the manufacturer, revise the size of the orifice to the smallest orifice feasible, based on test data, if the most reliable monitoring method available cannot reliably detect a system leak equal to a 0.040 inch diameter orifice.

(5) *Other emission control systems and components.*

(i) *Otto-cycle.* Any deterioration or malfunction occurring in an engine system or component directly intended to control emissions, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC, NO_X or CO. For engines equipped with a secondary air system, a functional check, as described in paragraph (b)(6) of this section, may satisfy the requirements of this paragraph (b)(5) provided the manufacturer can demonstrate that deterioration of the flow distribution system is unlikely. This demonstration is subject to Administrator approval and, if the demonstration and associated functional check are approved, the diagnostic system must indicate a malfunction when some degree of secondary airflow is not detectable in the exhaust system during the check. For engines equipped with positive crankcase ventilation (PCV), monitoring of the PCV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the PCV system is unlikely to fail.

(ii) *Diesel.* Any deterioration or malfunction occurring in an engine system or component directly intended to control emissions, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding any of the following levels: for model years 2007 through 2009, the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher and, for model years 2010 and later, the applicable PM FEL+0.02 g/bhp-hr or 0.03 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for model years 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard. A functional check, as described in paragraph (b)(6) of this section, may satisfy the requirements of this paragraph (b)(5) provided the manufacturer can demonstrate that a malfunction would not cause emissions to exceed the applicable levels. This demonstration is subject to Administrator approval. For engines equipped with crankcase ventilation (CV), monitoring of the CV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the CV system is unlikely to fail.

(6) *Other emission-related engine components.* Any other deterioration or malfunction occurring in an electronic emission-related engine system or component not otherwise described above that either provides input to or receives commands from the on-board computer and has a measurable impact on emissions; monitoring of components required by this paragraph (b)(6) must be satisfied by employing electrical circuit continuity checks and rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters), and functionality checks for computer output components (proper functional response to computer commands) except that the Administrator may waive such a rationality or functionality check where the manufacturer has demonstrated infeasibility. Malfunctions are defined as a failure of the system or component to meet the electrical circuit continuity checks or the rationality or functionality checks.

(7) *Performance of OBD functions.* Any sensor or other component deterioration or malfunction which renders that sensor or component incapable of performing its function as part of the OBD system must be detected and identified on engines so equipped.

(c) *Malfunction indicator light (MIL).* The OBD system must incorporate a malfunction indicator light (MIL) readily visible to the vehicle operator. When illuminated, the MIL must display ''Check Engine,'' ''Service Engine Soon,'' a universally recognizable engine symbol, or a similar phrase or symbol approved by the Administrator. More than one general purpose malfunction indicator light for emission-related problems should not be used; separate specific purpose warning lights (e.g., brake system, fasten seat belt, oil pressure, etc.) are permitted. The use of red for the OBD-related malfunction indicator light is prohibited.

(d) *MIL illumination.*

(1) The MIL must illuminate and remain illuminated when any of the conditions specified in paragraph (b) of this section are detected and verified, or whenever the engine control enters a default or secondary mode of operation considered abnormal for the given engine operating conditions. The MIL must blink once per second under any period of operation during which engine misfire is occurring and catalyst damage is imminent. If such misfire is detected again during the following driving cycle (i.e., operation consisting of, at a minimum, engine start-up and engine shut-off) or the next driving cycle in which similar conditions are encountered, the MIL must maintain a steady illumination when the misfire is not occurring and then remain illuminated until the MIL extinguishing criteria of this section are satisfied. The MIL must also illuminate when the vehicle's ignition is in the ''key-on'' position before engine starting or cranking and extinguish after engine starting if no malfunction has previously been detected. If a fuel system or engine misfire malfunction has previously been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which similar conditions are encountered and no new malfunctions have been detected. Similar conditions are defined as engine speed within 375 rpm, engine load within 20 percent, and engine warm-up status equivalent to that under which the malfunction was first detected. If any malfunction other than a fuel system or engine misfire malfunction has been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction, and no new malfunctions have been detected. Upon Administrator approval, statistical MIL illumination protocols may be employed, provided they result in comparable timeliness in detecting a malfunction and evaluating system performance, i.e., three to six driving cycles would be considered acceptable.

(2) *Drive cycle or driving cycle,* in the context of this § 86.007–17 and for model years 2010 and later, a drive cycle means operation that consists of engine startup and engine shutoff and includes the period of engine off time up to the next engine startup. For vehicles that employ engine shutoff strategies (e.g., engine shutoff at idle), the manufacturer may use an alternative definition for drive cycle (e.g., key-on followed by key-off). Any alternative definition must be based on equivalence to engine startup and engine shutoff signaling the beginning and ending of a single driving event for a conventional vehicle. For applications that span 14,000 pounds GVWR, the manufacturer may use the drive cycle definition of § 86.010–18 in lieu of the definition in this paragraph.

(e) *Storing of computer codes.* The OBD system shall record and store in computer memory diagnostic trouble codes and diagnostic readiness codes indicating the status of the emission control system. These codes shall be available through the standardized data link connector per specifications as referenced in paragraph (h) of this section.

(1) A diagnostic trouble code must be stored for any detected and verified malfunction causing MIL illumination. The stored diagnostic trouble code must identify the malfunctioning system or component as uniquely as possible. At the manufacturer's discretion, a diagnostic trouble code may be stored for conditions not causing MIL illumination. Regardless, a separate code should be stored indicating the expected MIL illumination status (i.e., MIL commanded ''ON,'' MIL commanded ''OFF'').

(2) For a single misfiring cylinder, the diagnostic trouble code(s) must uniquely identify the cylinder, unless the manufacturer submits data and/or engineering evaluations which adequately demonstrate that the misfiring cylinder cannot be reliably identified under certain operating conditions. For diesel engines only, the specific cylinder for which combustion cannot be detected need not be identified if new hardware would be required to do so. The diagnostic trouble code must identify multiple misfiring cylinder conditions; under multiple misfire conditions, the misfiring cylinders need not be uniquely identified if a distinct multiple misfire diagnostic trouble code is stored.

(3) The diagnostic system may erase a diagnostic trouble code if the same code is not re-registered in at least 40 engine warm-up cycles, and the malfunction indicator light is not illuminated for that code.

(4) Separate status codes, or readiness codes, must be stored in computer memory to identify correctly functioning emission control systems and those emission control systems which require further engine operation to complete proper diagnostic evaluation. A readiness code need not be stored for those monitors that can be considered continuously operating monitors (e.g., misfire monitor, fuel system monitor, etc.). Readiness codes should never be set to ''not ready'' status upon key-on or key-off; intentional setting of readiness codes to ''not ready'' status via service procedures must apply to all such codes, rather than applying to individual codes. Subject to Administrator approval, if monitoring is disabled for a multiple number of driving cycles (i.e., more than one) due to the continued presence of extreme operating conditions (e.g., ambient temperatures below 40°F, or altitudes above 8000 feet), readiness for the subject monitoring system may be set to ''ready'' status without monitoring having been completed. Administrator approval shall be based on the conditions for monitoring system disablement, and the number of driving cycles specified without completion of monitoring before readiness is indicated.

(f) *Available diagnostic data.*

(1) Upon determination of the first malfunction of any component or system, ''freeze frame'' engine conditions present at the time must be stored in computer memory. Should a subsequent fuel system or misfire malfunction occur, any previously stored freeze frame conditions must be replaced by the fuel system or misfire conditions (whichever occurs first). Stored engine conditions must include, but are not limited to: engine speed, open or closed loop operation, fuel system commands, coolant temperature, calculated load value, fuel pressure, vehicle speed, air flow rate, and intake manifold pressure if the information needed to determine these conditions is available to the computer. For freeze frame storage, the manufacturer must include the most appropriate set of conditions to facilitate effective repairs. If the diagnostic trouble code causing the conditions to be stored is erased in accordance with paragraph (d) of this section, the stored engine conditions may also be erased.

(2) The following data in addition to the required freeze frame information must be made available on demand through the serial port on the standardized data link connector, if the information is available to the on-board computer or can be determined using information available to the on-board computer: Diagnostic trouble codes, engine coolant temperature, fuel control system status (closed loop, open loop, other), fuel trim, ignition timing advance, intake air temperature, manifold air pressure, air flow rate, engine RPM, throttle position sensor output value, secondary air status (upstream, downstream, or atmosphere), calculated load value, vehicle speed, and fuel pressure. The signals must be provided in standard units based on SAE specifications as referenced in paragraph (h) of this section. Actual signals must be clearly identified separately from default value or limp home signals.

(3) For all OBD systems for which specific on-board evaluation tests are conducted (catalyst, oxygen sensor, etc.), the results of the most recent test performed by the vehicle, and the limits to which the system is compared must be available through the standardized data link connector per the appropriate standardized specifications as referenced in paragraph (h) of this section.

(4) Access to the data required to be made available under this section shall be unrestricted and shall not require any access codes or devices that are only available from the manufacturer.

(g) *Exceptions.* The OBD system is not required to evaluate systems or components during malfunction conditions if such evaluation would result in a risk to safety or failure of systems or components. Additionally, the OBD system is not required to evaluate systems or components during operation of a power take-off unit such as a dump bed, snow plow blade, or aerial bucket, etc.

(h) *Reference materials.* The following documents are incorporated by reference, see § 86.1. Anyone may inspect copies at the U.S. EPA or at the National Archives and Records Administration (NARA). For information on the availability of this material at U.S. EPA, NARA, or the standard making bodies directly, refer to § 86.1.

(1) SAE material.

(i) SAE J1850, Revised May 2001, shall be used as the on-board to off-board communications protocol. All emission related messages sent to the scan tool over a J1850 data link shall use the Cyclic Redundancy Check and the three byte header, and shall not use inter-byte separation or check sums.

(ii) SAE J1979, Revised April 2002. Basic diagnostic data (as specified in § 86.007–17(e) and (f)) shall be provided in the format and units in this industry standard.

(iii) SAE J2012, Revised April 2002. Diagnostic trouble codes shall be consistent with this industry standard.

(iv) SAE J1962, Revised April 2002. The connection interface between the OBD system and test equipment and diagnostic tools shall meet the functional requirements of this industry standard.

(v) SAE J1930, Revised April 2002; or, SAE J2403, Revised August 2007. All acronyms, definitions and abbreviations shall be formatted according to one or the other of these industry standards.

(vi) SAE J1978, Revised April 2002. All equipment used to interface, extract and display OBD-related information shall meet this industry standard.

(vii) As an alternative to the above standards, heavy-duty vehicles may conform to the specifications of these SAE standards: SAE J1939–11, Revised October 1999; SAE J1939–13, July 1999; SAE J1939–21, Revised April 2001; SAE J1939–31, Revised December 1997; SAE J1939–71, Revised August 2002; SAE J1939–73, Revised June 2001; SAE J1939–81, July 1997.

(2) ISO materials.

(i) ISO 9141–2, February 1, 1994. This industry standard may be used as an alternative to SAE J1850 (as specified in paragraph (h)(1)(i) of this section) as the on-board to off-board communications protocol.

(ii) ISO 14230–4:2000(E), June 1, 2000. This industry standard may be used as an alternative to SAE J1850 (as specified in paragraph (h)(1)(i) of this section) as the on-board to off-board communications protocol.

(iii) ISO 15765–4.3:2001, December 14, 2001. This industry standard may be used as an alternative to SAE J1850 (as specified in paragraph (h)(1)(i) of this section) as the on-board to off-board communications protocol.

(iv) ISO 15765–4:2005(E), January 15, 2005. Beginning with the 2008 model year and beyond, this industry standard shall be the only acceptable protocol used for standardized on-board to off-board communications for vehicles below 8500 pounds. For vehicles 8500 to 14000 pounds, either this ISO industry standard or the SAE standards listed in paragraph (h)(1)(vii) of this section shall be the only acceptable protocols used for standardized on-board to off-board communications.

(i) *Deficiencies and alternative fueled engines.* Upon application by the manufacturer, the Administrator may accept an OBD system as compliant even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: technical feasibility of the given monitor and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Administrator. Furthermore, EPA will not accept any deficiency requests that include the complete lack of a major diagnostic monitor (''major'' diagnostic monitors being those for exhaust aftertreatment devices, oxygen sensor, air-fuel ratio sensor, NO_X sensor, engine misfire, evaporative leaks, and diesel EGR, if equipped), with the possible exception of the special provisions for alternative fueled engines. For alternative fueled heavy-duty engines (e.g., natural gas, liquefied petroleum gas, methanol, ethanol), manufacturers may request the Administrator to waive specific monitoring requirements of this section for which monitoring may not be reliable with respect to the use of the alternative fuel. At a minimum, alternative fuel engines must be equipped with an OBD system meeting OBD requirements to the extent feasible as approved by the Administrator.

(j) *California OBDII compliance option.* For heavy-duty engines used in applications weighing 14,000 pounds GVWR or less, demonstration of compliance with California OBD II requirements (Title 13 California Code of Regulations § 1968.2 (13 CCR 1968.2)), as modified and approved on November 9, 2007 (incorporated by reference, see § 86.1), shall satisfy the requirements of this section, except that compliance with 13 CCR 1968.2(e)(4.2.2)(C), pertaining to 0.02 inch evaporative leak detection, and 13 CCR 1968.2(d)(1.4), pertaining to tampering protection, are not required to satisfy the requirements of this section. Also, the deficiency provisions of 13 CCR 1968.2(k) do not apply. The deficiency provisions of paragraph (i) of this section and the evaporative leak detection requirement of paragraph (b)(4) of this section apply to manufacturers selecting this paragraph (j) for demonstrating compliance. In addition, demonstration of compliance with 13 CCR 1968.2(e)(15.2.1)(C), to the extent it applies to the verification of proper alignment between the camshaft and crankshaft, applies only to vehicles equipped with variable valve timing.

(k) *Phase-in for heavy-duty engines.* Manufacturers of heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR must comply with the OBD requirements in this section according to the following phase-in schedule, based on the percentage of projected engine sales within each category. The 2007 requirements in the following phase-in schedule apply to all heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less. For the purposes of calculating compliance with the phase-in provisions of this paragraph (k), heavy-duty engines may be combined with heavy-duty vehicles subject to the phase-in requirements of paragraph § 86.1806–05(l). The OBD Compliance phase-in table follows:

OBD COMPLIANCE PHASE-IN FOR HEAVY-DUTY ENGINES INTENDED FOR USE IN A HEAVY-DUTY VEHICLE WEIGHING 14,000 POUNDS GVWR OR LESS

Model year	Otto-cycle phase-in based on projected sales	Diesel phase-in based on projected sales
2007 MY	80% compliance; alternative fuel waivers available	100% compliance.
2008+ MY 100% compliance	100% compliance	100% compliance.

■ 4. Section 86.007–30 is added to Subpart A to read as follows:

§ 86.007–30 Certification.

(a)(1)(i) If, after a review of the test reports and data submitted by the manufacturer, data derived from any inspection carried out under § 86.091–7(c) and any other pertinent data or information, the Administrator determines that a test vehicle(s) (or test engine(s)) meets the requirements of the Act and of this subpart, he will issue a certificate of conformity with respect to such vehicle(s) (or engine(s)) except in cases covered by paragraphs (a)(1)(ii) and (c) of this section.

(ii) Gasoline-fueled and methanol-fueled heavy-duty vehicles. If, after a review of the statement(s) of compliance submitted by the manufacturer under § 86.094–23(b)(4) and any other pertinent data or information, the Administrator determines that the requirements of the Act and this subpart have been met, he will issue one certificate of conformity per manufacturer with respect to the evaporative emission family(ies) covered by paragraph (c) of this section.

(2) Such certificate will be issued for such period not to exceed one model year as the Administrator may determine and upon such terms as he may deem necessary or appropriate to assure that any new motor vehicle (or new motor vehicle engine) covered by the certificate will meet the requirements of the Act and of this part.

(3)(i) One such certificate will be issued for each engine family. For gasoline-fueled and methanol-fueled light-duty vehicles and light-duty trucks, and petroleum-fueled diesel cycle light-duty vehicles and light-duty trucks not certified under § 86.098–28(g), one such certificate will be issued for each engine family-evaporative/refueling emission family combination. Each certificate will certify compliance with no more than one set of in-use and certification standards (or family emission limits, as appropriate).

(ii) For gasoline-fueled and methanol fueled heavy-duty vehicles, one such certificate will be issued for each manufacturer and will certify compliance for those vehicles previously identified in that manufacturer's statement(s) of compliance as required in § 86.098–23(b)(4)(i) and (ii).

(iii) For diesel light-duty vehicles and light-duty trucks, or diesel HDEs, included in the applicable particulate averaging program, the manufacturer may at any time during production elect to change the level of any family particulate emission limit by demonstrating compliance with the new limit as described in § 86.094–28(a)(6), § 86.094–28(b)(5)(i), or § 86.004–28(c)(5)(i). New certificates issued under this paragraph will be applicable only for vehicles (or engines) produced subsequent to the date of issuance.

(iv) For light-duty trucks or HDEs included in the applicable NO_X averaging program, the manufacturer may at any time during production elect to change the level of any family NO_X emission limit by demonstrating compliance with the new limit as described in § 86.094–28(b)(5)(ii) or § 86.004–28(c)(5)(ii). New certificates issued under this paragraph will be applicable only for vehicles (or engines) produced subsequent to the day of issue.

(4)(i) For exempt light-duty vehicles and light-duty trucks under the provisions of § 86.094–8(j) or § 86.094–9(j), an adjustment or modification performed in accordance with instructions provided by the manufacturer for the altitude where the vehicle is principally used will not be considered a violation of section 203(a)(3) of the Clean Air Act (42 U.S.C. 7522(a)(3)).

(ii) A violation of section 203(a)(1) of the Clean Air Act (42 U.S.C. 7522(a)(1)) occurs when a manufacturer sells or delivers to an ultimate purchaser any light-duty vehicle or light-duty truck, subject to the regulations under the Act, under any of the conditions specified in paragraph (a)(4)(ii) of this section.

(A) When a light-duty vehicle or light-duty truck is exempted from meeting high-altitude requirements as provided in § 86.090–8(h) or § 86.094–9(h):

(*1*) At a designated high-altitude location, unless such manufacturer has reason to believe that such vehicle will not be sold to an ultimate purchaser for principal use at a designated high-altitude location; or

(*2*) At a location other than a designated high-altitude location, when such manufacturer has reason to believe that such motor vehicle will be sold to an ultimate purchaser for principal use at a designated high-altitude location.

(B) When a light-duty vehicle or light-duty truck is exempted from meeting low-altitude requirements as provided in § 86.094–8(i) or § 86.094–9(i):

(*1*) At a designated low-altitude location, unless such manufacturer has reason to believe that such vehicle will not be sold to an ultimate purchaser for principal use at a designated low-altitude location; or

(*2*) At a location other than a designated low-altitude location, when such manufacturer has reason to believe that such motor vehicle will be sold to an ultimate purchaser for principal use at a designated low-altitude location.

(iii) A manufacturer shall be deemed to have reason to believe that a light-duty vehicle that has been exempted from compliance with emission standards at high-altitude, or a light-duty truck which is not configured to meet high-altitude requirements, will not be sold to an ultimate purchaser for principal use at a designated high-altitude location if the manufacturer has informed its dealers and field representatives about the terms of these high-altitude regulations, has not caused the improper sale itself, and has taken reasonable action which shall include, but not be limited to, either paragraph (a)(4)(iii) (A) or (B), and paragraph (a)(4)(iii)(C) of this section:

(A) Requiring dealers in designated high-altitude locations to submit written statements to the manufacturer signed by the ultimate purchaser that a vehicle which is not configured to meet high-altitude requirements will not be used principally at a designated high-altitude location; requiring dealers in counties contiguous to designated high-altitude locations to submit written statements to the manufacturer, signed by the ultimate purchaser who represents to the dealer in the normal course of business that he or she resides in a designated high-altitude location, that a vehicle which is not configured to meet high-altitude requirements will not be used principally at a designated high-altitude location; and for each sale or delivery of fleets of ten or more such vehicles in a high-altitude location or in counties contiguous to high-altitude locations, requiring either the selling dealer or the delivering dealer to submit written statements to the manufacturer, signed by the ultimate purchaser who represents to the dealer in the normal course of business that he or she resides in a designated high-altitude location, that a vehicle which is not configured to meet high-altitude requirements will not be used principally at a designated high-altitude location. In addition, the manufacturer will make available to EPA, upon reasonable written request (but not more frequently than quarterly, unless EPA has demonstrated that it has substantial reason to believe that an improperly configured vehicle has been sold), sales, warranty, or other information pertaining to sales of vehicles by the dealers described above maintained by the manufacturer in the normal course of business relating to the altitude configuration of vehicles and the locations of ultimate purchasers; or

(B) Implementing a system which monitors factory orders of low-altitude vehicles by high-altitude dealers, or through other means, identifies dealers that may have sold or delivered a vehicle not configured to meet the high-altitude requirements to an ultimate purchaser for principal use at a designated high-altitude location; and making such information available to EPA upon reasonable written request (but not more frequently than quarterly, unless EPA has demonstrated that it has substantial reason to believe that an improperly configured vehicle has been sold); and

(C) Within a reasonable time after receiving written notice from EPA or a State or local government agency that a dealer may have improperly sold or delivered a vehicle not configured to meet the high-altitude requirements to an ultimate purchaser residing in a designated high-altitude location, or based on information obtained pursuant to paragraph (a)(4)(iii) of this section that a dealer may have improperly sold or delivered a significant number of such vehicles to ultimate purchasers so residing, reminding the dealer in writing of the requirements of these regulations, and, where appropriate, warning the dealer that sale by the dealer of vehicles not configured to meet high-altitude requirements may be contrary to the terms of its franchise agreement with the manufacturer and the dealer certification requirements of § 85.2108 of this chapter.

(iv) A manufacturer shall be deemed to have reason to believe that a light-duty vehicle or light-duty truck which has been exempted from compliance with emission standards at low altitude, as provided in § 86.094–8(i) or § 86.094–9(i), will not be sold to an ultimate purchaser for principal use at a designated low-altitude location if the manufacturer has informed its dealers and field representatives about the terms of the high-altitude regulations, has not caused the improper sale itself, and has taken reasonable action which shall include, but not be limited to either § 86.094–30(a)(4)(iv)(A) or (B) and § 86.094–30(a)(4)(iv)(C):

(A) Requiring dealers in designated low-altitude locations to submit written statements to the manufacturer signed by the ultimate purchaser that a vehicle which is not configured to meet low-altitude requirements will not be used principally at a designated low-altitude location; requiring dealers in counties contiguous to designated low-altitude locations to submit written statements to the manufacturer, signed by the ultimate purchaser who represents to the dealer in the normal course of business that he or she resides in a designated low-altitude location, that a vehicle which is not configured to meet low-altitude requirements will not be used principally at a designated low-altitude location; and for each sale or delivery of fleets of ten or more such vehicles in a low-altitude location or in counties contiguous to low-altitude locations, requiring either the selling dealer or the delivering dealer to submit written statements to the manufacturer, signed by the ultimate purchaser who represents to the dealer in the normal course of business that he or she resides in a designated low-altitude location, that a vehicle which is not configured to meet low-altitude requirements will not be used principally at a designated high-altitude location. In addition, the manufacturer will make available to EPA, upon reasonable written request (but not more frequently than quarterly, unless EPA has demonstrated that it has substantial reason to believe that an improperly configured vehicle has been sold), sales, warranty, or other information pertaining to sales of vehicles by the dealers described above maintained by the manufacturer in the normal course of business relating to the altitude configuration of vehicles and the locations of ultimate purchasers; or

(B) Implementing a system which monitors factory orders of high-altitude vehicles by low-altitude dealers, or through other means, identifies dealers that may have sold or delivered a vehicle not configured to meet the low-altitude requirements to an ultimate purchaser for principal use at a designated low-altitude location; and making such information available to EPA upon reasonable written request (but not more frequently than quarterly, unless EPA has demonstrated that it has substantial reason to believe that an improperly configured vehicle has been sold); and

(C) Within a reasonable time after receiving written notice from EPA or a state or local government agency that a dealer may have improperly sold or delivered a vehicle not configured to meet the low-altitude requirements to an ultimate purchaser residing in a designated low-altitude location, or based on information obtained pursuant to paragraph (a)(4)(iv) of this section that a dealer may have improperly sold or delivered a significant number of such vehicles to ultimate purchasers so residing, reminding the dealer in writing of the requirements of these regulations, and, where appropriate, warning the dealer that sale by the dealer of vehicles not configured to meet low-altitude requirements may be contrary to the terms of its franchise agreement with the manufacturer and the dealer certification requirements of § 85.2108 of this chapter.

(5)(i) For the purpose of paragraph (a) of this section, a ''designated high-altitude location'' is any county which has substantially all of its area located above 1,219 meters (4,000 feet) and:

(A) Requested and extension past the attainment date of December 31, 1982, for compliance with either the National Ambient Air Quality Standards for carbon monoxide or ozone, as indicated in part 52 (Approval and Promulgation of Implementation Plans) of this title; or

(B) Is in the same state as a county designated as a high-altitude location according to paragraph (a)(5)(i)(A) of this section.

(ii) The designated high-altitude locations defined in paragraph (a)(5)(i) of this section are listed below:

State of Colorado

Adams
Alamosa
Arapahoe
Archuleta
Boulder
Chaffee
Cheyenne
Clear Creek
Conejos
Costilla
Crowley
Custer
Delta
Denver
Dolores
Douglas
Eagle
Elbert
El Paso
Fremont
Garfield
Gilpin
Grand
Gunnison
Hinsdale
Huerfano
Jackson
Jefferson
Kit Carson
Lake
La Plata
Larimer
Las Animas
Lincoln
Mesa
Mineral
Moffat
Montezuma
Montrose
Morgan
Otero
Ouray
Park
Pitkin
Pueblo
Rio Blanco
Rio Grande
Routt
Saguache
San Juan
San Miguel
Summit
Teller
Washington
Weld

State of Nevada

Carson City
Douglas
Elko
Esmeralda
Eureka
Humboldt
Lander
Lincoln
Lyon
Mineral
Nye
Pershing
Storey
Washoe
White Pine

State of New Mexico

Bernalillo
Catron
Colfax
Curry
De Baca
Grant
Guadalupe
Harding
Hidalgo
Lincoln
Los Alamos
Luna
McKinley
Mora
Otero
Rio Arriba
Roosevelt
Sandoval
San Juan
San Miguel Santa Fe
Sierra
Socorro
Taos
Torrance
Union
Valencia

State of Utah

Beaver

Box Elder
Cache
Carbon
Daggett
Davis
Duchesne
Emery
Garfield
Grand
Iron
Juab
Kane
Millard
Morgan
Piute
Rich
Salt Lake
San Juan
Sanpete
Sevier
Summit
Tooele
Uintah
Utah
Wasatch
Wayne
Weber

(iii) For the purpose of paragraph (a) of this section, a ''designated low-altitude location'' is any county which has substantially all of its area located below 1,219 meters (4,000 feet).

(iv) The designated low-altitude locations so defined include all counties in the United States which are not listed in either paragraph (a)(5)(ii) of this section or in the list below:

State of Arizona

Apache
Cochise
Coconino
Navajo
Yavapai

State of Idaho

Bannock
Bear Lake
Bingham
Blaine
Bonneville
Butte
Camas
Caribou
Cassia
Clark
Custer
Franklin
Fremont
Jefferson
Lemhi
Madison
Minidoka
Oneida
Power
Treton
Valley

State of Montana

Beaverhead
Deer Lodge
Gallatin
Jefferson
Judith Basin
Madison
Meagher
Park
Powell
Silver Bow
Wheatland

State of Nebraska

Banner
Cheyenne
Kimball
Sioux

State of Oregon

Harney
Klamath
Lake

State of Texas

Jeff Davis
Hudspeth
Parmer

State of Wyoming

Albany
Campbell
Carbon
Converse
Fremont
Goshen
Hot Springs
Johnson
Laramie
Lincoln
Natrona
Niobrara
Park
Platte
Sublette
Sweetwater
Teton
Uinta
Washakie
Weston

(6) Catalyst-equipped vehicles, otherwise covered by a certificate, which are driven outside the United States, Canada, and Mexico will be presumed to have been operated on leaded gasoline resulting in deactivation of the catalysts. If these vehicles are imported or offered for importation without retrofit of the catalyst, they will be considered not to be within the coverage of the certificate unless included in a catalyst control program operated by a manufacturer or a United States Government agency and approved by the Administrator.

(7) For incomplete light-duty trucks, a certificate covers only those new motor vehicles which, when completed by having the primary load-carrying device or container attached, conform to the maximum curb weight and frontal area limitations described in the application for certification as required in § 86.094–21(d).

(8) For heavy-duty engines, a certificate covers only those new motor vehicle engines installed in heavy-duty vehicles which conform to the minimum gross vehicle weight rating, curb weight, or frontal area limitations for heavyduty vehicles described in § 86.082–2.

(9) For incomplete gasoline-fueled and methanol-fueled heavy-duty vehicles a certificate covers only those new motor vehicles which, when completed, conform to the nominal maximum fuel tank capacity limitations as described in the application for certification as required in § 86.094–21(e).

(10)(i) For diesel-cycle light-duty vehicle and diesel-cycle light-duty truck families which are included in a particulate averaging program, the manufacturer's production-weighted average of the particulate emission limits of all engine families in a participating class or classes shall not exceed the applicable diesel-cycle particulate standard, or the composite particulate standard defined in § 86.090–2 as appropriate, at the end of the model year, as determined in accordance with this part. The certificate shall be void *ab initio* for those vehicles causing the production-weighted family emission limit (FEL) to exceed the particulate standard.

(ii) For all heavy-duty diesel-cycle engines which are included in the particulate ABT programs under § 86.098–15 or superseding ABT sections as applicable, the provisions of paragraphs (a)(10)(ii)(A)–(C) of this section apply.

(A) All certificates issued are conditional upon the manufacturer complying with the provisions of § 86.098–15 or superseding ABT sections as applicable and the ABT related provisions of other applicable sections, both during and after the model year production.

(B) Failure to comply with all provisions of § 86.098–15 or superseding ABT sections as applicable will be considered to be a failure to satisfy the conditions upon which the certificate was issued, and the certificate may be deemed void *ab initio*.

(C) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied or excused.

(11)(i) For light-duty truck families which are included in a NO_X averaging program, the manufacturer's production-weighted average of the NO_X

emission limits of all such engine families shall not exceed the applicable NO_X emission standard, or the composite NO_X emission standard defined in § 86.088–2, as appropriate, at the end of the model year, as determined in accordance with this part. The certificate shall be void *ab initio* for those vehicles causing the production-weighted FEL to exceed the NO_X standard.

(ii) For all HDEs which are included in the NO_X plus NMHC ABT programs contained in § 86.098–15, or superseding ABT sections as applicable, the provisions of paragraphs (a)(11)(ii)(A)–(C) of this section apply.

(A) All certificates issued are conditional upon the manufacturer complying with the provisions of § 86.098–15 or superseding ABT sections as applicable and the ABT related provisions of other applicable sections, both during and after the model year production.

(B) Failure to comply with all provisions of § 86.098–15 or superseding ABT sections as applicable will be considered to be a failure to satisfy the conditions upon which the certificate was issued, and the certificate may be deemed void *ab initio.*

(C) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied or excused.

(12) For all light-duty vehicles certified to standards under § 86.094–8 or to which standards under § 86.708–94 are applicable, the provisions of paragraphs (a)(12)(i) through (iii) of this section apply.

(13) For all light-duty trucks certified to Tier 0 standards under § 86.094–9 and to which standards under § 86.709–94 are applicable:

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of §§ 86.094–9 and 86.709–94 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in §§ 86.094–9 and 86.709–94 will be considered to be a failure to satisfy the conditions upon which the certificate(s) was issued and the individual vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(14) For all light-duty vehicles and light-duty trucks certified with an Alternative Service Accumulation Durability Program under § 86.094–13(e), paragraphs (a)(14)(i) through (iii) of this section apply.

(i) All certificates issued are conditional upon the manufacturer performing the in-use verification program pursuant to the agreement described in § 86.094–13(e)(8).

(ii) Failure to fully comply with all the terms of the in-use verification program pursuant to the agreement described in § 86.094–13(e)(8) will be considered a failure to satisfy the conditions upon which the certificate was issued. A vehicle or truck will be considered to be covered by the certificate only if the manufacturer fulfills the conditions upon which the certificate is issued.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(15) For all light-duty vehicles certified to evaporative test procedures and accompanying standards specified under § 86.096–8:

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.096–8 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.096–8 will be considered to be a failure to satisfy the conditions upon which the certificate was issued and the vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(16) For all light-duty trucks certified to evaporative test procedures and accompanying standards specified under § 86.096–9:

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.096–9 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.096–9 will be considered to be a failure to satisfy the conditions upon which the certificate was issued and the vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(17) For all heavy-duty vehicles certified to evaporative test procedures and accompanying standards specified under § 86.096–10:

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.096–10 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.096–10 will be considered to be a failure to satisfy the conditions upon which the certificate was issued and the vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(18) For all heavy-duty vehicles certified to evaporative test procedures and accompanying standards specified under § 86.098–11:

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.098–11 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.098–11 will be considered to be a failure to satisfy the conditions upon which the certificate was issued and the vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(19) For all light-duty vehicles certified to refueling emission standards under § 86.098–8, the provisions of paragraphs (a)(19) (i) through (iii) of this section apply.

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.098–8, both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.094–8 be considered to be a failure to satisfy the conditions upon which the certificate(s) was issued and the vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(20) For all light-duty trucks certified to refueling emission standards under § 86.001–9, the provisions of paragraphs (a)(20)(i)–(iii) this section apply.

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.001–9 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.001–9 will be considered to be a failure to satisfy the conditions upon which the certificate(s) was issued and the individual vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(21) For all light-duty trucks certified to refueling emission standards under § 86.004–9, the provisions of paragraphs (a)(21)(i)–(iii) of this section apply.

(i) All certificates issued are conditional upon the manufacturer complying with all provisions of § 86.004–9 both during and after model year production.

(ii) Failure to meet the required implementation schedule sales percentages as specified in § 86.004–9 will be considered to be a failure to satisfy the conditions upon which the certificate(s) was issued and the individual vehicles sold in violation of the implementation schedule shall not be covered by the certificate.

(iii) The manufacturer shall bear the burden of establishing to the satisfaction of the Administrator that the conditions upon which the certificate was issued were satisfied.

(b)(1) The Administrator will determine whether a vehicle (or engine) covered by the application complies with applicable standards (or family emission limits, as appropriate) by observing the following relationships: in paragraphs (b)(1)(i) through (iv) of this section:

(i) *Light-duty vehicles.*

(A) The durability data vehicle(s) selected under § 86.094–24(c)(1)(i) shall represent all vehicles of the same engine system combination.

(B) The emission data vehicle(s) selected under § 86.094–24(b)(1) (ii) through (iv) shall represent all vehicles of the same engine-system combination as applicable.

(C) The emission data vehicle(s) selected under § 86.094–24(b)(1)(vii)(A) and (B) shall represent all vehicles of the same evaporative control system within the evaporative family.

(ii) *Light-duty trucks.*

(A) The emission data vehicle(s) selected under § 86.094–24(b)(1)(ii), shall represent all vehicles of the same engine-system combination as applicable.

(B) The emission data vehicle(s) selected under § 86.001–24(b)(vii)(A) and (B) shall represent all vehicles of the same evaporative/refueling control system within the evaporative/refueling family.

(C) The emission data vehicle(s) selected under § 86.09424(b)(1)(v) shall represent all vehicles of the same engine system combination as applicable.

(D) The emission-data vehicle(s) selected under § 86.098–24(b)(1)(viii) shall represent all vehicles of the same evaporative/refueling control system within the evaporative/refueling emission family, as applicable.

(iii) *Heavy-duty engines.*

(A) An Otto-cycle emission data test engine selected under § 86.094–24(b)(2)(iv) shall represent all engines in the same family of the same engine displacement-exhaust emission control system combination.

(B) An Otto-cycle emission data test engine selected under § 86.094–24(b)(2)(iii) shall represent all engines in the same engine family of the same engine displacement-exhaust emission control system combination.

(C) A diesel emission data test engine selected under § 86.094–24(b)(3)(ii) shall represent all engines in the same engine-system combination.

(D) A diesel emission data test engine selected under § 86.094–24(b)(3)(iii) shall represent all engines of that emission control system at the rated fuel delivery of the test engine.

(iv) Gasoline-fueled and methanol-fueled heavy-duty vehicles. A statement of compliance submitted under § 86.094–23(b)(4)(i) or (ii) shall represent all vehicles in the same evaporative emission family-evaporative emission control system combination.

(2) The Administrator will proceed as in paragraph (a) of this section with respect to the vehicles (or engines) belonging to an engine family or engine family-evaporative/refueling emission family combination (as applicable), all of which comply with all applicable standards (or family emission limits, as appropriate).

(3) If after a review of the test reports and data submitted by the manufacturer, data derived from any additional testing conducted pursuant to § 86.091–29, data or information derived from any inspection carried out under § 86.094–7(d) or any other pertinent data or information, the Administrator determines that one or more test vehicles (or test engines) of the certification test fleet do not meet applicable standards (or family emission limits, as appropriate), he will notify the manufacturer in writing, setting forth the basis for his determination. Within 30 days following receipt of the notification, the manufacturer may request a hearing on the Administrator's determination. 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 determination and data in support of such objections. If, after a 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.

(4) For light-duty vehicles and light-duty trucks the manufacturer may, at its option, proceed with any of the following alternatives with respect to an emission data vehicle determined not in compliance with all applicable standards (or family emission limits, as appropriate) for which it was tested:

(i) Request a hearing under § 86.078–6; or

(ii) Remove the vehicle configuration (or evaporative/refueling vehicle configuration, as applicable) which failed, from his application:

(A) If the failed vehicle was tested for compliance with exhaust emission standards (or family emission limits, as appropriate) only: The Administrator may select, in place of the failed vehicle, in accordance with the selection criteria employed in selecting the failed vehicle, a new emission data vehicle to be tested for exhaust emission compliance only; or

(B) If the failed vehicle was tested for compliance with one or more of the exhaust, evaporative and refueling emission standards: The Administrator may select, in place of the failed vehicle, in accordance with the selection criteria employed in selecting the failed vehicle, a new emission data vehicle which will be tested for compliance with all of the applicable emission standards. If one vehicle cannot be selected in accordance with the selection criteria employed in selecting the failed vehicle, then two or more vehicles may be selected (e.g., one vehicle to satisfy the exhaust emission vehicle selection criteria and one vehicle to satisfy the evaporative and refueling emission vehicle selection criteria). The vehicle selected to satisfy the exhaust emission vehicle selection criteria will be tested for compliance with exhaust emission standards (or family emission limits, as appropriate) only. The vehicle selected to satisfy the evaporative and/or refueling emission vehicle selection criteria will be tested for compliance with exhaust, evaporative and/or refueling emission standards; or

(iii) Remove the vehicle configuration (or evaporative/refueling vehicle configuration, as applicable) which failed from the application and add a vehicle configuration(s) (or evaporative/refueling vehicle configuration(s), as applicable) not previously listed. The Administrator may require, if applicable, that the failed vehicle be modified to the new engine code (or evaporative/refueling emission code, as applicable) and demonstrate by testing that it meets applicable standards (or family emission limits, as appropriate) for which it was originally tested. In addition, the Administrator may select, in accordance with the vehicle selection criteria given in § 86.001–24(b), a new emission data vehicle or vehicles. The vehicles selected to satisfy the exhaust emission vehicle selection criteria will be tested for compliance with exhaust emission standards (or family emission limits, as appropriate) only. The vehicles selected to satisfy the evaporative emission vehicle selection criteria will be tested for compliance with all of the applicable emission standards (or family emission limits, as appropriate); or

(iv) Correct a component or system malfunction and show that with a correctly functioning system or component the failed vehicle meets applicable standards (or family emission limits, as appropriate) for which it was originally tested. The Administrator may require a new emission data vehicle, of identical vehicle configuration (or evaporative/refueling vehicle configuration, as applicable) to the failed vehicle, to be operated and tested for compliance with the applicable standards (or family emission limits, as appropriate) for which the failed vehicle was originally tested.

(5) For heavy-duty engines the manufacturer may, at his option, proceed with any of the following alternatives with respect to any engine family represented by a test engine(s) determined not in compliance with applicable standards (or family emission limit, as appropriate):

(i) Request a hearing under § 86.078–6; or

(ii) Delete from the application for certification the engines represented by the failing test engine. (Engines so deleted may be included in a later request for certification under § 86.079–32.) The Administrator may then select in place of each failing engine an alternate engine chosen in accordance with selection criteria employed in selecting the engine that failed; or

(iii) Modify the test engine and demonstrate by testing that it meets applicable standards. Another engine which is in all material respect the same as the first engine, as modified, may then be operated and tested in accordance with applicable test procedures.

(6) If the manufacturer does not request a hearing or present the required data under paragraphs (b)(4) or (5) of this section (as applicable) of this section, the Administrator will deny certification.

(c)(1) Notwithstanding the fact that any certification vehicle(s) (or certification engine(s)) may comply with other provisions of this subpart, the Administrator may withhold or deny the issuance of a certificate of conformity (or suspend or revoke any such certificate which has been issued) with respect to any such vehicle(s) (or engine(s)) if:

(i) The manufacturer submits false or incomplete information in his application for certification thereof;

(ii) The manufacturer renders inaccurate any test data which he submits pertaining thereto or otherwise circumvents the intent of the Act, or of this part with respect to such vehicle (or engine);

(iii) Any EPA Enforcement Officer is denied access on the terms specified in § 86.091–7(d) to any facility or portion thereof which contains any of the following:

(A) The vehicle (or engine);

(B) Any components used or considered for use in its modification or buildup into a certification vehicle (or certification engine);

(C) Any production vehicle (or production engine) which is or will be claimed by the manufacturer to be covered by the certificate;

(D) Any step in the construction of a vehicle (or engine) described in paragraph (c)(iii)(C) of this section;

(E) Any records, documents, reports, or histories required by this part to be kept concerning any of the above; or

(iv) Any EPA Enforcement Officer is denied "reasonable assistance" (as defined in § 86.091–7(d) in examining any of the items listed in paragraph (c)(1)(iii) of this section.

(2) The sanctions of withholding, denying, revoking, or suspending of a certificate may be imposed for the reasons in paragraphs (c)(1)(i), (ii), (iii), or (iv) of this section only when the infraction is substantial.

(3) In any case in which a manufacturer knowingly submits false or inaccurate information or knowingly renders inaccurate or invalid any test data or commits any other fraudulent acts and such acts contribute substantially to the Administrator's decision to issue a certificate of conformity, the Administrator may deem such certificate void *ab initio*.

(4) In any case in which certification of a vehicle (or engine) is proposed to be withheld, denied, revoked, or suspended under paragraph (c)(1)(iii) or (iv) of this section, and in which the Administrator has presented to the manufacturer involved reasonable evidence that a violation of § 86.091–7(d) in fact occurred, the manufacturer, if he wishes to contend that, even though the violation occurred, the vehicle (or engine) in question was not involved in the violation to a degree that would warrant withholding, denial, revocation, or suspension of certification under either paragraph (c)(1)(iii) or (iv) of this section, shall have the burden of establishing that contention to the satisfaction of the Administrator.

(5) Any revocation or suspension of certification under paragraph (c)(1) of this section shall:

(i) Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.078–6 hereof; and

(ii) Extend no further than to forbid the introduction into commerce of vehicles (or engines) previously covered by the certification which are still in the hands of the manufacturer, except in cases of such fraud or other misconduct as makes the certification invalid ab initio.

(6) The manufacturer may request in the form and manner specified in paragraph (b)(3) of this section that any determination made by the Administrator under paragraph (c)(1) of this section to withhold or deny certification be reviewed in a hearing conducted in accordance with § 86.078–6. If the Administrator finds, after a review of the request and supporting data, that the request raises a substantial factual issue, he will grant the request with respect to such issue.

(d)(1) For light-duty vehicles. Notwithstanding the fact that any vehicle configuration or engine family may be covered by a valid outstanding certificate of conformity, the Administrator may suspend such outstanding certificate of conformity in whole or in part with respect to such vehicle configuration or engine family if:

(i) The manufacturer refuses to comply with the provisions of a test order issued by the Administrator pursuant to § 86.603; or

(ii) The manufacturer refuses to comply with any of the requirements of § 86.603; or

(iii) The manufacturer submits false or incomplete information in any report or information provided pursuant to the requirements of § 86.609; or

(iv) The manufacturer renders inaccurate any test data which he submits pursuant to § 86.609; or

(v) Any EPA Enforcement Officer is denied the opportunity to conduct activities related to entry and access as authorized in § 86.606 of this part and in a warrant or court order presented to the manufacturer or the party in charge of a facility in question; or

(vi) EPA Enforcement Officers are unable to conduct activities related to entry and access or to obtain ''reasonable assistance'' as authorized in § 86.606 of this part because a manufacturer has located its facility in a foreign jurisdiction where local law prohibits those activities; or

(vii) The manufacturer refuses to or in fact does not comply with § 86.604(a), § 86.605, § 86.607, § 86.608, or § 86.610.

(2) The sanction of suspending a certificate may not be imposed for the reasons in paragraph (d)(1)(i), (ii), or (vii) of this section where the refusal is caused by conditions and circumstances outside the control of the manufacturer which render it impossible to comply with those requirements.

(3) The sanction of suspending a certificate may be imposed for the reasons in paragraph (d)(1)(iii), (iv), or (v) of this section only when the infraction is substantial.

(4) In any case in which a manufacturer knowingly submitted false or inaccurate information or knowingly rendered inaccurate any test data or committed any other fraudulent acts, and such acts contributed substantially to the Administrator's original decision not to suspend or revoke a certificate of conformity in whole or in part, the Administrator may deem such certificate void from the date of such fraudulent act.

(5) In any case in which certification of a vehicle is proposed to be suspended under paragraph (d)(1)(v) of this section and in which the Administrator has presented to the manufacturer involved reasonable evidence that a violation of § 86.606 in fact occurred, if the manufacturer wishes to contend that, although the violation occurred, the vehicle configuration or engine family in question was not involved in the violation to a degree that would warrant suspension of certification under paragraph (d)(1)(v) of this section, the manufacturer shall have the burden of establishing the contention to the satisfaction of the Administrator.

(6) Any suspension of certification under paragraph (d)(1) of this section shall:

(i) Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.614; and

(ii) Not apply to vehicles no longer in the hands of the manufacturer.

(7) Any voiding of a certificate of conformity under paragraph (d)(4) of this section will be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.614.

(8) Any voiding of the certificate under § 86.091–30(a)(10) will be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.614.

(e) *For light-duty trucks and heavy-duty engines.*

(1) Notwithstanding the fact that any vehicle configuration or engine family may be covered by a valid outstanding certificate of conformity, the Administrator may suspend such outstanding certificate of conformity in whole or in part with respect to such vehicle or engine configuration or engine family if:

(i) The manufacturer refuses to comply with the provisions of a test order issued by the Administrator pursuant to § 86.1003; or

(ii) The manufacturer refuses to comply with any of the requirements of § 86.1003; or

(iii) The manufacturer submits false or incomplete information in any report or information provided pursuant to the requirements of § 86.1009; or

(iv) The manufacturer renders inaccurate any test data submitted pursuant to § 86.1009; or

(v) Any EPA Enforcement Officer is denied the opportunity to conduct activities related to entry and access as authorized in § 86.1006 of this part and in a warrant or court order presented to the manufacturer or the party in charge of a facility in question; or

(vi) EPA Enforcement Officers are unable to conduct activities related to entry and access as authorized in § 86.1006 of this part because a manufacturer has located a facility in a foreign jurisdiction where local law prohibits those activities; or

(vii) The manufacturer refuses to or in fact does not comply with the requirements of §§ 86.1004(a), 86.1005, 86.1007, 86.1008, 86.1010, 86.1011, or 86.1013.

(2) The sanction of suspending a certificate may not be imposed for the reasons in paragraph (e)(1) (i), (ii), or (vii) of this section where such refusal or denial is caused by conditions and circumstances outside the control of the manufacturer which renders it impossible to comply with those requirements. Such conditions and circumstances shall include, but are not limited to, any uncontrollable factors which result in the temporary unavailability of equipment and personnel needed to conduct the required tests, such as equipment breakdown or failure or illness of personnel, but shall not include failure of the manufacturers to adequately plan for and provide the equipment and personnel needed to conduct the tests. The manufacturer will bear the burden of establishing the presence of the conditions and circumstances required by this paragraph.

(3) The sanction of suspending a certificate may be imposed for the reasons outlined in paragraph (e)(1)(iii), (iv), or (v) of this section only when the infraction is substantial.

(4) In any case in which a manufacturer knowingly submitted false or inaccurate information or knowingly rendered inaccurate any test data or committed any other fraudulent acts, and such acts contributed substantially to the Administrator's original decision not to suspend or revoke a certificate of conformity in whole or in part, the Administrator may deem such certificate void from the date of such fraudulent act.

(5) In any case in which certification of a light-duty truck or heavy-duty engine is proposed to be suspended under paragraph (e)(1)(v) of this section and in which the Administrator has presented to the manufacturer involved reasonable evidence that a violation of § 86.1006 in fact occurred, if the manufacturer wishes to contend that, although the violation occurred, the vehicle or engine configuration or engine family in question was not involved in the violation to a degree that would warrant suspension of certification under paragraph (e)(1)(v) of this section, he shall have the burden of establishing that contention to the satisfaction of the Administrator.

(6) Any suspension of certification under paragraph (e)(1) of this section shall:

(i) Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.1014; and

(ii) Not apply to vehicles or engines no longer in the hands of the manufacturer.

(7) Any voiding of a certificate of conformity under paragraph (e)(4) of this section shall be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.1014.

(8) Any voiding of the certificate under paragraph (a) (10) or (11) of this section will be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with § 86.1014.

(f) For engine families required to have an OBD system and meant for applications less than or equal to 14,000 pounds, certification will not be granted if, for any test vehicle approved by the Administrator in consultation with the manufacturer, the malfunction indicator light does not illuminate under any of the following circumstances, unless the manufacturer can demonstrate that any identified OBD problems discovered during the Administrator's evaluation will be corrected on production vehicles.

(1)(i) *Otto-cycle.* A catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in an increase of 1.5 times the NMHC+NO_X standard or FEL above the NMHC+NO_X emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel.*

(A) If monitored for emissions performance—a reduction catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in exhaust emissions exceeding, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr. Also if monitored for emissions performance—an oxidation catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in exhaust NMHC emissions exceeding, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard. If monitored for exotherm performance, an oxidation catalsyt is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in an inability to achieve a 100 degree C temperature rise, or the necessary regeneration temperature, within 60 seconds of initiating a DPF regeneration.

(B) If monitored for performance—a diesel particulate filter (DPF) is replaced with a DPF that has catastrophically failed, or an electronic simulation of such; or, for model years 2010 and later, a DPF is replaced with a deteriorated or defective DPF, or an electronic simulation of such, resulting in either exhaust PM emissions exceeding the applicable FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher. If monitored for a decrease in the expected pressure drop according to the alternative monitoring provision of § 86.007–17(b)(1)(ii)(B), the OBD system fails to detect any of the pressure drop values across the DPF provided by the manufacturer at each of the nine engine speed/load operating points regardless of how those pressure drops are generated.

(2)(i) *Otto-cycle.* An engine misfire condition is induced resulting in exhaust emissions exceeding 1.5 times the applicable standards or FEL for NMHC+NO_X or CO.

(ii) *Diesel.* An engine misfire condition is induced and is not detected.

(3) *Exhaust gas sensors.*

(i) *Oxygen sensors and air-fuel ratio sensors downstream of aftertreatment devices.*

(A) *Otto-cycle.* If so equipped, any oxygen sensor or air-fuel ratio sensor located downstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If so equipped, any oxygen sensor or air-fuel ratio sensor located downstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: The applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard.

(ii) *Oxygen sensors and air-fuel ratio sensors upstream of aftertreatment devices.*

(A) *Otto-cycle.* If so equipped, any oxygen sensor or air-fuel ratio sensor located upstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If so equipped, any oxygen sensor or air-fuel ratio sensor located upstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: For model years 2007 through 2012, the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher and, for model years 2013 and later, the applicable PM FEL+0.02 g/bhp-hr or 0.03 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for model years 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard.

(iii) *NO_X sensors.*

(A) *Otto-cycle.* If so equipped, any NO_X sensor is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If so equipped, any NO_X sensor is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: The applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr.

(4) If so equipped and for Otto-cycle engines, a vapor leak is introduced in

the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice, or the evaporative purge air flow is blocked or otherwise eliminated from the complete evaporative emission control system.

(5)(i) *Otto-cycle.* A malfunction condition is induced in any emission-related engine system or component, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC, NO_X, or CO.

(ii) *Diesel.* A malfunction condition is induced in any emission-related engine system or component, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding any of the following levels: The applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for model years 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard.

(6) A malfunction condition is induced in an electronic emission-related engine system or component not otherwise described above that either provides input to or receives commands from the on-board computer resulting in a measurable impact on emissions.

■ 5. Section 86.010–2 is added to Subpart A to read as follows:

§ 86.010–2 Definitions.

The definitions of § 86.004–2 continue to apply to 2004 and later model year vehicles. The definitions listed in this section apply beginning with the 2010 model year.

DTC means diagnostic trouble code.

Engine or engine system as used in §§ 86.007–17, 86.007–30, 86.010–18, and 86.010–38 means the engine, fuel system, induction system, aftertreatment system, and everything that makes up the system for which an engine manufacturer has received a certificate of conformity.

Engine start as used in § 86.010–18 means the point when the engine reaches a speed 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission). For hybrid vehicles or for engines employing alternative engine start hardware or strategies (e.g., integrated starter and generators.), the manufacturer may use an alternative definition for engine start (e.g., key-on) provided the alternative definition is based on equivalence to an engine start for a conventional vehicle.

Functional check, in the context of onboard diagnostics, means verifying that a component and/or system that receives information from a control computer responds properly to a command from the control computer.

Ignition cycle as used in § 86.010–18 means a cycle that begins with engine start, meets the engine start definition for at least two seconds plus or minus one second, and ends with engine shutoff.

Limp-home operation as used in § 86.010–18 means an operating mode that an engine is designed to enter upon determining that normal operation cannot be maintained. In general, limp-home operation implies that a component or system is not operating properly or is believed to be not operating properly.

Malfunction means the conditions have been met that require the activation of an OBD malfunction indicator light and storage of a DTC.

MIL-on DTC means the diagnostic trouble code stored when an OBD system has detected and confirmed that a malfunction exists (e.g., typically on the second drive cycle during which a given OBD monitor has evaluated a system or component). Industry standards may refer to this as a confirmed or an active DTC.

Onboard Diagnostics (OBD) group means a combination of engines, engine families, or engine ratings that use the same OBD strategies and similar calibrations.

Pending DTC means the diagnostic trouble code stored upon the detection of a potential malfunction.

Permanent DTC means a DTC that corresponds to a MIL-on DTC and is stored in non-volatile random access memory (NVRAM). A permanent DTC can only be erased by the OBD system itself and cannot be erased through human interaction with the OBD system or any onboard computer.

Potential malfunction means that conditions have been detected that meet the OBD malfunction criteria but for which more drive cycles are allowed to provide further evaluation prior to confirming that a malfunction exists.

Previous-MIL-on DTC means a DTC that corresponds to a MIL-on DTC but is distinguished by representing a malfunction that the OBD system has determined no longer exists but for which insufficient operation has occurred to satisfy the DTC erasure provisions.

Rationality check, in the context of onboard diagnostics, means verifying that a component that provides input to a control computer provides an accurate input to the control computer while in the range of normal operation and when compared to all other available information.

Similar conditions, in the context of onboard diagnostics, means engine conditions having an engine speed within 375 rpm, load conditions within 20 percent, and the same warm up status (i.e., cold or hot). The manufacturer may use other definitions of similar conditions based on comparable timeliness and reliability in detecting similar engine operation.

■ 6. Section 86.010–18 is added to Subpart A to read as follows:

§ 86.010–18 On-board Diagnostics for engines used in applications greater than 14,000 pounds GVWR.

(a) *General.* According to the implementation schedule shown in paragraph (o) of this section, heavy-duty engines intended for use in a heavy-duty vehicle weighing more than 14,000 pounds GVWR must be equipped with an on-board diagnostic (OBD) system capable of monitoring all emission-related engine systems or components during the life of the engine. The OBD system is required to detect all malfunctions specified in paragraphs (g), (h), and (i) of this § 86.010–18 although the OBD system is not required to use a unique monitor to detect each of those malfunctions.

(1) When the OBD system detects a malfunction, it must store a pending, a MIL-on, or a previous-MIL-on diagnostic trouble code (DTC) in the onboard computer's memory. A malfunction indicator light (MIL) must also be activated as specified in paragraph (b) of this section.

(2) *Data link connector.*

(i) For model years 2010 through 2012, the OBD system must be equipped with a data link connector to provide access to the stored DTCs as specified in paragraph (k)(2) of this section.

(ii) For model years 2013 and later, the OBD system must be equipped with a standardized data link connector to provide access to the stored DTCs as specified in paragraph (k)(2) of this section.

(3) The OBD system cannot be programmed or otherwise designed to deactivate based on age and/or mileage. This requirement does not alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its regulatory useful life, except where an engine has been programmed or otherwise designed so that an OBD system deactivates based on age and/or mileage of the engine.

(4) *Drive cycle or driving cycle*, in the context of this § 86.010–18, means operation that meets any of the conditions of paragraphs (a)(4)(i) through (a)(4)(iv) of this section. Further, for OBD monitors that run during engine-off conditions, the period of engine-off time following engine shutoff and up to the next engine start may be considered part of the drive cycle for the conditions of paragraphs (a)(4)(i) and (a)(4)(iv) of this section. For engines/vehicles that employ engine shutoff OBD monitoring strategies that do not require the vehicle operator to restart the engine to continue vehicle operation (e.g., a hybrid bus with engine shutoff at idle), the manufacturer may use an alternative definition for drive cycle (e.g., key-on followed by key-off). Any alternative definition must be based on equivalence to engine startup and engine shutoff signaling the beginning and ending of a single driving event for a conventional vehicle. For engines that are not likely to be routinely operated for long continuous periods of time, a manufacturer may also request approval to use an alternative definition for drive cycle (e.g., solely based on engine start and engine shutoff without regard to four hours of continuous engine-on time). Administrator approval of the alternative definition will be based on manufacturer-submitted data and/or information demonstrating the typical usage, operating habits, and/or driving patterns of these vehicles.

(i) Begins with engine start and ends with engine shutoff;

(ii) Begins with engine start and ends after four hours of continuous engine-on operation;

(iii) Begins at the end of the previous four hours of continuous engine-on operation and ends after four hours of continuous engine-on operation; or

(iv) Begins at the end of the previous four hours of continuous engine-on operation and ends with engine shutoff.

(5) As an alternative to demonstrating compliance with the provisions of paragraphs (b) through (l) of this § 86.010–18, a manufacturer may demonstrate how the OBD system they have designed to comply with California OBD requirements for engines used in applications greater than 14,000 pounds also complies with the intent of the provisions of paragraphs (b) through (l) of this section. To make use of this alternative, the manufacturer must demonstrate to the Administrator how the OBD system they intend to certify meets the intent behind all of the requirements of this section, where applicable (e.g., paragraph (h) of this section would not apply for a diesel fueled/CI engine). Furthermore, if making use of this alternative, the manufacturer must comply with the specific certification documentation requirements of paragraph (m)(3) of this section.

(6) *Temporary provisions to address hardship due to unusual circumstances*.

(i) After considering the unusual circumstances, the Administrator may permit the manufacturer to introduce into U.S. commerce engines that do not comply with this § 86.010–18 for a limited time if all the following conditions apply:

(A) Unusual circumstances that are clearly outside the manufacturer's control prevent compliance with the requirements of this § 86.010–18.

(B) The manufacturer exercised prudent planning and was not able to avoid the violation and has taken all reasonable steps to minimize the extent of the nonconformity.

(C) No other allowances are available under the regulations in this chapter to avoid the impending violation.

(ii) To apply for an exemption, the manufacturer must send to the Administrator a written request as soon as possible before being in violation. In the request, the manufacturer must show that all the conditions and requirements of paragraph (a)(6)(i) of this section are met.

(iii) The request must also include a plan showing how all the applicable requirements will be met as quickly as possible.

(iv) The manufacturer shall give the Administrator other relevant information upon request.

(v) The Administrator may include additional conditions on an approval granted under the provisions of this paragraph (a)(6), including provisions that may require field repair at the manufacturer's expense to correct the noncompliance.

(vi) Engines sold as non-compliant under this temporary hardship provision must display ''non-OBD'' in the data stream as required under paragraph (k)(4)(ii) of this section. Upon correcting the noncompliance, the data stream value must be updated accordingly.

(b) *Malfunction indicator light (MIL) and Diagnostic Trouble Codes (DTC)*. The OBD system must incorporate a malfunction indicator light (MIL) or equivalent and must store specific types of diagnostic trouble codes (DTC). Unless otherwise specified, all provisions of this paragraph (b) apply for 2010 and later model years.

(1) *MIL specifications*.

(i) For model years 2013 and later, the MIL must be located on the primary driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions. The MIL must be amber (yellow) in color; the use of red for the OBD-related MIL is prohibited. More than one general purpose malfunction indicator light for emission-related problems shall not be used; separate specific purpose warning lights (e.g., brake system, fasten seat belt, oil pressure, etc.) are permitted. When activated, the MIL shall display the International Standards Organization (ISO) engine symbol.

(ii) The OBD system must activate the MIL when the ignition is in the key-on/engine-off position before engine cranking to indicate that the MIL is functional. The MIL shall be activated continuously during this functional check for a minimum of 5 seconds. During this MIL key-on functional check, the data stream value (see paragraph (k)(4)(ii) of this section) for MIL status must indicate ''commanded off'' unless the OBD system has detected a malfunction and has stored a MIL-on DTC. This MIL key-on functional check is not required during vehicle operation in the key-on/engine-off position subsequent to the initial engine cranking of an ignition cycle (e.g., due to an engine stall or other non-commanded engine shutoff).

(iii) As an option, the MIL may be used to indicate readiness status (see paragraph (k)(4)(i) of this section) in a standardized format in the key-on/engine-off position.

(iv) A manufacturer may also use the MIL to indicate which, if any, DTCs are currently stored (e.g., to ''blink'' the stored DTCs). Such use must not activate unintentionally during routine driver operation.

(v) For model years 2013 and later, the MIL required by this paragraph (b) must not be used in any other way than is specified in this section.

(2) *MIL activation and DTC storage protocol.*

(i) Within 10 seconds of detecting a potential malfunction, the OBD system must store a pending DTC that identifies the potential malfunction.

(ii) If the potential malfunction is again detected before the end of the next drive cycle during which monitoring occurs (i.e., the potential malfunction has been confirmed as a malfunction), then within 10 seconds of such detection the OBD system must activate the MIL continuously and store a MIL-on DTC (systems using the SAE J1939 standard protocol specified in paragraph (k)(1) of this section may either erase or retain the pending DTC in conjunction with storing the MIL-on DTC). If the potential malfunction is not detected before the end of the next drive cycle during which monitoring occurs (i.e., there is no indication of the malfunction at any time during the drive cycle), the corresponding pending DTC should be erased at the end of the drive cycle. Similarly, if a malfunction is detected for the first time and confirmed on a given drive cycle without need for further evaluation, then within 10 seconds of such detection the OBD system must activate the MIL continuously and store a MIL-on DTC (again, systems using the SAE J1939 standard protocol specified in paragraph (k)(1) of this section may optionally store a pending DTC in conjunction with storing the MIL-on DTC).

(iii) A manufacturer may request Administrator approval to employ alternative statistical MIL activation and DTC storage protocols to those specified in paragraphs (b)(2)(i) and (b)(2)(ii) of this section. Approval will depend upon the manufacturer providing data and/or engineering evaluations that demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Strategies requiring on average more than six drive cycles for MIL activation will not be accepted.

(iv) The OBD system must store a ''freeze frame'' of the operating conditions (as defined in paragraph (k)(4)(iii) of this section) present upon detecting a malfunction or a potential malfunction. In the event that a pending DTC has matured to a MIL-on DTC, the manufacturer shall either retain the currently stored freeze frame conditions or replace the stored freeze frame with freeze frame conditions regarding the MIL-on DTC. Any freeze frame stored in conjunction with any pending DTC or MIL-on DTC should be erased upon erasure of the corresponding DTC.

(v) If the engine enters a limp-home mode of operation that can affect emissions or the performance of the OBD system, or in the event of a malfunction of an onboard computer(s) itself that can affect the performance of the OBD system, the OBD system must activate the MIL and store a MIL-on DTC within 10 seconds to inform the vehicle operator. If the limp-home mode of operation is recoverable (i.e., operation automatically returns to normal at the beginning of the following ignition cycle), the OBD system may wait to activate the MIL and store the MIL-on DTC if the limp-home mode of operation is again entered before the end of the next ignition cycle rather than activating the MIL within 10 seconds on the first drive cycle during which the limp-home mode of operation is entered.

(vi) Before the end of an ignition cycle, the OBD system must store a permanent DTC(s) that corresponds to any stored MIL-on DTC(s).

(3) *MIL deactivation and DTC erasure protocol*.

(i) *Deactivating the MIL*. Except as otherwise provided for in paragraphs (g)(2)(iv)(E) and (g)(6)(iv)(B) of this section for diesel misfire malfunctions and empty reductant tanks, and paragraphs (h)(1)(iv)(F), (h)(2)(viii), and (h)(7)(iv)(B) of this section for gasoline fuel system, misfire, and evaporative system malfunctions, once the MIL has been activated, it may be deactivated after three subsequent sequential drive cycles during which the monitoring system responsible for activating the MIL functions and the previously detected malfunction is no longer present and provided no other malfunction has been detected that would independently activate the MIL according to the requirements outlined in paragraph (b)(2) of this section.

(ii) *Erasing a MIL-on DTC*. The OBD system may erase a MIL-on DTC if the identified malfunction has not again been detected in at least 40 engine warm up cycles and the MIL is presently not activated for that malfunction. The OBD system may also erase a MIL-on DTC upon deactivating the MIL according to paragraph (b)(3)(i) of this section provided a previous-MIL-on DTC is stored upon erasure of the MIL-on DTC. The OBD system may erase a previous-MIL-on DTC if the identified malfunction has not again been detected in at least 40 engine warm up cycles and the MIL is presently not activated for that malfunction.

(iii) *Erasing a permanent DTC*. The OBD system can erase a permanent DTC only if:

(A) The OBD system itself determines that the malfunction that caused the corresponding permanent DTC to be stored is no longer present and is not commanding activation of the MIL, concurrent with the requirements of paragraph (b)(3)(i) of this section which, for purposes of this paragraph (b)(3)(iii), shall apply to all monitors.

(B) All externally erasable DTC information stored in the onboard computer has been erased (i.e., through the use of a scan tool or battery disconnect) and the monitor of the malfunction that caused the permanent DTC to be stored is subject to the minimum ratio requirements of paragraph (d) of this section, the OBD system shall erase the permanent DTC at the end of a drive cycle if the monitor has run and made one or more determinations during a drive cycle that the malfunction of the component or the system is not present and has not made any determinations within the same drive cycle that the malfunction is present.

(C) (*1*) All externally erasable DTC information stored in the onboard computer has been erased (i.e., through the use of a scan tool or battery disconnect) and the monitor of the malfunction that caused the permanent DTC to be stored is not subject to the minimum ratio requirements of paragraph (d) of this section, the OBD system shall erase the permanent DTC at the end of a drive cycle provided the following two criteria have independently been satisfied:

(*i*) The monitor has run and made one or more determinations during a drive cycle that the malfunction is no longer present and has not made any determinations within the same drive cycle that the malfunction is present; and,

(*ii*) The monitor does not detect a malfunction on a drive cycle and the criteria of paragraph (d)(4)(ii) of this section has been met.

(*2*) These two separate criteria may be met on the same or different drive cycles provided the monitor never detects a malfunction during either drive cycle, and if criteria (b)(3)(iii)(C)(*1*)(*i*) happens first then no malfunction may be detected before criteria (b)(3)(iii)(C)(*1*)(*ii*) occurs. If a malfunction occurs after criteria (b)(3)(iii)(C)(*1*)(*i*) then criteria (b)(3)(iii)(C)(*1*)(*i*) must be satisfied again. For the second criterion, the manufacturer must exclude any temperature and/or elevation provisions of paragraph (d)(4)(ii) of this section. For this paragraph (b)(3)(iii)(C), monitors required to use ''similar conditions'' as defined in § 86.010–2 to store and erase pending and MIL-on DTCs cannot require that the similar conditions be met prior to erasure of the permanent DTC.

(D) The Administrator shall allow monitors subject to paragraph (b)(3)(iii)(B) of this section to use the criteria of paragraph (b)(3)(iii)(C) of this section in lieu of paragraph (b)(3)(iii)(B). Further, manufacturers may request Administrator approval to use alternative criteria to erase the permanent DTC. The Administrator shall approve alternate criteria that will not likely require driving conditions that are longer and more difficult to meet than those required under paragraph (b)(3)(iii)(C) of this section and do not require access to enhanced scan tools to determine conditions necessary to erase the permanent DTC.

(4) *Exceptions to MIL and DTC requirements*.

(i) If a limp-home mode of operation causes a overt indication (e.g., activation of a red engine shut-down warning light) such that the driver is certain to respond and have the problem corrected, a manufacturer may choose not to activate the MIL as required by paragraph (b)(2)(v) of this section. Additionally, if an auxiliary emission control device has been properly activated as approved by the Administrator, a manufacturer may choose not to activate the MIL.

(ii) For gasoline engines, a manufacturer may choose to meet the MIL and DTC requirements in § 86.007–17 in lieu of meeting the requirements of paragraph (b) of this § 86.010–18.

(c) *Monitoring conditions*. The OBD system must monitor and detect the malfunctions specified in paragraphs (g), (h), and (i) of this section under the following general monitoring conditions. The more specific monitoring conditions of paragraph (d) of this section are sometimes required according to the provisions of paragraphs (g), (h), and (i) of this section.

(1) As specifically provided for in paragraphs (g), (h), and (i) of this section, the monitoring conditions for detecting malfunctions must be technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false indications of malfunctions); designed to ensure monitoring will occur under conditions that may reasonably be expected to be encountered in normal vehicle operation and normal vehicle use; and, designed to ensure monitoring will occur during the FTP transient test cycle contained in Appendix I paragraph (f), of this part, or similar drive cycle as approved by the Administrator.

(2) Monitoring must occur at least once per drive cycle in which the monitoring conditions are met.

(3) Manufacturers may define monitoring conditions that are not encountered during the FTP cycle as required in paragraph (c)(1) of this section. In doing so, the manufacturer would be expected to consider the degree to which the requirement to run during the FTP transient cycle restricts monitoring during in-use operation, the technical necessity for defining monitoring conditions that are not encountered during the FTP cycle, whether monitoring is otherwise not feasible during the FTP cycle, and/or the ability to demonstrate that the monitoring conditions satisfy the minimum acceptable in-use monitor performance ratio requirement as defined in paragraph (d) of this section.

(d) *In-use performance tracking.* As specifically required in paragraphs (g), (h), and (i) of this section, the OBD system must monitor and detect the malfunctions specified in paragraphs (g), (h), and (i) of this section according to the criteria of this paragraph (d). The OBD system is not required to track and report in-use performance for monitors other than those specifically identified in paragraph (d)(1) of this section, but all monitors on applicable model year engines are still required to meet the in-use performance ratio as specified in paragraph (d)(1)(ii) of this section.

(1) The manufacturer must implement software algorithms in the OBD system to individually track and report the in-use performance of the following monitors, if equipped, in the standardized format specified in paragraph (e) of this section: NMHC converting catalyst (paragraph (g)(5) of this section); NO_X converting catalyst (paragraph (g)(6) of this section); gasoline catalyst (paragraph (h)(6) of this section); exhaust gas sensor (paragraph (g)(9) of this section) or paragraph(h)(8) of this section); evaporative system (paragraph (h)(7) of this section); EGR system (paragraph (g)(3) of this section or (h)(3) of this section); VVT system (paragraph (g)(10) of this section or (h)(9) of this section); secondary air system (paragraph (h)(5) of this section); DPF system (paragraph (g)(8) of this section); boost pressure control system (paragraph (g)(4) of this section); and, NO_X adsorber system (paragraph (g)(7) of this section).

(i) The manufacturer shall not use the calculated ratio specified in paragraph (d)(2) of this section or any other indication of monitor frequency as a monitoring condition for a monitor (e.g., using a low ratio to enable more frequent monitoring through diagnostic executive priority or modification of other monitoring conditions, or using a high ratio to enable less frequent monitoring).

(ii) For model years 2013 and later, manufacturers must define monitoring conditions that, in addition to meeting the criteria in paragraphs (c)(1) and (d)(1) of this section, ensure that the monitor yields an in-use performance ratio (as defined in paragraph (d)(2) of this section) that meets or exceeds the minimum acceptable in-use monitor performance ratio of 0.100 for all monitors specifically required in paragraphs (g), (h), and (i) of this section to meet the monitoring condition requirements of this paragraph (d).

(iii) If the most reliable monitoring method developed requires a lower ratio for a specific monitor than that specified in paragraph (d)(1)(ii) of this section, the Administrator may lower the minimum acceptable in-use monitoring performance ratio.

(2) *In-use performance ratio definition.* For monitors required to meet the requirements of paragraph (d) of this section, the performance ratio must be calculated in accordance with the specifications of this paragraph (d)(2).

(i) The numerator of the performance ratio is defined as the number of times a vehicle has been operated such that all monitoring conditions have been encountered that are necessary for the specific monitor to detect a malfunction.

(ii) The denominator is defined as the number of times a vehicle has been operated in accordance with the provisions of paragraph (d)(4) of this section.

(iii) The performance ratio is defined as the numerator divided by the denominator.

(3) *Specifications for incrementing the numerator.*

(i) Except as provided for in paragraph (d)(3)(v) of this section, the numerator, when incremented, must be incremented by an integer of one. The numerator shall not be incremented more than once per drive cycle.

(ii) The numerator for a specific monitor must be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle:

(A) Every monitoring condition has been satisfied that is necessary for the specific monitor to detect a malfunction and store a pending DTC, including applicable enable criteria, presence or absence of related DTCs, sufficient length of monitoring time, and diagnostic executive priority assignments (e.g., diagnostic ''A'' must execute prior to diagnostic ''B''). For the purpose of incrementing the numerator, satisfying all the monitoring conditions necessary for a monitor to determine that the monitor is not malfunctioning shall not, by itself, be sufficient to meet this criteria.

(B) For monitors that require multiple stages or events in a single drive cycle to detect a malfunction, every monitoring condition necessary for all events to complete must be satisfied.

(C) For monitors that require intrusive operation of components to detect a malfunction, a manufacturer must request approval of the strategy used to determine that, had a malfunction been present, the monitor would have detected the malfunction. Administrator approval of the request will be based on the equivalence of the strategy to actual intrusive operation and the ability of the strategy to determine accurately if every monitoring condition was satisfied that was necessary for the intrusive event to occur.

(D) For the secondary air system monitor, the criteria in paragraphs (d)(3)(ii)(A) through (d)(3)(ii)(C) of this section are satisfied during normal operation of the secondary air system. Monitoring during intrusive operation of the secondary air system later in the same drive cycle for the sole purpose of monitoring shall not, by itself, be sufficient to meet these criteria.

(iii) For monitors that can generate results in a ''gray zone'' or ''non-detection zone'' (i.e., monitor results that indicate neither a properly operating system nor a malfunctioning system) or in a ''non-decision zone'' (e.g., monitors that increment and decrement counters until a pass or fail threshold is reached), the numerator, in general, shall not be incremented when the monitor indicates a result in the ''non-detection zone'' or prior to the monitor reaching a complete decision. When necessary, the Administrator will consider data and/or engineering analyses submitted by the manufacturer demonstrating the expected frequency of results in the ''non-detection zone'' and the ability of the monitor to determine accurately, had an actual malfunction been present, whether or not the monitor would have detected a malfunction instead of a result in the ''non-detection zone.''

(iv) For monitors that run or complete their evaluation with the engine off, the numerator must be incremented either within 10 seconds of the monitor completing its evaluation in the engine off state, or during the first 10 seconds of engine start on the subsequent drive cycle.

(v) Manufacturers that use alternative statistical MIL activation protocols as allowed in paragraph (b)(2)(iii) of this section for any of the monitors requiring a numerator, are required to increment the numerator(s) appropriately. The manufacturer may be required to provide supporting data and/or engineering analyses demonstrating both the equivalence of their incrementing approach to the incrementing specified in this paragraph (d)(3) for monitors using the standard MIL activation protocol, and the overall equivalence of the incrementing approach in determining that the minimum acceptable in-use performance ratio of paragraph (d)(1)(ii) of this section, if applicable, has been satisfied.

(4) *Specifications for incrementing the denominator.*

(i) The denominator, when incremented, must be incremented by an integer of one. The denominator shall not be incremented more than once per drive cycle.

(ii) The denominator for each monitor must be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle:

(A) Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet (2,400 meters) above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (−7 C);

(B) Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1,150 rotations per minute (diesel engines may use the gasoline criterion for 2010 through 2012 model years), either of which occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet (2,400 meters) above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (−7 C); and,

(C) Continuous engine operation at idle (e.g., accelerator pedal released by driver and engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission) or vehicle speed less than or equal to one mile per hour) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet (2,400 meters) above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (−7 C).

(iii) In addition to the requirements of paragraph (d)(4)(ii) of this section, the evaporative system monitor denominator(s) may be incremented if and only if:

(A) Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit (4 C) but less than or equal to 95 degrees Fahrenheit (35 C); and,

(B) Engine cold start occurs with the engine coolant temperature greater than or equal to 40 degrees Fahrenheit (4 C) but less than or equal to 95 degrees Fahrenheit (35 C) and less than or equal to 12 degrees Fahrenheit (7 C) higher than the ambient temperature.

(iv) In addition to the requirements of paragraph (d)(4)(ii) of this section, the denominator(s) for the following monitors may be incremented if and only if the component or strategy is commanded ''on'' for a cumulative time greater than or equal to 10 seconds. For purposes of determining this commanded ''on'' time, the OBD system shall not include time during intrusive operation of any of the components or strategies that occurs later in the same drive cycle for the sole purpose of monitoring.

(A) Secondary air system (paragraph (h)(5) of this section).

(B) Cold start emission reduction strategy (paragraph (h)(4) of this section).

(C) Components or systems that operate only at engine start-up (e.g., glow plugs, intake air heaters) and are subject to monitoring under ''other emission control systems'' (paragraph (i)(4) of this section) or comprehensive component output components (paragraph (i)(3)(iii) of this section).

(v) In addition to the requirements of paragraph (d)(4)(ii) of this section, the denominator(s) for the following monitors of output components (except those operated only at engine start-up and subject to the requirements of paragraph (d)(4)(iv) of this section, may be incremented if and only if the component is commanded to function (e.g., commanded ''on'', ''opened'', ''closed'', ''locked'') on two or more occasions during the drive cycle or for a cumulative time greater than or equal to 10 seconds, whichever occurs first:

(A) Variable valve timing and/or control system (paragraph (g)(10) of this section or (h)(9) of this section).

(B) ''Other emission control systems'' (paragraph (i)(4) of this section).

(C) Comprehensive component output component (paragraph (i)(3) of this section) (e.g., turbocharger waste-gates, variable length manifold runners).

(vi) For monitors of the following components, the manufacturer may use alternative or additional criteria for incrementing the denominator to that set forth in paragraph (d)(4)(ii) of this section. To do so, the alternative criteria must be based on equivalence to the criteria of paragraph (d)(4)(ii) of this section in measuring the frequency of monitor operation relative to the amount of engine operation:

(A) Engine cooling system input components (paragraph (i)(1) of this section).

(B) ''Other emission control systems'' (paragraph (i)(4) of this section).

(C) Comprehensive component input components that require extended monitoring evaluation (paragraph (i)(3) of this section) (e.g., stuck fuel level sensor rationality).

(D) Comprehensive component input component temperature sensor rationality monitors (paragraph (i)(3) of this section) (e.g., intake air temperature sensor, ambient temperature sensor, fuel temperature sensor).

(E) Diesel particulate filter (DPF) frequent regeneration (paragraph (g)(8)(ii)(B) of this section).

(vii) For monitors of the following components or other emission controls that experience infrequent regeneration events, the manufacturer may use alternative or additional criteria for incrementing the denominator to that set forth in paragraph (d)(4)(ii) of this section. To do so, the alternative criteria must be based on equivalence to the criteria of paragraph (d)(4)(ii) of this section in measuring the frequency of monitor operation relative to the amount of engine operation:

(A) NMHC converting catalyst (paragraph (g)(5) of this section).

(B) Diesel particulate filter (DPF) (paragraphs (g)(8)(ii)(A) and (g)(8)(ii)(D) of this section).

(viii) In addition to the requirements of paragraph (d)(4)(ii) of this section, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to 10 seconds:

(A) DPF incomplete regeneration (paragraph (g)(8)(ii)(C) of this section).

(B) DPF active/intrusive injection (paragraph (g)(8)(ii)(E) of this section).

(ix) For hybrids that employ alternative engine start hardware or strategies (e.g., integrated starter and generators), or alternative fuel vehicles (e.g., dedicated, bi-fuel, or dual-fuel applications), the manufacturer may use alternative criteria for incrementing the denominator to that set forth in paragraph (d)(4)(ii) of this section. In general, the Administrator will not approve alternative criteria for those hybrids that employ engine shut off only at or near idle and/or vehicle stop conditions. To use alternative criteria, the alternative criteria must be based on the equivalence to the criteria of paragraph (d)(4)(ii) of this section in measuring the amount of vehicle operation relative to the measure of conventional vehicle operation.

(5) *Disablement of numerators and denominators.*

(i) Within 10 seconds of detecting a malfunction (i.e., a pending or a MIL-on DTC has been stored) that disables a monitor for which the monitoring conditions in paragraph (d) of this section must be met, the OBD system must stop incrementing the numerator and denominator for any monitor that may be disabled as a consequence of the detected malfunction. Within 10 seconds of the time at which the malfunction is no longer being detected (e.g., the pending DTC is erased through OBD system self-clearing or through a scan tool command), incrementing of all applicable numerators and denominators must resume.

(ii) Within 10 seconds of the start of a power take-off unit (e.g., dump bed, snow plow blade, or aerial bucket, etc.) that disables a monitor for which the monitoring conditions in paragraph (d) of this section must be met, the OBD system must stop incrementing the numerator and denominator for any monitor that may be disabled as a consequence of power take-off operation. Within 10 seconds of the time at which the power take-off operation ends, incrementing of all applicable numerators and denominators must resume.

(iii) Within 10 seconds of detecting a malfunction (i.e., a pending or a MIL-on DTC has been stored) of any component used to determine if the criteria of paragraphs (d)(4)(ii) and (d)(4)(iii) of this section are satisfied, the OBD system must stop incrementing all applicable numerators and denominators. Within 10 seconds of the time at which the malfunction is no longer being detected (e.g., the pending DTC is erased through OBD system self-clearing or through a scan tool command), incrementing of all applicable numerators and denominators must resume.

(e) *Standardized tracking and reporting of in-use monitor performance.*

(1) *General.* For monitors required to track and report in-use monitor performance according to paragraph (d) of this section, the performance data must be tracked and reported in accordance with the specifications in paragraphs (d)(2), (e), and (k)(5) of this section. The OBD system must separately report an in-use monitor performance numerator and denominator for each of the following components:

(i) For diesel engines, NMHC catalyst bank 1, NMHC catalyst bank 2, NO_X catalyst bank 1, NO_X catalyst bank 2, exhaust gas sensor bank 1, exhaust gas sensor bank 2, EGR/VVT system, DPF, boost pressure control system, and NO_X adsorber. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format specified in paragraphs (e)(5), (e)(6), and (k)(5) of this section.

(ii) For gasoline engines, catalyst bank 1, catalyst bank 2, exhaust gas sensor bank 1, exhaust gas sensor bank 2, evaporative leak detection system, EGR/VVT system, and secondary air system. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format specified in paragraphs (e)(5), (e)(6), and (k)(5) of this section.

(iii) For specific components or systems that have multiple monitors that are required to be reported under paragraphs (g) and (h) of this section (e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system must separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator must be reported for the specific component.

(2) *Numerator.*

(i) The OBD system must report a separate numerator for each of the applicable components listed in paragraph (e)(1) of this section.

(ii) The numerator(s) must be reported in accordance with the specifications in paragraph (k)(5)(ii) of this section.

(3) *Denominator.*

(i) The OBD system must report a separate denominator for each of the applicable components listed in paragraph (e)(1) of this section.

(ii) The denominator(s) must be reported in accordance with the specifications in paragraph (k)(5)(ii) of this section.

(4) *Monitor performance ratio.* For purposes of determining which corresponding numerator and denominator to report as required in paragraph (e)(1)(iii) of this section, the ratio must be calculated in accordance with the specifications in paragraph (k)(5)(iii) of this section.

(5) *Ignition cycle counter.*

(i) The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced according to the specifications of paragraph (e)(5)(ii)(B) of this section. The ignition cycle counter must be reported in accordance with the specifications in paragraph (k)(5)(ii) of this section.

(ii) The ignition cycle counter must be incremented as follows:

(A) The ignition cycle counter, when incremented, must be incremented by an integer of one. The ignition cycle counter shall not be incremented more than once per ignition cycle.

(B) The ignition cycle counter must be incremented within 10 seconds if and only if the engine exceeds an engine speed of 50 to 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for engines paired with an automatic transmission) for at least two seconds plus or minus one second.

(iii) Within 10 seconds of detecting a malfunction (i.e., a pending or a MIL-on DTC has been stored) of any component used to determine if the criteria in paragraph (e)(5)(ii)(B) of this section are satisfied (i.e., engine speed or time of operation), the OBD system must stop incrementing the ignition cycle counter. Incrementing of the ignition cycle counter shall not be stopped for any other condition. Within 10 seconds of the time at which the malfunction is no longer being detected (e.g., the pending DTC is erased through OBD system self-clearing or through a scan tool command), incrementing of the ignition cycle counter must resume.

(6) *General denominator.*

(i) The general denominator is defined as a measure of the number of times an engine has been operated according to the specifications of paragraph (e)(6)(ii)(B) of this section. The general denominator must be reported in accordance with the specifications in paragraph (k)(5)(ii) of this section.

(ii) The general denominator must be incremented as follows:

(A) The general denominator, when incremented, must be incremented by an integer of one. The general denominator shall not be incremented more than once per drive cycle.

(B) The general denominator must be incremented within 10 seconds if and only if the criteria identified in paragraph (d)(4)(ii) of this section are satisfied on a single drive cycle.

(C) Within 10 seconds of detecting a malfunction (i.e., a pending or a MIL-on DTC has been stored) of any component used to determine if the criteria in paragraph (d)(4)(ii) of this section are satisfied (i.e., vehicle speed/load, ambient temperature, elevation, idle operation, or time of operation), the OBD system must stop incrementing the general denominator. Incrementing of the general denominator shall not be stopped for any other condition (e.g., the disablement criteria in paragraphs (d)(5)(i) and (d)(5)(ii) of this section shall not disable the general denominator). Within 10 seconds of the time at which the malfunction is no longer being detected (e.g., the pending DTC is erased through OBD system self-clearing or through a scan tool command), incrementing of the general denominator must resume.

(f) *Malfunction criteria determination.*

(1) In determining the malfunction criteria for the diesel engine monitors required under paragraphs (g) and (i) of this section that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard, the manufacturer must:

(i) Use the emission test cycle and standard (i.e., the transient FTP or the supplemental emissions test (SET)) determined by the manufacturer to provide the most effective monitoring conditions and robust monitor provided all other applicable requirements of this section are met.

(ii) Identify in the certification documentation required under paragraph (m) of this section, the test cycle and standard determined by the manufacturer to be the most stringent for each applicable monitor and the most effective and robust for each applicable monitor.

(iii) If the Administrator reasonably believes that a manufacturer has determined incorrectly the test cycle and standard that is most stringent or effective, the manufacturer must be able to provide emission data and/or engineering analysis supporting their choice of test cycle and standard.

(2) On engines equipped with emission controls that experience infrequent regeneration events, a manufacturer need not adjust the emission test results that are used to determine the malfunction criteria for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold. For each such monitor, should the manufacturer choose to adjust the emission test results, the manufacturer must adjust the emission result as done in accordance with the provisions of § 86.004–28(i) with the component for which the malfunction criteria are being established having been deteriorated to the malfunction threshold. The adjusted emission value must be used for purposes of determining whether or not the applicable emission threshold is exceeded.

(i) For purposes of this paragraph (f)(2), regeneration means an event, by design, during which emissions levels change while the emission control performance is being restored.

(ii) For purposes of this paragraph (f)(2), infrequent means having an expected frequency of less than once per transient FTP cycle.

(3) For gasoline engines, rather than meeting the malfunction criteria specified under paragraphs (h) and (i) of this section, the manufacturer may request approval to use an OBD system certified to the requirements of § 86.007–17. To do so, the manufacturer must demonstrate use of good engineering judgment in determining equivalent malfunction detection criteria to those required in this section.

(g) *OBD monitoring requirements for diesel-fueled/compression-ignition engines.* The following table shows the thresholds at which point certain components or systems, as specified in this paragraph (g), are considered malfunctioning.

TABLE 1—OBD EMISSIONS THRESHOLDS FOR DIESEL-FUELED/COMPRESSION-IGNITION ENGINES MEANT FOR PLACEMENT IN APPLICATIONS GREATER THAN 14,000 POUNDS GVWR (G/BHP-HR)

Component	§ 86.010–18 reference	NMHC	CO	NO_X	PM
Model years 2010–2012:					
NO_X aftertreatment system	(g)(6) (g)(7)			+0.6	
Diesel particulate filter (DPF) system	(g)(8)	2.5x			0.05/+0.04
Air-fuel ratio sensors upstream of aftertreatment devices	(g)(9)	2.5x	2.5x	+0.3	0.03/+0.02

TABLE 1—OBD EMISSIONS THRESHOLDS FOR DIESEL-FUELED/COMPRESSION-IGNITION ENGINES MEANT FOR PLACEMENT IN APPLICATIONS GREATER THAN 14,000 POUNDS GVWR (G/BHP-HR)—Continued

Component	§ 86.010–18 reference	NMHC	CO	NO_X	PM
Air-fuel ratio sensors downstream of aftertreatment devices	(g)(9)	2.5x	....	+0.3	0.05/+0.04
NO_X sensors	(g)(9)	....	....	+0.6	0.05/+0.04
"Other monitors" with emissions thresholds	(g)(1) (g)(3) (g)(4) (g)(10)	2.5x	2.5x	+0.3	0.03/+0.02
Model years 2013 and later:					
NO_X aftertreatment system	(g)(6) (g)(7)	....	....	+0.3	
Diesel particulate filter (DPF) system	(g)(8)	2x	....	....	0.05/+0.04
Air-fuel ratio sensors upstream of aftertreatment devices	(g)(9)	2x	2x	+0.3	0.03/+0.02
Air-fuel ratio sensors downstream of aftertreatment devices	(g)(9)	2x	....	+0.3	0.05/+0.04
NO_X sensors	(g)(9)	....	....	+0.3	0.05/+0.04
"Other monitors" with emissions thresholds	(g)(1) (g)(2) (g)(3) (g)(4) (g)(10)	2x	2x	+0.3	0.03/+0.02

Notes: FEL = Family Emissions Limit; 2.5x std means a multiple of 2.5 times the applicable emissions standard; +0.3 means the standard or FEL plus 0.3; 0.05/+0.04 means an absolute level of 0.05 or an additive level of the standard or FEL plus 0.04, whichever level is higher; these emissions thresholds apply to the monitoring requirements of paragraph (g) of this § 86.010–18.

(1) *Fuel system monitoring.*

(i) *General.* The OBD system must monitor the fuel delivery system to verify that it is functioning properly. The individual electronic components (e.g., actuators, valves, sensors, pumps) that are used in the fuel system and are not specifically addressed in this paragraph (g)(1) must be monitored in accordance with the requirements of paragraph (i)(3) of this section.

(ii) *Fuel system malfunction criteria.*

(A) *Fuel system pressure control.* The OBD system must monitor the fuel system's ability to control to the desired fuel pressure. This monitoring must be done continuously unless new hardware has to be added, in which case the monitoring must be done at least once per drive cycle. The OBD system must detect a malfunction of the fuel system's pressure control system when the pressure control system is unable to maintain an engine's emissions at or below the emissions thresholds for "other monitors" as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the fuel system pressure control could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that the commanded fuel system pressure cannot be delivered. For model year 2010 to 2012 engines with a unit injector fuel system, this requirement may be met by conducting a functional check of the fuel system pressure control in lieu of monitoring for conditions that could cause an engine's emissions to exceed the applicable emissions thresholds.

(B) *Fuel system injection quantity.* The OBD system must detect a malfunction of the fuel injection system when the system is unable to deliver the commanded quantity of fuel necessary to maintain an engine's emissions at or below the emissions thresholds for "other monitors" as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the fuel injection quantity could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that the commanded fuel quantity cannot be delivered. For model year 2010 to 2012 engines with a unit injector fuel system, this requirement may be met by conducting a functional check of the fuel system injection quantity in lieu of monitoring for conditions that could cause an engine's emissions to exceed the applicable emissions thresholds.

(C) *Fuel system injection timing.* The OBD system must detect a malfunction of the fuel injection system when the system is unable to deliver fuel at the proper crank angle/timing (e.g., injection timing too advanced or too retarded) necessary to maintain an engine's emissions at or below the emissions thresholds for "other monitors" as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the fuel injection timing could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that the commanded fuel injection timing cannot be achieved. For model year 2010 to 2012 engines with a unit injector fuel system, this requirement may be met by conducting a functional check of the fuel system injection timing in lieu of monitoring for conditions that could cause an engine's emissions to exceed the applicable emissions thresholds.

(D) *Combined Monitoring.* For engines with a unit injector fuel system, the manufacturer may request Administrator approval to combine the malfunction criteria of paragraphs (g)(1)(ii)(A) through (g)(1)(ii)(C) of this section into one malfunction provided the manufacturer can demonstrate that the combined malfunction will satisfy the intent of each separate malfunction criteria. For engines with a common rail fuel system, the manufacturer may request Administrator approval to combine the malfunction criteria of paragraphs (g)(1)(ii)(B) through (g)(1)(ii)(C) of this section into one malfunction provided the manufacturer can demonstrate that the combined malfunction will satisfy the intent of each separate malfunction criteria.

(E) *Fuel system feedback control.* See paragraph (i)(6) of this section.

(iii) *Fuel system monitoring conditions.*

(A) With the exceptions noted in this paragraph for unit injector systems, the OBD system must monitor continuously for malfunctions identified in paragraphs (g)(1)(ii)(A) and (g)(1)(ii)(E) of this section. For 2010 through 2012 unit injector systems, where functional monitoring is done in lieu of emission threshold monitoring for malfunctions identified in paragraph (g)(1)(ii)(A) of this section, the manufacturer must define the monitoring conditions in accordance with paragraphs (c) and (d) of this section. For 2013 and later unit injector systems, the manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(1)(ii)(A) of this section in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section.

(B) For 2010 through 2012, the manufacturer must define the monitoring conditions for malfunctions identified in paragraphs (g)(1)(ii)(B), (g)(1)(ii)(C), and (g)(1)(ii)(D) of this section in accordance with paragraphs (c) and (d) of this section. For 2013 and later, the manufacturer must define the monitoring conditions in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section.

(iv) *Fuel system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(2) *Engine misfire monitoring.*

(i) *General.* The OBD system must monitor the engine for misfire causing excess emissions.

(ii) *Engine misfire malfunction criteria.*

(A) The OBD system must be capable of detecting misfire occurring in one or more cylinders. To the extent possible without adding hardware for this specific purpose, the OBD system must also identify the specific misfiring cylinder. If more than one cylinder is misfiring continuously, or if more than one but less than half of the cylinders are misfiring continuously (if the manufacturer can demonstrate the robustness of their monitor to the approval of the Administrator), a separate DTC must be stored indicating that multiple cylinders are misfiring. When identifying multiple cylinder misfire, the OBD system is not required to identify individually through separate DTCs each of the continuously misfiring cylinders.

(B) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality (e.g., for use in engines with homogeneous charge compression ignition (HCCI) control systems), the OBD system must detect a misfire malfunction causing emissions to exceed the applicable thresholds for ''other monitors'' shown in Table 1 of this paragraph (g). To determine what level of misfire would cause emissions to exceed the applicable emissions thresholds, the manufacturer must determine the percentage of misfire evaluated in 1,000 revolution increments that would cause emissions from an emission durability demonstration engine to exceed the emissions thresholds if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer must use misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1,000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent. Any misfire malfunction must be detected if the percentage of misfire established via this testing is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous). The manufacturer may employ other revolution increments besides the 1,000 revolution increment. To do so, the manufacturer must demonstrate that the strategy is equally effective and timely in detecting misfire.

(iii) *Engine misfire monitoring conditions.*

(A) The OBD system must monitor for engine misfire during engine idle conditions at least once per drive cycle in which the monitoring conditions for misfire are met. The manufacturer must be able to demonstrate via engineering analysis and/or data that the self-defined monitoring conditions: are technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false detection of malfunctions); require no more than 1000 cumulative engine revolutions; and, do not require any single continuous idle operation of more than 15 seconds to make a determination that a malfunction is present (e.g., a decision can be made with data gathered during several idle operations of 15 seconds or less); or, satisfy the requirements of paragraph (c) of this section with alternative engine operating conditions.

(B) Manufacturers may employ alternative monitoring conditions (e.g., off-idle) provided the manufacturer is able to demonstrate that the alternative monitoring ensure equivalent robust detection of malfunctions and equivalent timeliness in detection of malfunctions.

(C) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality the OBD system must monitor continuously for engine misfire under all positive torque engine speed and load conditions. If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions, the manufacturer may request that the Administrator approve the monitoring system nonetheless. In evaluating the manufacturer's request, the Administrator will consider the following factors: the magnitude of the region(s) in which misfire detection is limited; the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events); the frequency with which said region(s) are expected to be encountered in-use; the type of misfire patterns for which misfire detection is troublesome; and demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines). The evaluation will be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders; single cylinder continuous misfire; and, paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(iv) *Engine misfire MIL activation and DTC storage.*

(A) General requirements for MIL activation and DTC storage are set forth in paragraph (b) of this section.

(B) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality, upon detection of the percentage of misfire specified in paragraph (g)(2)(ii)(B) of this section, the following criteria shall apply for MIL activation and DTC storage: A pending DTC must be stored no later than after the fourth exceedance of the percentage of misfire specified in paragraph (g)(2)(ii) of this section during a single drive cycle; if a pending fault code has been stored, the OBD system must activate the MIL and store a MIL-on DTC within 10 seconds if the percentage of misfire specified in paragraph (g)(2)(ii) of this section is again exceeded four times during the drive cycle immediately following storage of the pending DTC, regardless of the conditions encountered during the drive cycle, or on the next drive cycle in which similar conditions are encountered to those that were occurring when the pending DTC was stored. Similar conditions means an engine speed within 375 rpm, engine load within 20 percent, and the same warm up status (i.e., cold or hot). The Administrator may approve other definitions of similar conditions based on comparable timeliness and reliability in detecting similar engine operation. The pending DTC may be erased at the end of the next drive cycle in which similar conditions are encountered to those that were occurring when the pending DTC was stored provided the specified percentage of misfire was not again exceeded. The pending DTC may also be erased if similar conditions are not encountered during the 80 drive cycles immediately following initial detection of the malfunction.

(C) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality, the OBD system must store and erase freeze frame conditions either in conjunction with storing and erasing a pending DTC or in conjunction with storing and erasing a MIL-on DTC. If freeze frame conditions are stored for a malfunction other than a misfire malfunction when a DTC is stored as specified in paragraph (g)(2)(iv)(B) of this section, the stored freeze frame information must be replaced with the freeze frame information regarding the misfire malfunction.

(D) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality, upon detection of misfire according to paragraph (g)(2)(iv)(B) of this section, the OBD system must also store the following engine conditions: engine speed, load, and warm up status of the first misfire event that resulted in the storage of the pending DTC.

(E) For model years 2013 and later, on engines equipped with sensors that can detect combustion or combustion quality, the MIL may be deactivated after three sequential drive cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

(3) *EGR system monitoring.*

(i) *General.* The OBD system must monitor the EGR system on engines so equipped for low flow rate, high flow rate, and slow response malfunctions. For engines equipped with EGR coolers (e.g., heat exchangers), the OBD system must monitor the cooler for insufficient cooling malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section.

(ii) *EGR system malfunction criteria.*

(A) *EGR low flow.* The OBD system must detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it cannot increase EGR flow to achieve the commanded flow rate.

(B) *EGR high flow.* The OBD system must detect a malfunction of the EGR system, including a leaking EGR valve (i.e., exhaust gas flowing through the valve when the valve is commanded closed) prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it cannot reduce EGR flow to achieve the commanded flow rate.

(C) *EGR slow response.* The OBD system must detect a malfunction of the EGR system prior to any failure or deterioration in the capability of the EGR system to achieve the commanded flow rate within a manufacturer-specified time that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). The OBD system must monitor both the capability of the EGR system to respond to a commanded increase in flow and the capability of the EGR system to respond to a commanded decrease in flow.

(D) *EGR system feedback control.* See paragraph (i)(6) of this section.

(E) *EGR cooler performance.* The OBD system must detect a malfunction of the EGR cooler prior to a reduction from the manufacturer's specified cooling performance that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the EGR cooler could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has no detectable amount of EGR cooling.

(iii) *EGR system monitoring conditions.*

(A) The OBD system must monitor continuously for malfunctions identified in paragraphs (g)(3)(ii)(A), (g)(3)(ii)(B), and (g)(3)(ii)(D) of this section.

(B) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(3)(ii)(C) of this section in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(3)(ii)(C) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(C) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(3)(ii)(E) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(3)(ii)(E) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(D) The manufacturer may request Administrator approval to disable temporarily the EGR system monitor(s) under specific ambient conditions (e.g., when freezing may affect performance of the system) or during specific operating conditions (e.g., transients, extreme low or high flow conditions). The manufacturer must be able to demonstrate via data or engineering analysis that a reliable system monitor cannot be run when these conditions exist because it cannot robustly distinguish between a malfunctioning system and a properly operating system. The manufacturer is still required to maintain comprehensive component monitoring as required in paragraph (i)(3) of this section.

(iv) *EGR system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(4) *Turbo boost control system monitoring.*

(i) *General.* The OBD system must monitor the boost pressure control system (e.g., turbocharger) on engines so equipped for under and over boost malfunctions. For engines equipped with variable geometry turbochargers (VGT), the OBD system must monitor the VGT system for slow response malfunctions. For engines equipped with charge air cooler systems, the OBD system must monitor the charge air cooler system for cooling system performance malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the boost pressure control system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section.

(ii) *Turbo boost control system malfunction criteria.*

(A) *Turbo underboost.* The OBD system must detect a malfunction of the boost pressure control system prior to a decrease from the manufacturer's commanded boost pressure, or expected boost pressure on engines not equipped with a boost pressure control system, that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the boost pressure control system that causes a decrease in boost could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it cannot increase boost to achieve the commanded boost pressure.

(B) *Turbo overboost.* The OBD system must detect a malfunction of the boost pressure control system on engines so equipped prior to an increase from the manufacturer's commanded boost pressure that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the boost pressure control system that causes an increase in boost could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it cannot decrease boost to achieve the commanded boost pressure.

(C) *VGT slow response.* The OBD system must detect a malfunction prior to any failure or deterioration in the capability of the VGT system on engines so equipped to achieve the commanded turbocharger geometry within a manufacturer-specified time that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the VGT system response could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction of the VGT system when proper functional response of the system to computer commands does not occur.

(D) *Turbo boost feedback control.* See paragraph (i)(6)of this section.

(E) *Charge air undercooling.* The OBD system must detect a malfunction of the charge air cooling system prior to a decrease from the manufacturer's specified cooling rate that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g). For engines in which no failure or deterioration of the charge air cooling system that causes a decrease in cooling performance could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has no detectable amount of charge air cooling.

(iii) *Turbo boost monitoring conditions.*

(A) The OBD system must monitor continuously for malfunctions identified in paragraphs (g)(4)(ii)(A), (g)(4)(ii)(B), and (g)(4)(ii)(D) of this section.

(B) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(4)(ii)(C) of this section in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(4)(ii)(C) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(C) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(4)(ii)(E) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(4)(ii)(E) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(D) The manufacturer may request Administrator approval to disable temporarily the turbo boost system monitor(s) during specific operating conditions (e.g., transients, extreme low or high flow conditions). The manufacturer must be able to demonstrate via data or engineering analysis that a reliable system monitor cannot be run when these conditions exist because it cannot robustly distinguish between a malfunctioning system and a properly operating system. The manufacturer is still required to maintain comprehensive component monitoring as required in paragraph (i)(3) of this section.

(iv) *Turbo boost system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(5) *NMHC converting catalyst monitoring.*

(i) *General.* The OBD system must monitor the NMHC converting catalyst(s) for proper NMHC conversion capability. For purposes of this paragraph (g)(5), each catalyst that converts NMHC must be monitored either individually or in combination with others. For purposes of this paragraph (g)(5), NMHC conversion that may occur over the DPF or other aftertreatment devices is not included.

(ii) *NMHC converting catalyst malfunction criteria.*

(A) *NMHC converting catalyst conversion efficiency.* The OBD system must detect a malfunction when the catalyst has no detectable amount of NMHC conversion capability.

(B) *NMHC converting catalyst aftertreatment assistance functions.* For catalysts used to generate an exotherm to assist DPF regeneration, the OBD system must detect a malfunction when the catalyst is unable to generate a sufficient exotherm to achieve DPF regeneration. In meeting this requirement, the OBD system must detect a malfunction when the DOC is unable to generate a temperature rise of 100 degrees C, or to reach the necessary DPF regeneration temperature, within 60 seconds of initiating an active DPF regeneration. Further, the OBD system must detect a malfunction when the DOC is unable to sustain the necessary regeneration temperature for the duration of the regeneration event. The OBD or control system must abort the regeneration if the regeneration temperature has not been reached within five minutes of initiating an active regeneration event, or if the regeneration temperature cannot be sustained for the duration of the regeneration event. As an alternative to these specific malfunction criteria, the manufacturer may employ different criteria. To do so, the manufacturer must submit a description with supporting data, subject to Administrator approval, of their DPF regeneration monitoring strategy. The Administrator will consider the strategy's equivalence to the specific criteria stated in this paragraph when considering the request. Also as an alternative to these specific malfunction criteria, the manufacturer may employ an OBD monitor that detects a catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.5 times the applicable NMHC emission standard but must adjust emission test results pursuant to paragraph (f)(2) of this section. For catalysts located downstream of a DPF and used to convert NMHC emissions during DPF regeneration, the OBD system must detect a malfunction when the catalyst has no detectable amount of NMHC conversion capability unless the manufacturer can demonstrate that deterioration or malfunction of the catalyst will not result in emissions that exceed the applicable NMHC standard.

(iii) *NMHC converting catalyst monitoring conditions*. The manufacturer must define the monitoring conditions for malfunctions identified in paragraphs (g)(5)(ii)(A) and (g)(5)(ii)(B) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraphs (g)(5)(ii)(A) and (g)(5)(ii)(B) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv) *NMHC converting catalyst MIL activation and DTC storage*. The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section. The monitoring method for the NMHC converting catalyst(s) must be capable of detecting all instances, except diagnostic self-clearing, when a catalyst DTC has been erased but the catalyst has not been replaced (e.g., catalyst over-temperature histogram approaches are not acceptable).

(6) *Selective catalytic reduction (SCR) and lean NO_X catalyst monitoring*.

(i) *General*. The OBD system must monitor the SCR and/or the lean NO_X converting catalyst(s) for proper conversion capability. For engines equipped with SCR systems or other catalyst systems that use an active/intrusive reductant injection (e.g., active lean NO_X catalysts that use diesel fuel post-injection or in-exhaust injection), the OBD system must monitor the active/intrusive reductant injection system for proper performance. The individual electronic components (e.g., actuators, valves, sensors, heaters, pumps) in the active/intrusive reductant injection system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section. For purposes of this paragraph (g)(6), each catalyst that converts NO_X must be monitored either individually or in combination with others.

(ii) *SCR and lean NO_X catalyst malfunction criteria*.

(A) *SCR and lean NO_X catalyst conversion efficiency*. The OBD system must detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the emissions thresholds for NO_X aftertreatment systems as shown in Table 1 of this paragraph (g). If no failure or deterioration of the catalyst NO_X conversion capability could result in an engine's emissions exceeding any of the applicable emissions thresholds, the OBD system must detect a malfunction when the catalyst has no detectable amount of NO_X conversion capability.

(B) *SCR and lean NO_X catalyst active/intrusive reductant delivery performance*. The OBD system must detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed any of the applicable emissions thresholds for NO_X aftertreatment systems as shown in Table 1 of this paragraph (g). If no failure or deterioration of the reductant delivery system could result in an engine's emissions exceeding any of the applicable thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(C) *SCR and lean NO_X catalyst active/intrusive reductant quantity*. If the SCR or lean NO_X catalyst system uses a reductant other than the fuel used for the engine, or uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system must detect a malfunction when there is no longer sufficient reductant available (e.g., the reductant tank is empty).

(D) *SCR and lean NO_X catalyst active/intrusive reductant quality*. If the SCR or lean NO_X catalyst system uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system must detect a malfunction when an improper reductant is used in the reductant reservoir/tank (e.g., the reductant tank is filled with something other than the reductant).

(E) *SCR and lean NO_X catalyst active/intrusive reductant feedback control*. See paragraph (i)(6) of this section.

(iii) *SCR and lean NO_X catalyst monitoring conditions*.

(A) The manufacturers must define the monitoring conditions for malfunctions identified in paragraphs (g)(6)(ii)(A) and (g)(6)(ii)(D) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(6)(ii)(A) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(B) The OBD system must monitor continuously for malfunctions identified in paragraphs (g)(6)(ii)(B), (g)(6)(ii)(C), and (g)(6)(ii)(E) of this section.

(iv) *SCR and lean NO_X catalyst MIL activation and DTC storage*.

(A) For malfunctions identified in paragraph (g)(6)(ii)(A) of this section, the MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(B) For malfunctions identified in paragraphs (g)(6)(ii)(B), (g)(6)(ii)(C), and (g)(6)(ii)(D) of this section, the manufacturer may delay activating the MIL if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of the malfunction. The alternative indicator must be of sufficient illumination and be located such that it is readily visible to the vehicle operator under all lighting conditions. If the vehicle is not equipped with such an alternative indicator and the OBD MIL activates, the MIL may be immediately deactivated and the corresponding DTC(s) erased once the OBD system has verified that the reductant tank has been refilled properly and the MIL has not been activated for any other malfunction. The Administrator may approve other strategies that provide equivalent assurance that a vehicle operator would be promptly notified and that corrective action would be taken.

(C) The monitoring method for the SCR and lean NO_X catalyst(s) must be capable of detecting all instances, except diagnostic self-clearing, when a catalyst DTC(s) has been erased but the catalyst has not been replaced (*e.g.*, catalyst over-temperature histogram approaches are not acceptable).

(7) *NO_X adsorber system monitoring.*

(i) *General.* The OBD system must monitor the NO_X adsorber on engines so-equipped for proper performance. For engines equipped with active/intrusive injection (e.g., in-exhaust fuel and/or air injection) to achieve desorption of the NO_X adsorber, the OBD system must monitor the active/intrusive injection system for proper performance. The individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section.

(ii) *NO_X adsorber system malfunction criteria.*

(A) *NO_X adsorber system capability.* The OBD system must detect a NO_X adsorber malfunction when its capability (i.e., its combined adsorption and conversion capability) decreases to the point that would cause an engine's NO_X emissions to exceed the emissions thresholds for NO_X aftertreatment systems as shown in Table 1 of this paragraph (g). If no failure or deterioration of the NO_X adsorber capability could result in an engine's NO_X emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has no detectable amount of NO_X adsorber capability.

(B) *NO_X adsorber system active/intrusive reductant delivery performance.* For NO_X adsorber systems that use active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve desorption of the NO_X adsorber, the OBD system must detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve desorption of the NO_X adsorber.

(C) *NO_X adsorber system feedback control.* Malfunction criteria for the NO_X adsorber and the NO_X adsorber active/instrusive reductant delivery system are contained in paragraph (i)(6) of this section.

(iii) *NO_X adsorber system monitoring conditions.*

(A) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(7)(ii)(A) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(7)(ii)(A) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(B) The OBD system must monitor continuously for malfunctions identified in paragraphs (g)(7)(ii)(B) and (g)(7)(ii)(C) of this section.

(iv) *NO_X adsorber system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(8) *Diesel particulate filter (DPF) system monitoring.*

(i) *General.* The OBD system must monitor the DPF on engines so-equipped for proper performance. For engines equipped with active regeneration systems that use an active/intrusive injection (*e.g.*, in-exhaust fuel injection, in-exhaust fuel/air burner), the OBD system must monitor the active/intrusive injection system for proper performance. The individual electronic components (*e.g.*, injectors, valves, sensors) that are used in the active/intrusive injection system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section.

(ii) *DPF system malfunction criteria.*

(A) *DPF filtering performance.* The OBD system must detect a malfunction prior to a decrease in the PM filtering capability of the DPF (e.g., cracking, melting, etc.) that would cause an engine's PM emissions to exceed the emissions thresholds for DPF systems as shown in Table 1 of this paragraph (g). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when no detectable amount of PM filtering occurs. As an alternative to a threshold monitor, the OBD system, on model year 2010 through 2012 engines only, can be designed to detect a malfunction based on a detectable decrease in the expected pressure drop across the DPF for a period of 5 seconds or more. The monitoring area for this alternative is determined using engine speed and load points defined in test cycles and procedures for the supplemental emissions test (SET) under § 86.1360–2007. The monitoring area shall include all engine speed and load points greater than a region bounded by a line connecting mode numbers 2, 6, 3, and 13 (i.e. A100, A75, B50, and C50). At engine speeds greater than ''speed C'', the monitor shall run whenever engine load is greater than 50%. For purposes of this paragraph, the detectable change in pressure drop is determined by operating the engine at the B50 engine speed and load point (as described in the SET test procedures), observing the pressure drop on a clean, nominal DPF, and multiplying the observed pressure drop by 0.5 or other factor supported by data and approved by the Administrator. The detectable change in pressure drop shall be reported in units of kilopascals (kPa). At time of certification, manufacturers shall provide the detectable change in pressure drop value along with OBD data stream parameters recorded with a clean DPF under the following nine engine speed/load operating points of the SET: A50, A75, A100, B50, B75, B100, C50, C75, and C100. The OBD data stream pararmeters to be reported are described in (k)(4)(ii) of this section and shall include the following: Engine speed; calculated load; air flow rate from mass air flow sensor (if so equipped); fuel rate; and DPF delta pressure.

(B) *DPF regeneration frequency.* The OBD system must detect a malfunction when the DPF regeneration frequency increases from (*i.e.*, occurs more often than) the manufacturer's specified regeneration frequency to a level such that it would cause an engine's NMHC emissions to exceed the emissions threshold for DPF systems as shown in Table 1 of this paragraph (g). If no such regeneration frequency exists that could cause NMHC emissions to exceed the applicable emission threshold, the OBD system must detect a malfunction when the DPF regeneration frequency exceeds the manufacturer's specified design limits for allowable regeneration frequency.

(C) *DPF incomplete regeneration.* The OBD system must detect a regeneration malfunction when the DPF does not properly regenerate under manufacturer-defined conditions where regeneration is designed to occur.

(D) *DPF missing substrate.* The OBD system must detect a malfunction if either the DPF substrate is completely destroyed, removed, or missing, or if the DPF assembly has been replaced with a muffler or straight pipe.

(E) *DPF system active/intrusive injection.* For DPF systems that use active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve regeneration of the DPF, the OBD system must detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve regeneration of the DPF.

(F) *DPF regeneration feedback control.* See paragraph (i)(6) of this section.

(iii) *DPF monitoring conditions.* The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (g)(8)(ii) of this section in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section. For OBD systems designed to the alternative malfunction criteria of paragraph (g)(8)(ii)(A) of this section, the alternative DPF monitor shall run continuously whenever engine speed and load conditions are within the monitoring area described in paragraph (g)(8)(ii)(A). The OBD system may make a malfunction or potential malfunction determination during any successful monitoring event but shall include in the enable criteria of any subsequent monitoring events a confirmed successful and complete DPF regeneration. The subsequent monitoring events must be conducted within an operating period that ensures that the detected malfunction has not ''healed'' due to trapped particulates in the compromised portion of the DPF substrate. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(8)(ii) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv)*DPF system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(9) *Exhaust gas sensor and sensor heater monitoring.*

(i) *General.* The OBD system must monitor for proper output signal, activity, response rate, and any other parameter that can affect emissions, all exhaust gas sensors (e.g., oxygen, air-fuel ratio, NO_X) used for emission control system feedback (e.g., EGR control/feedback, SCR control/feedback, NO_X adsorber control/feedback) and/or as a monitoring device. For engines equipped with heated exhaust gas sensors, the OBD system must monitor the heater for proper performance.

(ii) *Malfunction criteria for air-fuel ratio sensors located upstream of aftertreatment devices.*

(A)*Sensor performance.* The OBD system must detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g).

(B) *Circuit integrity.* The OBD system must detect malfunctions of the sensor related to a lack of circuit continuity or signal out-of-range values.

(C) *Feedback function.* The OBD system must detect a malfunction of the sensor if the emission control system (e.g., EGR, SCR, or NO_X adsorber) is unable to use that sensor as a feedback input (e.g., causes limp-home or open-loop operation).

(D) *Monitoring function.* To the extent feasible, the OBD system must detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NO_X adsorber monitoring).

(iii) *Malfunction criteria for air-fuel ratio sensors located downstream of aftertreatment devices.*

(A) *Sensor performance.* The OBD system must detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed the emissions thresholds for air-fuel ratio sensors downstream of aftertreatment devices as shown in Table 1 of this paragraph (g).

(B) *Circuit integrity.* The OBD system must detect malfunctions of the sensor related to a lack of circuit continuity or signal out-of-range values.

(C) *Feedback function.* The OBD system must detect a malfunction of the sensor if the emission control system (e.g., EGR, SCR, or NO_X absorber) is unable to use that sensor as a feedback input (e.g., causes limp-home or open-loop operation).

(D) *Monitoring function.* To the extent feasible, the OBD system must detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NO_X absorber monitoring).

(iv) *Malfunction criteria for* NO_X *sensors.*

(A) *Sensor performance.* The OBD system must detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed the emissions thresholds for NO_X sensors as shown in Table 1 of this paragraph (g).

(B) *Circuit integrity.* The OBD system must detect malfunctions of the sensor related to a lack of circuit continuity or signal out-of-range values.

(C) *Feedback function.* The OBD system must detect a malfunction of the sensor if the emission control system (*e.g.*, EGR, SCR, or NO_X adsorber) is unable to use that sensor as a feedback input (*e.g.*, causes limp-home or open-loop operation).

(D) *Monitoring function.* To the extent feasible, the OBD system must detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (*e.g.*, for catalyst, EGR, SCR, or NO_X adsorber monitoring).

(v) *Malfunction criteria for other exhaust gas sensors.* For other exhaust gas sensors, the manufacturer must submit a monitoring plan to the Administrator for approval. The plan must include data and/or engineering evaluations that demonstrate that the monitoring plan is as reliable and effective as the monitoring required in paragraphs (g)(9)(ii), (g)(9)(iii), (g)(9)(iv) of this section.

(vi) *Malfunction criteria for exhaust gas sensor heaters.*

(A) The OBD system must detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (*i.e.*, within the criteria required to be met by the component vendor for heater circuit performance at high mileage). The manufacturer may use other malfunction criteria for heater performance malfunctions. To do so, the manufacturer must be able to demonstrate via data and/or an engineering evaluation that the monitor is reliable and robust.

(B) The OBD system must detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (*e.g.*, shorted to 12 Volts when commanded to 0 Volts (ground)).

(vii) *Monitoring conditions for exhaust gas sensors.*

(A) The manufacturer must define the monitoring conditions for malfunctions identified in paragraphs (g)(9)(ii)(A), (g)(9)(iii)(A), and (g)(9)(iv)(A) of this section (*i.e.*, sensor performance) in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraphs (g)(9)(ii)(A), (g)(9)(iii)(A), and (g)(9)(iv)(A) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(B) The manufacturer must define the monitoring conditions for malfunctions identified in paragraphs (g)(9)(ii)(D), (g)(9)(iii)(D), and (g)(9)(iv)(D) of this section (*i.e.*, monitoring function) in accordance with paragraphs (c) and (d) of this section with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section.

(C) Except as provided for in paragraph (g)(9)(vii)(D) of this section, the OBD system must monitor continuously for malfunctions identified in paragraphs (g)(9)(ii)(B), (g)(9)(ii)(C), (g)(9)(iii)(B), (g)(9)(iii)(C), (g)(9)(iv)(B), (g)(9)(iv)(C) of this section (*i.e.*, circuit integrity and feedback function).

(D) A manufacturer may request approval to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (*e.g.*, disable monitoring for out-of-range on the low side during fuel cut conditions). To do so, the manufacturer must demonstrate via data and/or engineering analyses that a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false malfunction detection.

(viii) *Monitoring conditions for exhaust gas sensor heaters.*

(A) The manufacturer must define monitoring conditions for malfunctions identified in paragraph (g)(9)(vi)(A) of this section (*i.e.*, sensor heater performance) in accordance with paragraphs (c) and (d) of this section.

(B) The OBD system must monitor continuously for malfunctions identified in paragraph (g)(9)(vi)(B) of this section (*i.e.*, circuit malfunctions).

(ix) *Exhaust gas sensor and sensor heater MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(10) *Variable Valve Timing (VVT) system monitoring.*

(i) *General.* The OBD system must monitor the VVT system on engines so equipped for target error and slow response malfunctions. The individual electronic components (*e.g.*, actuators, valves, sensors) that are used in the VVT system must be monitored in accordance with the comprehensive components requirements in paragraph (i)(3) of this section.

(ii) *VVT system malfunction criteria.*

(A) *VVT system target error.* The OBD system must detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's emissions to exceed the emission thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g).

(B) *VVT slow response.* The OBD system must detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's emissions to exceed the emission thresholds for ''other monitors'' as shown in Table 1 of this paragraph (g).

(C) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding the applicable emissions thresholds of paragraphs (g)(10)(ii)(A) and (g)(10)(ii)(B) of this section, the OBD system must detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(iii) *VVT system monitoring conditions.* Manufacturers must define the monitoring conditions for VVT system malfunctions identified in paragraph (g)(10)(ii) of this section in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (g)(10)(ii) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv) *VVT MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(h) *OBD monitoring requirements for gasoline-fueled/spark-ignition engines.* The following table shows the thresholds at which point certain components or systems, as specified in this paragraph (h), are considered malfunctioning.

TABLE 2—OBD EMISSIONS THRESHOLDS FOR GASOLINE-FUELED/SPARK-IGNITION ENGINES MEANT FOR PLACEMENT IN APPLICATIONS GREATER THAN 14,000 POUNDS GVWR (G/BHP-HR)

Component	NO_X	NMHC	CO	§ 86.010–18 reference
Catalyst system	1.75x std	1.75x std		(h)(6)
Evaporative emissions control system.		0.150 inch leak		(h)(7)
''Other monitors'' with emissions thresholds.	1.5x std	1.5x std	1.5x std	(h)(1), (h)(2), (h)(3), (h)(4), (h)(5), (h)(8), (h)(9)

Notes: 1.75x std means a multiple of 1.75 times the applicable emissions standard; these emissions thresholds apply to the monitoring requirements of paragraph (h) of this section; The evaporative emissions control system threshold is not, technically, an emissions threshold but rather a leak size that must be detected; nonetheless, for ease we refer to this as the threshold.

(1) *Fuel system monitoring.*

(i) *General.* The OBD system must monitor the fuel delivery system to determine its ability to provide compliance with emission standards.

(ii) *Fuel system malfunction criteria.*

(A) The OBD system must detect a malfunction of the fuel delivery system (including feedback control based on a secondary oxygen sensor) when the fuel delivery system is unable to maintain an engine's emissions at or below the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h).

(B) Except as provided for in paragraph (h)(1)(ii)(C) of this section, if the engine is equipped with adaptive feedback control, the OBD system must detect a malfunction when the adaptive feedback control has used up all of the adjustment allowed by the manufacturer.

(C) If the engine is equipped with feedback control that is based on a secondary oxygen (or equivalent) sensor, the OBD system is not required to detect a malfunction of the fuel system solely when the feedback control based on a secondary oxygen sensor has used up all of the adjustment allowed by the manufacturer. However, if a failure or deterioration results in engine emissions that exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h), the OBD system is required to detect a malfunction.

(D) The OBD system must detect a malfunction whenever the fuel control system fails to enter closed loop operation following engine start within a manufacturer specified time interval. The specified time interval must be supported by data and/or engineering analyses submitted by the manufacturer.

(E) The manufacturer may adjust the malfunction criteria and/or monitoring conditions to compensate for changes in altitude, for temporary introduction of large amounts of purge vapor, or for other similar identifiable operating conditions when such conditions occur.

(iii) *Fuel system monitoring conditions.* The fuel system must be monitored continuously for the presence of a malfunction.

(iv) *Fuel system MIL activation and DTC storage.*

(A) A pending DTC must be stored immediately upon the fuel system exceeding the malfunction criteria established in paragraph (h)(1)(ii) of this section.

(B) Except as provided for in paragraph (h)(1)(iv)(C) of this section, if a pending DTC is stored, the OBD system must activate the MIL immediately and store a MIL-on DTC if a malfunction is again detected during either the drive cycle immediately following storage of the pending DTC regardless of the conditions encountered during that drive cycle, or on the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored. Similar conditions means engine conditions having an engine speed within 375 rpm, load conditions within 20 percent, and the same warm-up status (i.e., cold or hot) as the engine conditions stored pursuant to paragraph (h)(1)(iv)(E) of this section. Other definitions of similar conditions may be used but must result in comparable timeliness and reliability in detecting similar engine operation.

(C) The pending DTC may be erased at the end of the next drive cycle in which similar conditions have been encountered without having again exceeded the specified fuel system malfunction criteria. The pending DTC may also be erased if similar conditions are not encountered during the 80 drive cycles immediately following detection of the potential malfunction for which the pending DTC was stored.

(D) Storage of freeze frame conditions. The OBD system must store and erase freeze frame conditions either in conjunction with storing and erasing a pending DTC or in conjunction with storing and erasing a MIL-on DTC. Freeze frame information associated with a fuel system malfunction shall be stored in preference to freeze frame information required elsewhere in paragraphs (h) or (i) of this section.

(E) Storage of fuel system conditions for determining similar conditions of operation. The OBD must store the engine speed, load, and warm-up status present at the time it first detects a potential malfunction meeting the criteria of paragraph (h)(1)(ii) of this section and stores a pending DTC.

(F) Deactivating the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without detecting a malfunction of the fuel system.

(2) *Engine misfire monitoring.*

(i) *General.*

(A) The OBD system must monitor the engine for misfire causing catalyst damage and misfire causing excess emissions.

(B) The OBD system must identify the specific cylinder that is misfiring. The manufacturer may store a general misfire DTC instead of a cylinder specific DTC under certain operating conditions. To do so, the manufacturer must submit data and/or engineering analyses that demonstrate that the misfiring cylinder cannot be identified reliably when the conditions occur.

(C) If more than one cylinder is misfiring, a separate DTC must be stored to indicate that multiple cylinders are misfiring unless otherwise allowed by this paragraph (h)(2). When identifying multiple cylinder misfire, the OBD system is not required to also identify using separate DTCs each of the misfiring cylinders individually. If more than 90 percent of the detected misfires occur in a single cylinder, an appropriate DTC may be stored that indicates the specific misfiring cylinder rather than storing the multiple cylinder misfire DTC. If two or more cylinders individually have more than 10 percent of the total number of detected misfires, a multiple cylinder DTC must be stored.

(ii) *Engine misfire malfunction criteria.*

(A) *Misfire causing catalyst damage.* The manufacturer must determine the percentage of misfire evaluated in 200 revolution increments for each engine speed and load condition that would result in a temperature that causes catalyst damage. If this percentage of misfire is exceeded, it shall be considered a malfunction that must be detected. For every engine speed and load condition for which this percentage of misfire is determined to be lower than five percent, the manufacturer may set the malfunction criteria at five percent. The manufacturer may use a longer interval than 200 revolutions but only for determining, on a given drive cycle, the first misfire exceedance as provided in paragraph (h)(2)(iv)(A) of this section. To do so, the manufacturer must demonstrate that the interval is not so long that catalyst damage would occur prior to the interval being elapsed.

(B) *Misfire causing emissions to exceed the applicable thresholds.* The manufacturer must determine the percentage of misfire evaluated in 1000 revolution increments that would cause emissions from an emissions durability demonstration engine to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h) if that percentage of misfire were present from the beginning of the test. If this percentage of misfire is exceeded, regardless of the pattern of misfire events (e.g., random, equally spaced, continuous), it shall be considered a malfunction that must be detected. To establish this percentage of misfire, the manufacturer must use misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent. The manufacturer may use a longer interval than 1000 revolutions. To do so, the manufacturer must demonstrate that the strategy would be equally effective and timely at detecting misfire.

(iii) *Engine misfire monitoring conditions.*

(A) The OBD system must monitor continuously for misfire under the following conditions: from no later than the end of the second crankshaft revolution after engine start; during the rise time and settling time for engine speed to reach the desired idle engine speed at engine start-up (i.e., ''flare-up'' and ''flare-down''); and, under all positive torque engine speeds and load conditions except within the engine operating region bound by the positive torque line (i.e., engine load with the transmission in neutral), and the points represented by an engine speed of 3000 rpm with the engine load at the positive torque line and the redline engine speed with the engine's manifold vacuum at four inches of mercury lower than that at the positive torque line. For this purpose, redline engine speed is defined as either the recommended maximum engine speed as displayed on the instrument panel tachometer, or the engine speed at which fuel shutoff occurs.

(B) If an OBD monitor cannot detect all misfire patterns under all required engine speed and load conditions as required by paragraph (h)(2)(iii)(A) of this section, the OBD system may still be acceptable. The Administrator will evaluate the following factors in making a determination: The magnitude of the region(s) in which misfire detection is limited; the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events); the frequency with which said region(s) are expected to be encountered in-use; the type of misfire patterns for which misfire detection is troublesome; and demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under the required conditions (i.e., compliance can be achieved on other engines). The evaluation will be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders; single cylinder continuous misfire; and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(C) The manufacturer may use monitoring system that has reduced misfire detection capability during the portion of the first 1000 revolutions after engine start that a cold start emission reduction strategy is active that reduces engine torque (e.g., spark retard strategies). To do so, the manufacturer must demonstrate that the probability of detection is greater than or equal to 75 percent during the worst case condition (i.e., lowest generated torque) for a vehicle operated continuously at idle (park/neutral idle) on a cold start between 50 and 86 degrees Fahrenheit and that the technology cannot reliably detect a higher percentage of the misfire events during the conditions.

(D) The manufacturer may disable misfire monitoring or use an alternative malfunction criterion when misfire cannot be distinguished from other effects. To do so, the manufacturer must demonstrate that the disablement interval or the period of use of an alternative malfunction criterion is limited only to that necessary for avoiding false detection and for one or more of the following operating conditions: Rough road; fuel cut; gear changes for manual transmission vehicles; traction control or other vehicle stability control activation such as anti-lock braking or other engine torque modifications to enhance vehicle stability; off-board control or intrusive activation of vehicle components or monitors during service or assembly plant testing; portions of intrusive evaporative system or EGR monitors that can significantly affect engine stability (i.e., while the purge valve is open during the vacuum pull-down of an evaporative system leak check but not while the purge valve is closed and the evaporative system is sealed or while an EGR monitor causes the EGR valve to be cycled intrusively on and off during positive torque conditions); or, engine speed, load, or torque transients due to throttle movements more rapid than those that occur over the FTP cycle for the worst case engine within each engine family. In general, the Administrator will not approve disablement for conditions involving normal air conditioning compressor cycling from on-to-off or off-to-on, automatic transmission gear shifts (except for shifts occurring during wide open throttle operation), transitions from idle to off-idle, normal engine speed or load changes that occur during the engine speed rise time and settling time (i.e., ''flare-up'' and ''flare-down'') immediately after engine starting without any vehicle operator-induced actions (e.g., throttle stabs), or excess acceleration (except for acceleration rates that exceed the maximum acceleration rate obtainable at wide open throttle while the vehicle is in gear due to abnormal conditions such as slipping of a clutch). The Administrator may approve misfire monitoring disablement or use of an alternate malfunction criterion for any other condition on a case by case basis upon determining that the manufacturer has demonstrated that the request is based on an unusual or unforeseen circumstance and that it is applying the best available computer and monitoring technology.

(E) For engines with more than eight cylinders that cannot meet the requirements of paragraph (h)(2)(iii)(A) of this section, a manufacturer may use alternative misfire monitoring conditions. Such use must be based on data and/or an engineering evaluation submitted by the manufacturer that demonstrate that misfire detection throughout the required operating region cannot be achieved when employing proven monitoring technology (i.e., a technology that provides for compliance with these requirements on other engines) and provided misfire is detected to the fullest extent permitted by the technology. However, the misfire detection system must still monitor during all positive torque operating conditions encountered during an FTP cycle.

(iv) *MIL activation and DTC storage for engine misfire causing catalyst damage.*

(A) *Pending DTCs.* A pending DTC must be stored immediately if, during a single drive cycle, the specified misfire percentage described in paragraph (h)(2)(ii)(A) of this section is exceeded three times when operating in the positive torque region encountered during a FTP cycle or is exceeded on a single occasion when operating at any other engine speed and load condition in the positive torque region defined in paragraph (h)(2)(iii)(A) of this section. Immediately after a pending DTC is stored pursuant to this paragraph, the MIL must blink once per second at all times during the drive cycle that engine misfire is occurring. The MIL may be deactivated during those times that misfire is not occurring. If, at the time that a catalyst damaging misfire malfunction occurs, the MIL is already activated for a malfunction other than misfire, the MIL must still blink once per second at all times during the drive cycle that engine misfire is occurring. If misfire ceases, the MIL must stop blinking but remain activated as appropriate in accordance with the other malfunction.

(B) *MIL-on DTCs.* If a pending DTC is stored in accordance with paragraph (h)(2)(iv)(A) of this section, the OBD system must immediately store a MIL-on DTC if the percentage of misfire described in paragraph (h)(2)(ii)(A) of this section is again exceeded one or more times during either the drive cycle immediately following storage of the pending DTC, regardless of the conditions encountered during that drive cycle, or on the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored. If, during a previous drive cycle, a pending DTC is stored in accordance with paragraph (h)(2)(iv)(A) of this section, a MIL-on DTC must be stored immediately upon exceeding the percentage misfire described in paragraph (h)(2)(ii)(A) of this section regardless of the conditions encountered. Upon storage of a MIL-on DTC, the MIL must blink once per second at all times during the drive cycle that engine misfire is occurring. If misfire ceases, the MIL must stop blinking but remain activated until the conditions are met for extinguishing the MIL.

(C) *Erasure of pending DTCs.* Pending DTCs stored in accordance with paragraph (h)(2)(iv)(A) of this section must be erased at the end of the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored provided no exceedances have been detected of the misfire percentage described in paragraph (h)(2)(ii)(A) of this section. The pending DTC may also be erased if similar conditions are not encountered during the next 80 drive cycles immediately following storage of the pending DTC.

(D) *Exemptions for engines with fuel shutoff and default fuel control.* In engines that provide for fuel shutoff and default fuel control to prevent over fueling during catalyst damaging misfire conditions, the MIL need not blink as required by paragraphs (h)(2)(iv)(A) and (h)(2)(iv)(B) of this section. Instead, the MIL may be activated continuously upon misfire detection provided that the fuel shutoff and default fuel control are activated immediately upon misfire detection. Fuel shutoff and default fuel control may be deactivated only when the engine is outside of the misfire range except that the manufacturer may periodically, but not more than once every 30 seconds, deactivate fuel shutoff and default fuel control to determine if the catalyst damaging misfire is still occurring. Normal fueling and fuel control may be resumed if the catalyst damaging misfire is no longer occurring.

(E) The manufacturer may use a strategy that activates the MIL continuously rather than blinking the MIL during extreme catalyst damage misfire conditions (i.e., catalyst damage misfire occurring at all engine speeds and loads). Use of such a strategy must be limited to catalyst damage misfire levels that cannot be avoided during reasonable driving conditions. To use such a strategy, the manufacturer must be able to demonstrate that the strategy will encourage operation of the vehicle in conditions that will minimize catalyst damage (e.g., at low engine speeds and loads).

(v) *MIL activation and DTC storage for engine misfire causing emissions to exceed applicable emissions thresholds.*

(A) Immediately upon detection, during the first 1000 revolutions after engine start of the misfire percentage described in paragraph (h)(2)(ii)(B) of this section, a pending DTC must be stored. If such a pending DTC is stored already and another such exceedance of the misfire percentage is detected within the first 1000 revolutions after engine start on any subsequent drive cycle, the MIL must activate and a MIL-on DTC must be stored. The pending DTC may be erased if, at the end of the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored, there has been no exceedance of the misfire percentage described in paragraph (h)(2)(ii)(B) of this section. The pending DTC may also be erased if similar conditions are not encountered during the next 80 drive cycles immediately following storage of the pending DTC.

(B) No later than the fourth detection during a single drive cycle, following the first 1000 revolutions after engine start of the misfire percentage described in paragraph (h)(2)(ii)(B) of this section, a pending DTC must be stored. If such a pending DTC is stored already, then the MIL must activate and a MIL-on DTC must be stored within 10 seconds of the fourth detection of the misfire percentage described in paragraph (h)(2)(ii)(B) of this section during either the drive cycle immediately following storage of the pending DTC, regardless of the conditions encountered during that drive cycle excepting those conditions within the first 1000 revolutions after engine start, or on the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored excepting those conditions within the first 1000 revolutions after engine start. The pending DTC may be erased if, at the end of the next drive cycle in which similar conditions are encountered to those that occurred when the pending DTC was stored, there has been no exceedance of the misfire percentage described in paragraph (h)(2)(ii)(B) of this section. The pending DTC may also be erased if similar conditions are not encountered during the next 80 drive cycles immediately following storage of the pending DTC.

(vi) *Storage of freeze frame conditions for engine misfire.*

(A) The OBD system must store and erase freeze frame conditions (as defined in paragraph (k)(4)(iii) of this section) either in conjunction with storing and erasing a pending DTC or in conjunction with storing and erasing a MIL-on DTC.

(B) If, upon storage of a DTC as required by paragraphs (h)(2)(iv) and (h)(2)(v) of this section, there already exist stored freeze frame conditions for a malfunction other than a misfire or fuel system malfunction (see paragraph (h)(1) of this section) then the stored freeze frame information shall be replaced with freeze frame information associated with the misfire malfunction.

(vii) *Storage of engine conditions in association with engine misfire.* Upon detection of the misfire percentages described in paragraphs (h)(2)(ii)(A) and (h)(2)(ii)(B) of this section, the following engine conditions must be stored for use in determining similar conditions: Engine speed, load, and warm up status of the first misfire event that resulted in pending DTC storage.

(viii) *MIL deactivation in association with engine misfire.* The MIL may be deactivated after three sequential drive cycles in which similar conditions have been encountered without an exceedance of the misfire percentages described in paragraphs (h)(2)(ii)(A) and (h)(2)(ii)(B) of this section.

(3) *Exhaust gas recirculation system monitoring.*

(i) *General.* The OBD system must monitor the EGR system on engines so equipped for low and high flow rate malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section.

(ii) *EGR system malfunction criteria.*

(A) The OBD system must detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h). For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has no detectable amount of EGR flow.

(B) The OBD system must detect a malfunction of the EGR system prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h). For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when the system has reached its control limits such that it cannot reduce EGR flow.

(iii) *EGR system monitoring conditions.*

(A) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (h)(3)(ii) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required by paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (h)(3)(ii) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(B) The manufacturer may disable temporarily the EGR monitor under conditions when monitoring may not be reliable (e.g., when freezing may affect performance of the system). To do so, the manufacturer must be able to demonstrate that the monitor is unreliable when such conditions exist.

(iv) *EGR system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(4) *Cold start emission reduction strategy monitoring.*

(i) *General.* If an engine incorporates a specific engine control strategy to reduce cold start emissions, the OBD system must monitor the key components (e.g., idle air control valve), other than secondary air, while the control strategy is active to ensure proper operation of the control strategy.

(ii) *Cold start strategy malfunction criteria.*

(A) The OBD system must detect a malfunction prior to any failure or deterioration of the individual components associated with the cold start emission reduction control strategy that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h). The manufacturer must establish the malfunction criteria based on data from one or more representative engine(s) and provide an engineering evaluation for establishing the malfunction criteria for the remainder of the manufacturer's product line.

(B) Where no failure or deterioration of a component used for the cold start emission reduction strategy could result in an engine's emissions exceeding the applicable emissions thresholds, the individual component must be monitored for proper functional response while the control strategy is active in accordance with the malfunction criteria in paragraphs (i)(3)(ii) and (i)(3)(iii) of this section.

(iii) *Cold start strategy monitoring conditions.* The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(4)(ii) of this section in accordance with paragraphs (c) and (d) of this section.

(iv) *Cold start strategy MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(5) *Secondary air system monitoring.*

(i) *General.* The OBD system on engines equipped with any form of secondary air delivery system must monitor the proper functioning of the secondary air delivery system including all air switching valve(s). The individual electronic components (e.g., actuators, valves, sensors) that are used in the secondary air system must be monitored in accordance with the comprehensive component requirements in paragraph (i)(3) of this section. For purposes of this paragraph (h)(5), ''air flow'' is defined as the air flow delivered by the secondary air system to the exhaust system. For engines using secondary air systems with multiple air flow paths/distribution points, the air flow to each bank (i.e., a group of cylinders that share a common exhaust manifold, catalyst, and control sensor) must be monitored in accordance with the malfunction criteria in paragraph (h)(5)(ii) of this section. Also for purposes of this paragraph (h)(5), ''normal operation'' is defined as the condition when the secondary air system is activated during catalyst and/or engine warm-up following engine start. ''Normal operation'' does not include the condition when the secondary air system is turned on intrusively for the sole purpose of monitoring.

(ii) *Secondary air system malfunction criteria.*

(A) Except as provided in paragraph (h)(5)(ii)(C) of this section, the OBD system must detect a secondary air system malfunction prior to a decrease from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h).

(B) Except as provided in paragraph (h)(5)(ii)(C) of this section, the OBD system must detect a secondary air system malfunction prior to an increase from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h).

(C) For engines in which no deterioration or failure of the secondary air system would result in an engine's emissions exceeding the applicable emissions thresholds, the OBD system must detect a malfunction when no detectable amount of air flow is delivered by the secondary air system during normal operation.

(iii) *Secondary air system monitoring conditions.* The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(5)(ii) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required by paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (h)(5)(ii) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv) *Secondary air system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(6) *Catalyst system monitoring.*

(i) *General.* The OBD system must monitor the catalyst system for proper conversion capability.

(ii) *Catalyst system malfunction criteria.* The OBD system must detect a catalyst system malfunction when the catalyst system's conversion capability decreases to the point that emissions exceed the emissions thresholds for the catalyst system as shown in Table 2 of this paragraph (h).

(iii) *Catalyst system monitoring conditions.* The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(6)(ii) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required by paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (h)(6)(ii) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv) *Catalyst system MIL activation and DTC storage.*

(A) The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(B) The monitoring method for the catalyst system must be capable of detecting when a catalyst DTC has been erased (except OBD system self erasure), but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(7) *Evaporative system monitoring.*

(i) *General.* The OBD system must verify purge flow from the evaporative system and monitor the complete evaporative system, excluding the tubing and connections between the purge valve and the intake manifold, for vapor leaks to the atmosphere. Individual components of the evaporative system (e.g. valves, sensors) must be monitored in accordance with the comprehensive components requirements in paragraph (i)(3) of this section.

(ii) *Evaporative system malfunction criteria.*

(A) *Purge monitor.* The OBD system must detect an evaporative system malfunction when no purge flow from the evaporative system to the engine can be detected by the OBD system.

(B) *Leak monitor.* The OBD system must detect an evaporative system malfunction when the complete evaporative system contains a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.150 inch diameter hole.

(C) The manufacturer may demonstrate that detection of a larger hole is more appropriate than that specified in paragraph (h)(7)(ii)(B) of this section. To do so, the manufacturer must demonstrate through data and/or engineering analyses that holes smaller than the proposed detection size would not result in evaporative or running loss emissions that exceed 1.5 times the applicable evaporative emissions standards. Upon such a demonstration, the proposed detection size could be substituted for the requirement of paragraph (h)(7)(ii)(B) of this section.

(iii) *Evaporative system monitoring conditions.*

(A) The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(7)(ii)(A) of this section in accordance with paragraphs (c) and (d) of this section.

(B) The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(7)(ii)(B) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required by paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (h)(7)(ii)(B) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(C) The manufacturer may disable or abort an evaporative system monitor when the fuel tank level is over 85 percent of nominal tank capacity or during a refueling event.

(D) The manufacturer may request Administrator approval to run the evaporative system monitor during only those drive cycles characterized as cold starts provided such a condition is needed to ensure reliable monitoring. In making the request, the manufacturer must demonstrate through data and/or engineering analyses that a reliable monitor can only be run on drive cycles that begin with a specific set of cold start criteria. A set of cold start criteria based solely on ambient temperature exceeding engine coolant temperature will not be acceptable.

(E) The OBD system may disable temporarily the evaporative purge system to run an evaporative system leak monitor.

(iv) *Evaporative system MIL activation and DTC storage.*

(A) Except as provided for in paragraph (h)(7)(iv)(B) of this section, the MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(B) If the OBD system is capable of discerning that a system leak is being caused by a missing or improperly secured gas cap, the OBD system need not activate the MIL or store a DTC provided the vehicle is equipped with an alternative indicator for notifying the operator of the gas cap problem. The alternative indicator must be of sufficient illumination and location to be readily visible under all lighting conditions. If the vehicle is not equipped with such an alternative indicator, the MIL must activate and a DTC be stored as required in paragraph (h)(7)(iv)(A) of this section; however, these may be deactivated and erased, respectively, if the OBD system determines that the gas cap problem has been corrected and the MIL has not been activated for any other malfunction. The Administrator may approve other strategies that provide equivalent assurance that a vehicle operator will be notified promptly of a missing or improperly secured gas cap and that corrective action will be undertaken.

(8) *Exhaust gas sensor monitoring.*

(i) *General.*

(A) The OBD system must monitor for malfunctions the output signal, response rate, and any other parameter that can affect emissions of all primary (i.e., fuel control) exhaust gas sensors (e.g., oxygen, wide-range air/fuel). Both the lean-to-rich and rich-to-lean response rates must be monitored.

(B) The OBD system must also monitor all secondary exhaust gas sensors (those used for secondary fuel trim control or as a monitoring device) for proper output signal, activity, and response rate.

(C) For engines equipped with heated exhaust gas sensor, the OBD system must monitor the heater for proper performance.

(ii) *Primary exhaust gas sensor malfunction criteria.*

(A) The OBD system must detect a malfunction prior to any failure or deterioration of the exhaust gas sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) (including drift or bias corrected for by secondary sensors) that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h).

(B) The OBD system must detect malfunctions of the exhaust gas sensor caused by either a lack of circuit continuity or out-of-range values.

(C) The OBD system must detect a malfunction of the exhaust gas sensor when a sensor failure or deterioration causes the fuel system to stop using that sensor as a feedback input (e.g., causes default or open-loop operation).

(D) The OBD system must detect a malfunction of the exhaust gas sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring).

(iii) *Secondary exhaust gas sensor malfunction criteria.*

(A) The OBD system must detect a malfunction prior to any failure or deterioration of the exhaust gas sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed the emissions thresholds for ''other monitors'' as shown in Table 2 of this paragraph (h).

(B) The OBD system must detect malfunctions of the exhaust gas sensor caused by a lack of circuit continuity.

(C) To the extent feasible, the OBD system must detect a malfunction of the exhaust gas sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring).

(D) The OBD system must detect malfunctions of the exhaust gas sensor caused by out-of-range values.

(E) The OBD system must detect a malfunction of the exhaust gas sensor when a sensor failure or deterioration causes the fuel system (e.g., fuel control) to stop using that sensor as a feedback input (e.g., causes default or open-loop operation).

(iv) *Exhaust gas sensor heater malfunction criteria.*

(A) The OBD system must detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Other malfunction criteria for heater performance malfunctions may be used upon demonstrating via data or engineering analyses that the monitoring reliability and timeliness is equivalent to the stated criteria in this paragraph (h)(8)(iv)(A).

(B) The OBD system must detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

(v) *Primary exhaust gas sensor monitoring conditions.*

(A) The manufacturer must define monitoring conditions for malfunctions identified in paragraphs (h)(8)(ii)(A) and (h)(8)(ii)(D) of this section in accordance with paragraphs (c) and (d) of this section. For purposes of tracking and reporting as required by paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraphs (h)(8)(ii)(A) and (h)(8)(ii)(D) of this section must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(B) Except as provided for in paragraph (h)(8)(v)(C) of this section, monitoring for malfunctions identified in paragraphs (h)(8)(ii)(B) and (h)(8)(ii)(C) of this section must be conducted continuously.

(C) The manufacturer may disable continuous primary exhaust gas sensor monitoring when a primary exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). To do so, the manufacturer must demonstrate via data or engineering analyses that a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(vi) *Secondary exhaust gas sensor monitoring conditions.*

(A) The manufacturer must define monitoring conditions for malfunctions identified in paragraphs (h)(8)(iii)(A) through (h)(8)(iii)(C) of this section in accordance with paragraphs (c) and (d) of this section.

(B) Except as provided for in paragraph (h)(8)(vi)(C) of this section, monitoring for malfunctions identified in paragraphs (h)(8)(iii)(D) and (h)(8)(iii)(E) of this section must be conducted continuously.

(C) The manufacturer may disable continuous secondary exhaust gas sensor monitoring when a secondary exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). To do so, the manufacturer must demonstrate via data or engineering analyses that a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(vii) *Exhaust gas sensor heater monitoring conditions.*

(A) The manufacturer must define monitoring conditions for malfunctions identified in paragraph (h)(8)(iv)(A) of this section in accordance with paragraphs (c) and (d) of this section.

(B) Monitoring for malfunctions identified in paragraph (h)(8)(iv)(B) of this section must be conducted continuously.

(viii) *Exhaust gas sensor MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(9) *Variable valve timing (VVT) system monitoring.*

(i) *General.* The OBD system must monitor the VVT system on engines so equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the VVT system must be monitored in accordance with the comprehensive components requirements in paragraph (i)(3).

(ii) *VVT system malfunction criteria.*

(A) *VVT system target error.* The OBD system must detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's emissions to exceed the emission thresholds for "other monitors" as shown in Table 2 of this paragraph (h).

(B) *VVT slow response.* The OBD system must detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's emissions to exceed the emission thresholds for "other monitors" as shown in Table 2 of this paragraph (h).

(C) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding the applicable emissions thresholds of paragraphs (h)(9)(ii)(A) and (h)(9)(ii)(B) of this section, the OBD system must detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(iii) *VVT system monitoring conditions.* Manufacturers must define the monitoring conditions for VVT system malfunctions identified in paragraph (h)(9)(ii) in accordance with paragraphs (c) and (d) of this section, with the exception that monitoring must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section. For purposes of tracking and reporting as required in paragraph (d)(1) of this section, all monitors used to detect malfunctions identified in paragraph (h)(9)(ii) must be tracked separately but reported as a single set of values as specified in paragraph (e)(1)(iii) of this section.

(iv) *VVT MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(i) *OBD monitoring requirements for all engines.*

(1) *Engine cooling system monitoring.*

(i) *General.*

(A) The OBD system must monitor the thermostat on engines so equipped for proper operation.

(B) The OBD system must monitor the engine coolant temperature (ECT) sensor for electrical circuit continuity, out-of-range values, and rationality malfunctions.

(C) For engines that use a system other than the cooling system and ECT sensor (e.g., oil temperature, cylinder head temperature) to determine engine operating temperature for emission control purposes (e.g., to modify spark or fuel injection timing or quantity), the manufacturer may forego cooling system monitoring and instead monitor the components or systems used in their approach. To do so, the manufacturer must to submit data and/or engineering analyses that demonstrate that their monitoring plan is as reliable and effective as the monitoring required in this paragraph (i)(1).

(ii) *Malfunction criteria for the thermostat.*

(A) The OBD system must detect a thermostat malfunction if, within the manufacturer specified time interval following engine start, any of the following conditions occur: The coolant temperature does not reach the highest temperature required by the OBD system to enable other diagnostics; and, the coolant temperature does not reach a warmed-up temperature within 20 degrees Fahrenheit of the manufacturer's nominal thermostat regulating temperature. For the second of these two conditions, the manufacturer may use a lower temperature for this criterion if either the manufacturer can demonstrate that the fuel, spark timing, and/or other coolant temperature-based modification to the engine control strategies would not cause an emissions increase greater than or equal to 50 percent of any of the applicable emissions standards; or, ambient air temperature is between 20 degrees Fahrenheit and 50 degrees Fahrenheit in which case, upon Administrator approval, the minimum coolant temperature required to be reached may be decreased based on the ambient air temperature.

(B) With Administrator approval, the manufacturer may use alternative malfunction criteria to those of paragraph (i)(1)(ii)(A) of this section and/or alternative monitoring conditions to those of paragraph (i)(1)(iv) of this section that are a function of temperature at engine start on engines that do not reach the temperatures specified in the malfunction criteria when the thermostat is functioning properly. To do so, the manufacturer is required to submit data and/or engineering analyses that demonstrate that a properly operating system does not reach the specified temperatures and that the possibility is minimized for cooling system malfunctions to go undetected thus disabling other OBD monitors.

(C) The manufacturer may request Administrator approval to forego monitoring of the thermostat if the manufacturer can demonstrate that a malfunctioning thermostat cannot cause a measurable increase in emissions during any reasonable driving condition nor cause any disablement of other OBD monitors.

(iii) *Malfunction criteria for the ECT sensor.*

(A) *Circuit integrity.* The OBD system must detect malfunctions of the ECT sensor related to a lack of circuit continuity or out-of-range values.

(B) *Time to reach closed-loop/feedback enable temperature.* The OBD system must detect if, within the manufacturer specified time interval following engine start, the ECT sensor does not achieve the highest stabilized minimum temperature that is needed to initiate closed-loop/feedback control of all affected emission control systems (e.g., fuel system, EGR system). The manufacturer specified time interval must be a function of the engine coolant temperature and/or intake air temperature at startup. The manufacturer time interval must be supported by data and/or engineering analyses demonstrating that it provides robust monitoring and minimizes the likelihood of other OBD monitors being disabled. The manufacturer may forego the requirements of this paragraph (i)(1)(iii)(B) provided the manufacturer does not use engine coolant temperature or the ECT sensor to enable closed-loop/feedback control of any emission control systems.

(C) *Stuck in range below the highest minimum enable temperature.* To the extent feasible when using all available information, the OBD system must detect a malfunction if the ECT sensor inappropriately indicates a temperature below the highest minimum enable temperature required by the OBD system to enable other monitors (e.g., an OBD system that requires ECT to be greater than 140 degrees Fahrenheit to enable a diagnostic must detect malfunctions that cause the ECT sensor to inappropriately indicate a temperature below 140 degrees Fahrenheit). The manufacturer may forego this requirement for temperature regions in which the monitors required under paragraphs (i)(1)(ii) or (i)(1)(iii)(B) of this section will detect ECT sensor malfunctions as defined in this paragraph (i)(1)(iii)(C).

(D) *Stuck in range above the lowest maximum enable temperature.* The OBD system must detect a malfunction if the ECT sensor inappropriately indicates a temperature above the lowest maximum enable temperature required by the OBD system to enable other monitors (e.g., an OBD system that requires an engine coolant temperature less than 90 degrees Fahrenheit at startup prior to enabling an OBD monitor must detect malfunctions that cause the ECT sensor to indicate inappropriately a temperature above 90 degrees Fahrenheit). The manufacturer may forego this requirement within temperature regions in which the monitors required under paragraphs (i)(1)(ii), (i)(1)(iii)(B), (i)(1)(iii)(C) of this section will detect ECT sensor malfunctions as defined in this paragraph (i)(1)(iii)(D) or in which the MIL will be activated according to the provisions of paragraph (b)(2)(v) of this section. The manufacturer may also forego this monitoring within temperature regions where a temperature gauge on the instrument panel indicates a temperature in the "red zone" (engine overheating zone) and displays the same temperature information as used by the OBD system.

(iv) *Monitoring conditions for the thermostat.*

(A) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (i)(1)(ii)(A) of this section in accordance with paragraph (c) of this section. Additionally, except as provided for in paragraphs (i)(1)(iv)(B) and (i)(1)(iv)(C) of this section, monitoring for malfunctions identified in paragraph (i)(1)(ii)(A) of this section must be conducted once per drive cycle on every drive cycle in which the ECT sensor indicates, at engine start, a temperature lower than the temperature established as the malfunction criteria in paragraph (i)(1)(ii)(A) of this section.

(B) The manufacturer may disable thermostat monitoring at ambient engine start temperatures below 20 degrees Fahrenheit.

(C) The manufacturers may request Administrator approval to suspend or disable thermostat monitoring if the engine is subjected to conditions that could lead to false diagnosis. To do so, the manufacturer must submit data and/or engineering analyses that demonstrate that the suspension or disablement is necessary. In general, the manufacturer will not be allowed to suspend or disable the thermostat monitor on engine starts where the engine coolant temperature at engine start is more than 35 degrees Fahrenheit lower than the thermostat malfunction threshold temperature determined under paragraph (i)(1)(ii)(A) of this section.

(v) *Monitoring conditions for the ECT sensor.*

(A) Except as provided for in paragraph (i)(1)(v)(D) of this section, the OBD system must monitor continuously for malfunctions identified in paragraph monitoring for malfunctions identified in paragraph (i)(1)(iii)(A) of this section (i.e., circuit integrity and out-of-range).

(B) The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (i)(1)(iii)(B) of this section in accordance with paragraph (c) of this section. Additionally, except as provided for in paragraph (i)(1)(v)(D) of this section, monitoring for malfunctions identified in paragraph (i)(1)(iii)(B) of this section must be conducted once per drive cycle on every drive cycle in which the ECT sensor indicates a temperature lower than the closed-loop enable temperature at engine start (i.e., all engine start temperatures greater than the ECT sensor out-of-range low temperature and less than the closed-loop enable temperature).

(C) The manufacturer must define the monitoring conditions for malfunctions identified in paragraphs (i)(1)(iii)(C) and (i)(1)(iii)(D) of this section in accordance with paragraphs (c) and (d) of this section.

(D) The manufacturer may suspend or delay the monitor for the time to reach closed-loop enable temperature if the engine is subjected to conditions that could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 to 75 percent of the warm-up time).

(E) The manufacturer may request Administrator approval to disable continuous ECT sensor monitoring when an ECT sensor malfunction cannot be distinguished from other effects. To do so, the manufacturer must submit data and/or engineering analyses that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(vi) *Engine cooling system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(2) *Crankcase ventilation (CV) system monitoring.*

(i) *General.* The OBD system must monitor the CV system on engines so equipped for system integrity. Engines not required to be equipped with CV systems are exempt from monitoring the CV system. For diesel engines, the manufacturer must submit a plan for Administrator approval prior to OBD certification. That plan must include descriptions of the monitoring strategy, malfunction criteria, and monitoring conditions for CV system monitoring. The plan must demonstrate that the CV system monitor is of equivalent effectiveness, to the extent feasible, to the malfunction criteria and the monitoring conditions of this paragraph (i)(2).

(ii) *Crankcase ventilation system malfunction criteria.*

(A) For the purposes of this paragraph (i)(2), ''CV system'' is defined as any form of crankcase ventilation system, regardless of whether it utilizes positive pressure. ''CV valve'' is defined as any form of valve or orifice used to restrict or control crankcase vapor flow. Further, any additional external CV system tubing or hoses used to equalize crankcase pressure or to provide a ventilation path between various areas of the engine (e.g., crankcase and valve cover) are considered part of the CV system ''between the crankcase and the CV valve'' and subject to the malfunction criteria in paragraph (i)(2)(ii)(B) of this section.

(B) Except as provided for in paragraphs (i)(2)(ii)(C) through (i)(2)(ii)(E) of this section, the OBD system must detect a malfunction of the CV system when a disconnection of the system occurs between either the crankcase and the CV valve, or between the CV valve and the intake manifold.

(C) The manufacturer may forego monitoring for a disconnection between the crankcase and the CV valve provided the CV system is designed such that the CV valve is fastened directly to the crankcase such that it is significantly more difficult to remove the CV valve from the crankcase than to disconnect the line between the CV valve and the intake manifold (taking aging effects into consideration). To do so, the manufacturer must be able to provide data and/or an engineering evaluation demonstrating that the CV system is so designed.

(D) The manufacturer may forego monitoring for a disconnection between the crankcase and the CV valve provided the CV system is designed such that it uses tubing connections between the CV valve and the crankcase that are: resistant to deterioration or accidental disconnection; significantly more difficult to disconnect than is the line between the CV valve and the intake manifold; and, not subject to disconnection per the manufacturer's repair procedures for any non-CV system repair. To do so, the manufacturer must be able to provide data and/or engineering evaluation demonstrating that the CV system is so designed.

(E) The manufacturer may forego monitoring for a disconnection between the CV valve and the intake manifold provided the CV system is designed such that any disconnection either causes the engine to stall immediately during idle operation, or is unlikely to occur due to a CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses). To do so, the manufacturer must be able to provide data and/or an engineering evaluation demonstrating that the CV system is so designed.

(iii) *Crankcase ventilation system monitoring conditions.* The manufacturer must define the monitoring conditions for malfunctions identified in paragraph (i)(2) of this section in accordance with paragraphs (c) and (d) of this section.

(iv) *Crankcase ventilation system MIL activation and DTC storage.* The MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section. The stored DTC need not identify specifically the CV system (e.g., a DTC for idle speed control or fuel system monitoring can be stored) if the manufacturer can demonstrate that additional monitoring hardware is necessary to make such an identification and provided the manufacturer's diagnostic and repair procedures for the detected malfunction include directions to check the integrity of the CV system.

(3) *Comprehensive component monitoring.*

(i) *General.* Except as provided for in paragraph (i)(4) of this section, the OBD system must detect a malfunction of any electronic engine component or system not otherwise described in paragraphs (g), (h), (i)(1), and (i)(2) of this section that either provides input to (directly or indirectly, such components may include the crank angle sensor, knock sensor, throttle position sensor, cam position sensor, intake air temperature sensor, boost pressure sensor, manifold pressure sensor, mass air flow sensor, exhaust temperature sensor, exhaust pressure sensor, fuel pressure sensor, fuel composition sensor of a flexible fuel vehicle, etc.) or receives commands from (such components or systems may include the idle speed control system, glow plug system, variable length intake manifold runner systems, supercharger or turbocharger electronic components, heated fuel preparation systems, the wait-to-start lamp on diesel applications, the MIL, etc.) the onboard computer(s) and meets either of the criteria described in paragraphs (i)(3)(i)(A) and/or (i)(3)(i)(B) of this section. Note that, for the purposes of this paragraph (i)(3), ''electronic engine component or system'' does not include components that are driven by the engine and are not related to the control of the fueling, air handling, or emissions of the engine (e.g., PTO components, air conditioning system components, and power steering components).

(A) It can cause emissions to exceed applicable emission standards. To preclude monitoring, the manufacturer must be able to provide emission data showing that the component or system, when malfunctioning and installed on a suitable test engine, does not cause emissions to exceed the emission standards.

(B) It is used as part of the monitoring strategy for any other monitored system or component.

(ii) *Comprehensive component malfunction criteria for input components.*

(A) The OBD system must detect malfunctions of input components caused by a lack of circuit continuity and out-of-range values. In addition, where feasible, rationality checks must also be done and shall verify that a sensor output is neither inappropriately high nor inappropriately low (i.e., ''two-sided'' monitoring).

(B) To the extent feasible, the OBD system must separately detect and store different DTCs that distinguish rationality malfunctions from lack of circuit continuity and out-of-range malfunctions. For lack of circuit continuity and out-of-range malfunctions, the OBD system must, to the extent feasible, separately detect and store different DTCs for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). The OBD system is not required to store separate DTCs for lack of circuit continuity malfunctions that cannot be distinguished from other out-of-range circuit malfunctions.

(C) For input components that are used to activate alternative strategies that can affect emissions (e.g., AECDs, engine shutdown systems), the OBD system must conduct rationality checks to detect malfunctions that cause the system to activate erroneously or deactivate the alternative strategy. To the extent feasible when using all available information, the rationality check must detect a malfunction if the input component inappropriately indicates a value that activates or deactivates the alternative strategy. For example, for an alternative strategy that activates when the intake air temperature is greater than 120 degrees Fahrenheit, the OBD system must detect malfunctions that cause the intake air temperature sensor to indicate inappropriately a temperature above 120 degrees Fahrenheit.

(D) For engines that require precise alignment between the camshaft and the crankshaft, the OBD system must monitor the crankshaft position sensor(s) and camshaft position sensor(s) to verify proper alignment between the camshaft and crankshaft in addition to monitoring the sensors for circuit continuity and proper rationality. Proper alignment monitoring between a camshaft and a crankshaft is required only in cases where both are equipped with position sensors. For engines equipped with VVT systems and a timing belt or chain, the OBD system must detect a malfunction if the alignment between the camshaft and crankshaft is off by one or more cam/crank sprocket cogs (e.g., the timing belt/chain has slipped by one or more teeth/cogs). If a manufacturer demonstrates that a single tooth/cog misalignment cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system must detect a malfunction when the minimum number of teeth/cogs misalignment has occurred that does cause a measurable emission increase.

(iii) *Comprehensive component malfunction criteria for output components/systems*.

(A) The OBD system must detect a malfunction of an output component/system when proper functional response does not occur in response to computer commands. If such a functional check is not feasible, the OBD system must detect malfunctions of output components/systems caused by a lack of circuit continuity or circuit malfunction (e.g., short to ground or high voltage). For output component lack of circuit continuity malfunctions and circuit malfunctions, the OBD system is not required to store different DTCs for each distinct malfunction (e.g., open circuit, shorted low). Manufacturers are not required to activate an output component/system when it would not normally be active for the sole purpose of performing a functional check of it as required in this paragraph (i)(3).

(B) For gasoline engines, the idle control system must be monitored for proper functional response to computer commands. For gasoline engines using monitoring strategies based on deviation from target idle speed, a malfunction must be detected when either of the following conditions occurs: The idle speed control system cannot achieve the target idle speed within 200 revolutions per minute (rpm) above the target speed or 100 rpm below the target speed; or, the idle speed control system cannot achieve the target idle speed within the smallest engine speed tolerance range required by the OBD system to enable any other monitors. Regarding the former of these conditions, the manufacturer may use larger engine speed tolerances. To do so, the manufacturer must be able to provide data and/or engineering analyses that demonstrate that the tolerances can be exceeded without a malfunction being present.

(C) For diesel engines, the idle control system must be monitored for proper functional response to computer commands. For diesel engines, a malfunction must be detected when either of the following conditions occurs: the idle fuel control system cannot achieve the target idle speed or fuel injection quantity within +/−50 percent of the manufacturer-specified fuel quantity and engine speed tolerances; or, the idle fuel control system cannot achieve the target idle speed or fueling quantity within the smallest engine speed or fueling quantity tolerance range required by the OBD system to enable any other monitors.

(D) For model years 2010 through 2012, glow plugs must be monitored for circuit continuity malfunctions. For model years 2010 and later, intake air heater systems and, for model years 2013 and later, glow plugs must be monitored for proper functional response to computer commands and for circuit continuity malfunctions. The glow plug/intake air heater circuit(s) must be monitored for proper current and voltage drop. The manufacturer may use other monitoring strategies but must be able to provide data and/or engineering analyses that demonstrate reliable and timely detection of malfunctions. The OBD system must also detect a malfunction when a single glow plug no longer operates within the manufacturer's specified limits for normal operation. If a manufacturer can demonstrate that a single glow plug malfunction cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system must instead detect a malfunction when the number of glow plugs needed to cause an emission increase is malfunctioning. To the extent feasible, the stored DTC must identify the specific malfunctioning glow plug(s).

(E) The wait-to-start lamp circuit and the MIL circuit must be monitored for malfunctions that cause either lamp to fail to activate when commanded to do so (e.g., burned out bulb). This monitoring of the wait-to-start lamp circuit and the MIL circuit is not required for wait-to-start lamps and MILs using light-emitting diodes (LEDs).

(iv) *Monitoring conditions for input components*.

(A) The OBD system must monitor input components continuously for out-of-range values and circuit continuity. The manufacturer may disable continuous monitoring for circuit continuity and out-of-range values when a malfunction cannot be distinguished from other effects. To do so, the manufacturer must be able to provide data and/or engineering analyses that demonstrate that a properly functioning input component cannot be distinguished from a malfunctioning input component and that the disablement interval is limited only to that necessary for avoiding false malfunction detection.

(B) For input component rationality checks (where applicable), the manufacturer must define the monitoring conditions for detecting malfunctions in accordance with paragraphs (c) and (d) of this section, with the exception that rationality checks must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section.

(v) *Monitoring conditions for output components/systems*.

(A) The OBD system must monitor output components/systems continuously for circuit continuity and circuit malfunctions. The manufacturer may disable continuous monitoring for circuit continuity and circuit malfunctions when a malfunction cannot be distinguished from other effects. To do so, the manufacturer must be able to provide data and/or engineering analyses that demonstrate that a properly functioning output component/system cannot be distinguished from a malfunctioning one and that the disablement interval is limited only to that necessary for avoiding false malfunction detection.

(B) For output component/system functional checks, the manufacturer must define the monitoring conditions for detecting malfunctions in accordance with paragraphs (c) and (d) of this section. Specifically for the idle control system, the manufacturer must define the monitoring conditions for detecting malfunctions in accordance with paragraphs (c) and (d) of this section, with the exception that functional checks must occur every time the monitoring conditions are met during the drive cycle rather than once per drive cycle as required in paragraph (c)(2) of this section.

(vi) *Comprehensive component MIL activation and DTC storage*.

(A) Except as provided for in paragraphs (i)(3)(vi)(B) and (i)(3)(vi)(C) of this section, the MIL must activate and DTCs must be stored according to the provisions of paragraph (b) of this section.

(B) The MIL need not be activated in conjunction with storing a MIL-on DTC for any comprehensive component if: the component or system, when malfunctioning, could not cause engine emissions to increase by 15 percent or more of the applicable FTP standard during any reasonable driving condition; or, the component or system is not used as part of the monitoring strategy for any other system or component that is required to be monitored.

(C) The MIL need not be activated if a malfunction has been detected in the MIL circuit that prevents the MIL from activating (e.g., burned out bulb or light-emitting diode, LED). Nonetheless, the electronic MIL status (see paragraph (k)(4)(ii) of this section) must be reported as MIL commanded-on and a MIL-on DTC must be stored.

(4) *Other emission control system monitoring*.

(i) *General*. For other emission control systems that are either not addressed in paragraphs (g) through (i)(3) of this section (e.g., hydrocarbon traps, homogeneous charge compression ignition control systems), or addressed in paragraph (i)(3) of this section but not corrected or compensated for by an adaptive control system (e.g., swirl control valves), the manufacturer must submit a plan for Administrator approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production engine. The plan must demonstrate the effectiveness of the monitoring strategy, the malfunction criteria used, the monitoring conditions required by the monitor, and, if applicable, the determination that the requirements of paragraph (i)(4)(ii) of this section are satisfied.

(ii) For engines that use emission control systems that alter intake air flow or cylinder charge characteristics by actuating valve(s), flap(s), etc., in the intake air delivery system (e.g., swirl control valve systems), the manufacturer, in addition to meeting the requirements of paragraph (i)(4)(i) of this section, may elect to have the OBD system monitor the shaft to which all valves in one intake bank are physically attached rather than performing a functional check of the intake air flow, cylinder charge, or individual valve(s)/flap(s). For non-metal shafts or segmented shafts, the monitor must verify all shaft segments for proper functional response (e.g., by verifying that the segment or portion of the shaft farthest from the actuator functions properly). For systems that have more than one shaft to operate valves in multiple intake banks, the manufacturer is not required to add more than one set of detection hardware (e.g., sensor, switch) per intake bank to meet this requirement.

(5) *Exceptions to OBD monitoring requirements*.

(i) The Administrator may revise the PM filtering performance malfunction criteria for DPFs to exclude detection of specific failure modes such as partially melted substrates, if the most reliable monitoring method developed requires it.

(ii) The manufacturer may disable an OBD system monitor at ambient engine start temperatures below 20 degrees Fahrenheit (low ambient temperature conditions may be determined based on intake air or engine coolant temperature at engine start) or at elevations higher than 8,000 feet above sea level. To do so, the manufacturer must submit data and/or engineering analyses that demonstrate that monitoring is unreliable during the disable conditions. A manufacturer may request that an OBD system monitor be disabled at other ambient engine start temperatures by submitting data and/or engineering analyses demonstrating that misdiagnosis would occur at the given ambient temperatures due to their effect on the component itself (e.g., component freezing).

(iii) The manufacturer may disable an OBD system monitor when the fuel level is 15 percent or less of the nominal fuel tank capacity for those monitors that can be affected by low fuel level or running out of fuel (e.g., misfire detection). To do so, the manufacturer must submit data and/or engineering analyses that demonstrate that monitoring at the given fuel levels is unreliable, and that the OBD system is still able to detect a malfunction if the component(s) used to determine fuel level indicates erroneously a fuel level that causes the disablement.

(iv) The manufacturer may disable OBD monitors that can be affected by engine battery or system voltage levels.

(A) For an OBD monitor affected by low vehicle battery or system voltages, manufacturers may disable monitoring when the battery or system voltage is below 11.0 Volts. The manufacturer may use a voltage threshold higher than 11.0 Volts to disable monitors but must submit data and/or engineering analyses that demonstrate that monitoring at those voltages is unreliable and that either operation of a vehicle below the disablement criteria for extended periods of time is unlikely or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(B) For an OBD monitor affected by high engine battery or system voltages, the manufacturer may disable monitoring when the battery or system voltage exceeds a manufacturer-defined voltage. To do so, the manufacturer must submit data and/or engineering analyses that demonstrate that monitoring above the manufacturer-defined voltage is unreliable and that either the electrical charging system/alternator warning light will be activated (or voltage gauge would be in the ''red zone'') or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(v) The manufacturer may also disable affected OBD monitors in systems designed to accommodate the installation of power take off (PTO) units provided monitors are disabled only while the PTO unit is active and the OBD readiness status (see paragraph (k)(4)(i) of this section) is cleared by the onboard computer (i.e., all monitors set to indicate ''not complete'' or ''not ready'') while the PTO unit is activated. If monitors are so disabled and when the disablement ends, the readiness status may be restored to its state prior to PTO activation.

(6) *Feedback control system monitoring.* If the engine is equipped with feedback control of any of the systems covered in paragraphs (g), (h) and (i) of this section, then the OBD system must detect as malfunctions the conditions specified in this paragraph (i)(6) for each of the individual feedback controls.

(i) The OBD system must detect when the system fails to begin feedback control within a manufacturer specified time interval.

(ii) When any malfunction or deterioration causes open loop or limp-home operation.

(iii) When feedback control has used up all of the adjustment allowed by the manufacturer.

(iv) A manufacturer may temporarily disable monitoring for malfunctions specified in paragraph (i)(6)(iii) of this section during conditions that the specific monitor cannot distinguish robustly between a malfunctioning system and a properly operating system. To do so, the manufacturer is required to submit data and/or engineering analyses demonstrating that the individual feedback control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions while having used up all of the adjustment allowed by the manufacturer. In lieu of detecting, with a system specific monitor, the malfunctions specified in paragraphs (i)(6)(i) and (i)(6)(ii) of this section the OBD system may monitor the individual parameters or components that are used as inputs for individual feedback control systems provided that the monitors detect all malfunctions that meet the criteria of paragraphs (i)(6)(i) and (i)(6)(ii) of this section.

(j) *Production evaluation testing.*

(1) *Verification of Standardization Requirements.*

(i) For model years 2013 and later, the manufacturer must perform testing to verify that production vehicles meet the requirements of paragraphs (k)(3) and (k)(4) of this section relevant to the proper communication of required emissions-related messages to a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool.

(ii) *Selection of Test Vehicles.*

(A) The manufacturer must perform this testing every model year on ten unique production vehicles (i.e., engine rating and chassis application combination) per engine family. If there are less than ten unique production vehicles for a certain engine family, the manufacturer must test each unique production vehicle in that engine family. The manufacturer must perform this testing within either three months of the start of engine production or one month of the start of vehicle production, whichever is later. The manufacturer may request approval to group multiple production vehicles together and test one representative vehicle per group. To do so, the software and hardware designed to comply with the standardization requirements of paragraph (k)(1) of this section (e.g., communication protocol message timing, number of supported data stream parameters, engine and vehicle communication network architecture) in the representative vehicle must be identical to all others in the group and any differences in the production vehicles cannot be relevant with respect to meeting the criteria of paragraph (j)(1)(iv) of this section.

(B) For 2016 and subsequent model years, the required number of vehicles to be tested shall be reduced to five per engine family provided zero vehicles fail the testing required by paragraph (j)(1) of this section for two consecutive years.

(C) For 2019 and subsequent model years, the required number of vehicles to be tested shall be reduced to three per engine family provided zero vehicles fail the testing required by paragraph (j)(1) of this section for three consecutive years.

(D) The requirement for submittal of data from one or more of the production vehicles shall be waived if data have been submitted previously for all of the production vehicles. The manufacturer may request approval to carry over data collected in previous model years. To do so, the software and hardware designed to comply with the standardization requirements of paragraph (k)(1) of this section must be identical to the previous model year and there must not have been other hardware or software changes that affect compliance with the standardization requirements.

(iii) *Test equipment.* For the testing required by paragraph (j)(1) of this section, the manufacturer shall use an off-board device to conduct the testing. The manufacturer must be able to show that the off-board device is able to verify that the vehicles tested using the device are able to perform all of the required functions in paragraph (j)(1)(iv) of this section with any other off-board device designed and built in accordance with the SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) generic scan tool specifications.

(iv) *Required testing.* The testing must verify that communication can be established properly between all emission-related on-board computers and a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool designed to adhere strictly to the communication protocols allowed in paragraph (k)(3) of this section. The testing must also verify that all emission-related information is communicated properly between all emission-related on-board computers and a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool in accordance with the requirements of paragraph (k)(1) of this section and the applicable ISO and SAE specifications including specifications for physical layer, network layer, message structure, and message content. The testing must also verify that the onboard computer(s) can properly respond to a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool request to clear emissions-related DTCs and reset the ready status in accordance with paragraph (k)(4)(ix) of this section. The testing must further verify that the following information can be properly communicated to a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool:

(A) The current ready status from all onboard computers required to support ready status in accordance with SAE J1978 or SAE J1939–73 (both as specified in paragraph (k)(1) of this section) and paragraph (k)(4)(i) of this section in the key-on, engine-off position and while the engine is running.

(B) The MIL command status while a deactivated MIL is commanded and while an activated MIL is commanded in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) and paragraph (k)(4)(ii) of this section in the key-on, engine-off position and while the engine is running, and in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) and paragraphs (b)(1)(ii) of this section during the MIL functional check, if applicable, and, if applicable, (k)(4)(i)(C) of this section during the MIL ready status check while the engine is off.

(C) All data stream parameters required in paragraph (k)(4)(ii) of this section in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) including, if applicable, the proper identification of each data stream parameter as supported in SAE J1979 (e.g., Mode/Service $01, PID $00).

(D) The CAL ID, CVN, and VIN as required by paragraphs (k)(4)(vi), (k)(4)(vii), and (k)(4)(viii) of this section and in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section).

(E) An emissions-related DTC (permanent, pending, MIL-on, previous-MIL-on) in accordance with SAE J1979 or SAE J1939–73 (both as specified in paragraph (k)(1) of this section) including the correct indication of the number of stored DTCs (e.g., Mode/Service $01, PID $01, Data A for SAE J1979 (as specified in paragraph (k)(1) of this section)) and paragraph (k)(4)(iv) of this section.

(v) *Reporting of results.* The manufacturer must submit to the Administrator the following, based on the results of the testing required by paragraph (j)(1)(iv) of this section:

(A) If a variant meets all the requirements of paragraph (j)(1)(iv) of this section, a statement specifying that the variant passed all the tests. Upon request from the Administrator, the detailed results of any such testing may have to be submitted.

(B) If any variant does not meet the requirements paragraph (j)(1)(iv) of this section, a written report detailing the problem(s) identified and the manufacturer's proposed corrective action (if any) to remedy the problem(s). This report must be submitted within one month of testing the specific variant. The Administrator will consider the proposed remedy and, if in disagreement, will work with the manufacturer to propose an alternative remedy. Factors to be considered by the Administrator in considering the proposed remedy will include the severity of the problem(s), the ability of service technicians to access the required diagnostic information, the impact on equipment and tool manufacturers, and the amount of time prior to implementation of the proposed corrective action.

(vi) Alternative testing protocols. Manufacturers may request approval to use other testing protocols. To do so, the manufacturer must demonstrate that the alternative testing methods and equipment will provide an equivalent level of verification of compliance with the standardization requirements as is required by paragraph (j)(1) of this section.

(2) *Verification of monitoring requirements.*

(i) Within either the first six months of the start of engine production or the first three months of the start of vehicle production, whichever is later, the manufacturer must conduct a complete evaluation of the OBD system of one or more production vehicles (test vehicles) and submit the results of the evaluation to the Administrator.

(ii) *Selection of test vehicles.*

(A) For each engine selected for monitoring system demonstration in paragraph (l) of this section, the manufacturer must evaluate one production vehicle equipped with an engine from the same engine family and rating as the demonstration engine. The vehicle selection must be approved by the Administrator.

(B) If the manufacturer is required to test more than one test vehicle, the manufacturer may test an engine in lieu of a vehicle for all but one of the required test vehicles.

(C) The requirement for submittal of data from one or more of the test vehicles may be waived if data have been submitted previously for all of the engine ratings and variants.

(iii) *Evaluation requirements.*

(A) The evaluation must demonstrate the ability of the OBD system on the selected test vehicle to detect a malfunction, activate the MIL, and, where applicable, store an appropriate DTC readable by a scan tool when a malfunction is present and the monitoring conditions have been satisfied for each individual monitor required by this section. For model years 2013 and later, the evaluation must demonstrate the ability of the OBD system on the selected test vehicle to detect a malfunction, activate the MIL, and, where applicable, store an appropriate DTC readable by a SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool when a malfunction is present and the monitoring conditions have been satisfied for each individual monitor required by this section.

(B) The evaluation must verify that the malfunction of any component used to enable another OBD monitor but that does not itself result in MIL activation (e.g., fuel level sensor) will not inhibit the ability of other OBD monitors to detect malfunctions properly.

(C) The evaluation must verify that the software used to track the numerator and denominator for the purpose of determining in-use monitoring frequency increments as required by paragraph (d)(2) of this section.

(D) Malfunctions may be implanted mechanically or simulated electronically, but internal onboard computer hardware or software changes shall not be used to simulate malfunctions. For monitors that are required to indicate a malfunction before emissions exceed an emission threshold, manufacturers are not required to use malfunctioning components/systems set exactly at their malfunction criteria limits. Emission testing is not required to confirm that the malfunction is detected before the appropriate emission thresholds are exceeded.

(E) The manufacturer must submit a proposed test plan for approval prior to performing evaluation testing. The test plan must identify the method used to induce a malfunction for each monitor.

(F) If the demonstration of a specific monitor cannot be reasonably performed without causing physical damage to the test vehicle (e.g., onboard computer internal circuit malfunctions), the manufacturer may omit the specific demonstration.

(G) For evaluation of test vehicles selected in accordance with paragraph (j)(2)(ii) of this section, the manufacturer is not required to demonstrate monitors that were demonstrated prior to certification as required in paragraph (l) of this section.

(iv) The manufacturer must submit a report of the results of all testing conducted as required by paragraph (j)(2) of this section. The report must identify the method used to induce a malfunction in each monitor, the MIL activation status, and the DTC(s) stored.

(3) *Verification of in-use monitoring performance ratios.*

(i) The manufacturer must collect and report in-use monitoring performance data representative of production vehicles (i.e., engine rating and chassis application combination). The manufacturer must collect and report the data to the Administrator within 12 months after the first production vehicle was first introduced into commerce.

(ii) The manufacturer must separate production vehicles into the monitoring performance groups and submit data that represents each of these groups. The groups shall be based on the following criteria:

(A) Emission control system architecture. All engines that use the same or similar emissions control system architecture (e.g., EGR with DPF and SCR; EGR with DPF and NO_X adsorber; EGR with DPF-only) and associated monitoring system would be in the same emission architecture category.

(B) Vehicle application type. Within an emission architecture category, engines shall be separated into one of three vehicle application types: Engines intended primarily for line-haul chassis applications, engines intended primarily for urban delivery chassis applications, and all other engines.

(iii) The manufacturer may use an alternative grouping method to collect representative data. To do so, the manufacturer must show that the alternative groups include production vehicles using similar emission controls, OBD strategies, monitoring condition calibrations, and vehicle application driving/usage patterns such that they are expected to have similar in-use monitoring performance. The manufacturer will still be required to submit one set of data for each of the alternative groups.

(iv) For each monitoring performance group, the data must include all of the in-use performance tracking data (i.e., all numerators, denominators, the general denominator, and the ignition cycle counter), the date the data were collected, the odometer reading, the VIN, and the calibration ID. For model years 2013 and later, for each monitoring performance group, the data must include all of the in-use performance tracking data reported through SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section; i.e., all numerators, denominators, the general denominator, and the ignition cycle counter), the date the data were collected, the odometer reading, the VIN, and the calibration ID.

(v) The manufacturer must submit a plan to the Administrator that details the types of production vehicles in each monitoring performance group, the number of vehicles per group to be sampled, the sampling method, the timeline to collect the data, and the reporting format. The plan must provide for effective collection of data from, at least, 15 vehicles per monitoring performance group and provide for data that represent a broad range of temperature conditions. The plan shall not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles expected to have the highest in-use performance ratios.

(vi) The 12 month deadline for reporting may be extended to 18 months if the manufacturer can show that the delay is justified. In such a case, an interim report of progress to date must be submitted within the 12 month deadline.

(k) *Standardization requirements.*

(1) *Reference materials.* The following documents are incorporated by reference, see § 86.1. Anyone may inspect copies at the U.S. EPA or at the National Archives and Records Administration (NARA). For information on the availability of this material at U.S. EPA, NARA, or the standard making bodies directly, refer to § 86.1.

(i) SAE J1930, Revised April 2002.

(ii) SAE J1939, Revised October 2007.

(iii) SAE J1939–13, Revised March 2004, for model years 2013 and later.

(iv) SAE J1939–73, Revised September 2006.

(v) SAE J1962, Revised April 2002, for model years 2013 and later.

(vi) SAE J1978, Revised April 2002.

(vii) SAE J1979, Revised May 2007.

(viii) SAE J2012, Revised April 2002.

(ix) SAE J2403, Revised August 2007.

(x) ISO 15765–4:2005(E), January 15, 2005.

(2) *Diagnostic connector.* For model years 2010 through 2012, the manufacturer defined data link connector must be accessible to a trained service technician. For model years 2013 and later, a standard data link connector conforming to SAE J1962 (as specified in paragraph (k)(1) of this section) or SAE J1939–13 (as specified in paragraph (k)(1) of this section) specifications (except as provided for in paragraph (k)(2)(iii) if this section) must be included in each vehicle.

(i) For model years 2013 and later, the connector must be located in the driver's side foot-well region of the vehicle interior in the area bound by the driver's side of the vehicle and the driver's side edge of the center console (or the vehicle centerline if the vehicle does not have a center console) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position. The connector shall not be located on or in the center console (i.e., neither on the horizontal faces near the floor-mounted gear selector, parking brake lever, or cup-holders nor on the vertical faces near the car stereo, climate system, or navigation system controls). The location of the connector shall be capable of being easily identified and accessed (e.g., to connect an off-board tool). For vehicles equipped with a driver's side door, the connector must be identified and accessed easily by someone standing (or ''crouched'') on the ground outside the driver's side of the vehicle with the driver's side door open. The Administrator may approve an alternative location upon request from the manufacturer. In all cases, the installation position of the connector must be both identified and accessed easily by someone standing outside the vehicle and protected from accidental damage during normal vehicle use.

(ii) For model years 2013 and later, if the connector is covered, the cover must be removable by hand without the use of any tools and be labeled ''OBD'' to aid technicians in identifying the location of the connector. Access to the diagnostic connector shall not require opening or the removal of any storage accessory (e.g., ashtray, coinbox). The label must clearly identify that the connector is located behind the cover and is consistent with language and/or symbols commonly used in the automobile and/or heavy truck industry.

(iii) For model years 2013 and later, if the ISO 15765–4:2005(E) (as specified in paragraph (k)(1) of this section) communication protocol is used for the required OBD standardized functions, the connector must meet the ''Type A'' specifications of SAE J1962 (as specified in paragraph (k)(1) of this section). Any pins in the connector that provide electrical power must be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes and shall not exceed 20.0 Volts DC regardless of the nominal vehicle system or battery voltage (e.g., 12V, 24V, 42V).

(iv) For model years 2013 and later, if the SAE J1939 (as specified in paragraph (k)(1) of this section) protocol is used for the required OBD standardized functions, the connector must meet the specifications of SAE J1939–13 (as specified in paragraph (k)(1) of this section). Any pins in the connector that provide electrical power must be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes.

(v) For model years 2013 and later, the manufacturer may equip engines/vehicles with additional diagnostic connectors for manufacturer-specific purposes (i.e., purposes other than the required OBD functions). However, if the additional connector conforms to the ''Type A'' specifications of SAE J1962 (as specified in paragraph (k)(1) of this section) or the specifications of SAE J1939–13 (as specified in paragraph (k)(1) of this section) and is located in the vehicle interior near the required connector as described in this paragraph (k)(2), the connector(s) must be labeled clearly to identify which connector is used to access the standardized OBD information required by paragraph (k) of this section.

(3) *Communications to a scan tool.* For model years 2013 and later, all OBD control modules (e.g., engine, auxiliary emission control module) on a single vehicle must use the same protocol for communication of required emission-related messages from on-board to off-

board network communications to a scan tool meeting SAE J1978 (as specified in paragraph (k)(1) of this section) specifications or designed to communicate with an SAE J1939 (as specified in paragraph (k)(1) of this section) network. Engine manufacturers shall not alter normal operation of the engine emission control system due to the presence of off-board test equipment accessing information required by this paragraph (k). The OBD system must use one of the following standardized protocols:

(i) ISO 15765–4:2005(E) (as specified in paragraph (k)(1) of this section). All required emission-related messages using this protocol must use a 500 kbps baud rate.

(ii) SAE J1939 (as specified in paragraph (k)(1) of this section). This protocol may only be used on vehicles with diesel engines.

(4) *Required emission related functions.* The following functions must be implemented and must be accessible by, at a minimum, a manufacturer scan tool. For model years 2013 and later, the following standardized functions must be implemented in accordance with the specifications in SAE J1979 (as specified in paragraph (k)(1) of this section) or SAE J1939 (as specified in paragraph (k)(1) of this section) to allow for access to the required information by a scan tool meeting SAE J1978 (as specified in paragraph (k)(1) of this section) specifications or designed to communicate with an SAE J1939 (as specified in paragraph (k)(1) of this section) network:

(i) *Ready status.* The OBD system must indicate, in accordance with SAE J1979 or SAE J1939–73 (both as specified in paragraph (k)(1) of this section) specifications for model years 2013 and later, ''complete'' or ''not complete'' for each of the installed monitored components and systems identified in paragraphs (g), (h) with the exception of (h)(4), and (i)(3) of this section. All components or systems identified in paragraphs (h)(1), (h)(2), or (i)(3) of this section that are monitored continuously must always indicate ''complete.'' Components or systems that are not subject to being monitored continuously must immediately indicate ''complete'' upon the respective monitor(s) being executed fully and determining that the component or system is not malfunctioning. A component or system must also indicate ''complete'' if, after the requisite number of decisions necessary for determining MIL status has been executed fully, the monitor indicates a malfunction of the component or system. The status for each of the monitored components or systems must indicate ''not complete'' whenever diagnostic memory has been cleared or erased by a means other than that allowed in paragraph (b) of this section. Normal vehicle shut down (i.e., key-off/engine-off) shall not cause the status to indicate ''not complete.''

(A) The manufacturer may request that the ready status for a monitor be set to indicate ''complete'' without the monitor having completed if monitoring is disabled for a multiple number of drive cycles due to the continued presence of extreme operating conditions (e.g., cold ambient temperatures, high altitudes). Any such request must specify the conditions for monitoring system disablement and the number of drive cycles that would pass without monitor completion before ready status would be indicated as ''complete.''

(B) For the evaporative system monitor, the ready status must be set in accordance with this paragraph (k)(4)(i) when both the functional check of the purge valve and, if applicable, the leak detection monitor of the hole size specified in paragraph (h)(7)(ii)(B) of this section indicate that they are complete.

(C) If the manufacturer elects to indicate ready status through the MIL in the key-on/engine-off position as provided for in paragraph (b)(1)(iii) of this section, the ready status must be indicated in the following manner: If the ready status for all monitored components or systems is ''complete,'' the MIL shall remain continuously activated in the key-on/engine-off position for at least 10–20 seconds. If the ready status for one or more of the monitored components or systems is ''not complete,'' after at least 5 seconds of operation in the key-on/engine-off position with the MIL activated continuously, the MIL shall blink once per second for 5–10 seconds. The data stream value for MIL status as required in paragraph (k)(4)(ii) of this section must indicate ''commanded off'' during this sequence unless the MIL has also been ''commanded on'' for a detected malfunction.

(ii) *Data stream.* For model years 2010 through 2012, the following signals must be made available on demand through the data link connector. For model years 2013 and later, the following signals must be made available on demand through the standardized data link connector in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications. The actual signal value must always be used instead of a limp home value. Data link signals may report an error state or other predefined status indicator if they are defined for those signals in the SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications.

(A) *For gasoline engines.*

(*1*) Calculated load value, engine coolant temperature, engine speed, vehicle speed, and time elapsed since engine start.

(*2*) Absolute load, fuel level (if used to enable or disable any other monitors), barometric pressure (directly measured or estimated), engine control module system voltage, and commanded equivalence ratio.

(*3*) Number of stored MIL-on DTCs, catalyst temperature (if directly measured or estimated for purposes of enabling the catalyst monitor(s)), monitor status (i.e., disabled for the rest of this drive cycle, complete this drive cycle, or not complete this drive cycle) since last engine shut-off for each monitor used for ready status, distance traveled (or engine run time for engines not using vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not using vehicle speed information) since DTC memory last erased, and number of warm-up cycles since DTC memory last erased, OBD requirements to which the engine is certified (e.g., California OBD, EPA OBD, European OBD, non-OBD) and MIL status (i.e., commanded-on or commanded-off).

(B) *For diesel engines.*

(*1*) Calculated load (engine torque as a percentage of maximum torque available at the current engine speed), driver's demand engine torque (as a percentage of maximum engine torque), actual engine torque (as a percentage of maximum engine torque), reference engine maximum torque, reference maximum engine torque as a function of engine speed (suspect parameter numbers (SPN) 539 through 543 defined by SAE J1939 (as specified in paragraph (k)(1) of this section) within parameter group number (PGN) 65251 for engine configuration), engine coolant temperature, engine oil temperature (if used for emission control or any OBD monitors), engine speed, and time elapsed since engine start.

(*2*) Fuel level (if used to enable or disable any other monitors), vehicle speed (if used for emission control or any OBD monitors), barometric pressure (directly measured or estimated), and engine control module system voltage.

(*3*) Number of stored MIL-on DTCs, monitor status (i.e., disabled for the rest of this drive cycle, complete this drive cycle, or not complete this drive cycle) since last engine shut-off for each monitor used for ready status, distance traveled (or engine run time for engines not using vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not using vehicle speed information) since DTC memory last erased, number of warm-up cycles since DTC memory last erased, OBD requirements to which the engine is certified (e.g., California OBD, EPA OBD, European OBD, non-OBD), and MIL status (i.e., commanded-on or commanded-off).

(*4*) NO_X NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific NO_X NTE carve-out area, or deficiency active area) and PM NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific PM NTE carve-out area, or deficiency active area).

(*5*) For purposes of the calculated load and torque parameters in paragraph (k)(4)(ii)(B)(*1*) of this section, manufacturers must report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). Most accurate, in this context, must be of sufficient accuracy, resolution, and filtering to be used for the purposes of in-use emission testing with the engine still in a vehicle (e.g., using portable emission measurement equipment).

(C) *For all engines so equipped.*

(*1*) Absolute throttle position, relative throttle position, fuel control system status (e.g., open loop, closed loop), fuel trim, fuel pressure, ignition timing advance, fuel injection timing, intake air/manifold temperature, engine intercooler temperature, manifold absolute pressure, air flow rate from mass air flow sensor, secondary air status (upstream, downstream, or atmosphere), ambient air temperature, commanded purge valve duty cycle/position, commanded EGR valve duty cycle/position, actual EGR valve duty cycle/position, EGR error between actual and commanded, PTO status (active or not active), redundant absolute throttle position (for electronic throttle or other systems that utilize two or more sensors), absolute pedal position, redundant absolute pedal position, commanded throttle motor position, fuel rate, boost pressure, commanded/target boost pressure, turbo inlet air temperature, fuel rail pressure, commanded fuel rail pressure, DPF inlet pressure, DPF inlet temperature, DPF outlet pressure, DPF outlet temperature, DPF delta pressure, exhaust pressure sensor output, exhaust gas temperature sensor output, injection control pressure, commanded injection control pressure, turbocharger/turbine speed, variable geometry turbo position, commanded variable geometry turbo position, turbocharger compressor inlet temperature, turbocharger compressor inlet pressure, turbocharger turbine inlet temperature, turbocharger turbine outlet temperature, waste gate valve position, and glow plug lamp status.

(*2*) Oxygen sensor output, air/fuel ratio sensor output, NO_X sensor output, and evaporative system vapor pressure.

(iii) *Freeze frame.*

(A) For model years 2010 through 2012, ''Freeze frame'' information required to be stored pursuant to paragraphs (b)(2)(iv), (h)(1)(iv)(D), and (h)(2)(vi) of this section must be made available on demand through the data link connector. For model years 2013 and later, ''Freeze frame'' information required to be stored pursuant to paragraphs (b)(2)(iv), (h)(1)(iv)(D), and (h)(2)(vi) of this section must be made available on demand through the standardized data link connector in accordance with SAE J1979 or SAE J1939–73 (both as specified in paragraph (k)(1) of this section) specifications.

(B) ''Freeze frame'' conditions must include the DTC that caused the data to be stored along with all of the signals required in paragraphs (k)(4)(ii)(A)*(1)* and (k)(4)(ii)(B)*(1)* of this section. Freeze frame conditions must also include all of the signals required on the engine in paragraphs (k)(4)(ii)(A)*(2)* and (k)(4)(ii)(B)*(2)* of this section, and paragraph (k)(4)(ii)(C)*(1)* of this section that are used for diagnostic or control purposes in the specific monitor or emission-critical powertrain control unit that stored the DTC.

(C) Only one frame of data is required to be recorded. For model years 2010 through 2012, the manufacturer may choose to store additional frames provided that at least the required frame can be read by, at a minimum, a manufacturer scan tool. For model years 2013 and later, the manufacturer may choose to store additional frames provided that at least the required frame can be read by a scan tool meeting SAE J1978 (as specified in paragraph (k)(1) of this section) specifications or designed to communicate with an SAE J1939 (as specified in paragraph (k)(1) of this section) network.

(iv) *Diagnostic trouble codes.*

(A) For model years 2010 through 2012, For all monitored components and systems, any stored pending, MIL-on, and previous-MIL-on DTCs must be made available through the diagnostic connector. For model years 2013 and later, all monitored components and systems, any stored pending, MIL-on, and previous-MIL-on DTCs must be made available through the diagnostic connector in a standardized format in accordance with SAE J1939 (as specified in paragraph (k)(1) of this section) or ISO 15765–4:2005(E) (as specified in paragraph (k)(1) of this section) specifications; standardized DTCs conforming to the applicable standardized specifications must be employed.

(B) The stored DTC must, to the extent possible, pinpoint the probable cause of the malfunction or potential malfunction. To the extent feasible, the manufacturer must use separate DTCs for every monitor where the monitor and repair procedure or probable cause of the malfunction is different. In general, rationality and functional checks must use different DTCs than the respective circuit integrity checks. Additionally, to the extent possible, input component circuit integrity checks must use different DTCs for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit).

(C) The manufacturer must use appropriate standard-defined DTCs whenever possible. With Administrator approval, the manufacturer may use manufacturer-defined DTCs in accordance with the applicable standard's specifications. To do so, the manufacturer must be able to show a lack of available standard-defined DTCs, uniqueness of the monitor or monitored component, expected future usage of the monitor or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined DTCs must be used in a consistent manner (i.e., the same DTC shall not be used to represent two different failure modes) across a manufacturer's entire product line.

(D) For model years 2010 through 2012, a pending or MIL-on DTC (as required in paragraphs (g) through (i) of this section) must be stored and available to, at a minimum, a manufacturer scan tool within 10 seconds after a monitor has determined that a malfunction or potential malfunction has occurred. A permanent DTC must be stored and available to, at a minimum, a manufacturer scan tool no later than the end of an ignition cycle in which the corresponding MIL-on DTC that caused MIL activation has been stored. For model years 2013 and later, a pending or MIL-on DTC (as required in paragraphs (g) through (i) of this section) must be stored and available to an SAE J1978 (as specified in paragraph (k)(1) of this section) or SAE J1939 (as specified in paragraph (k)(1) of this section) scan tool within 10 seconds after a monitor has determined that a malfunction or potential malfunction has occurred. A permanent DTC must be stored and available to an SAE J1978 (as specified in paragraph (k)(1) of this section) or SAE J1939 (as specified in paragraph (k)(1) of this section) scan tool no later than the end of an ignition cycle in which the corresponding MIL-on DTC that caused MIL activation has been stored.

(E) For model years 2010 through 2012, pending DTCs for all components and systems (including those monitored continuously and non-continuously) must be made available through the diagnostic connector. For model years 2013 and later, pending DTCs for all components and systems (including those monitored continuously and non-continuously) must be made available through the diagnostic connector in accordance with the applicable standard's specifications. For all model years, a manufacturer using alternative statistical protocols for MIL activation as allowed in paragraph (b)(2)(iii) of this section must submit the details of their protocol for setting pending DTCs. The protocol must be, overall, equivalent to the requirements of this paragraph (k)(4)(iv)(E) and provide service technicians with a quick and accurate indication of a potential malfunction.

(F) For model years 2010 through 2012, permanent DTC for all components and systems must be made available through the diagnostic connector in a format that distinguishes permanent DTCs from pending DTCs, MIL-on DTCs, and previous-MIL-on DTCs. A MIL-on DTC must be stored as a permanent DTC no later than the end of the ignition cycle and subsequently at all times that the MIL-on DTC is commanding the MIL on. For model years 2013 and later, permanent DTC for all components and systems must be made available through the diagnostic connector in a standardized format that distinguishes permanent DTCs from pending DTCs, MIL-on DTCs, and previous-MIL-on DTCs. A MIL-on DTC must be stored as a permanent DTC no later than the end of the ignition cycle and subsequently at all times that the MIL-on DTC is commanding the MIL on. For all model years, permanent DTCs must be stored in non-volatile random access memory (NVRAM) and shall not be erasable by any scan tool command or by disconnecting power to the on-board computer. Permanent DTCs must be erasable if the engine control module is reprogrammed and the ready status described in paragraph (k)(4)(i) of this section for all monitored components and systems are set to ''not complete.'' The OBD system must have the ability to store a minimum of four current MIL-on DTCs as permanent DTCs in NVRAM. If the number of MIL-on DTCs currently commanding activation of the MIL exceeds the maximum number of permanent DTCs that can be stored, the OBD system must store the earliest detected MIL-on DTC as permanent DTC. If additional MIL-on DTCs are stored when the maximum number of permanent DTCs is already stored in NVRAM, the OBD system shall not replace any existing permanent DTC with the additional MIL-on DTCs.

(v) *Test results*.

(A) For model years 2010 through 2012 and except as provided for in paragraph (k)(4)(v)(G) of this section, for all monitored components and systems identified in paragraphs (g) and (h) of this section, results of the most recent monitoring of the components and systems and the test limits established for monitoring the respective components and systems must be stored and available through the data link. For model years 2013 and later and except as provided for in paragraph (k)(4)(v)(G) of this section, for all monitored components and systems identified in paragraphs (g) and (h) of this section, results of the most recent monitoring of the components and systems and the test limits established for monitoring the respective components and systems must be stored and available through the data link in accordance with the standardized format specified in SAE J1979 (as specified in paragraph (k)(1) of this section) for engines using the ISO 15765–4:2005(E) (as specified in paragraph (k)(1) of this section) protocol or SAE J1939 (as specified in paragraph (k)(1) of this section).

(B) The test results must be reported such that properly functioning components and systems (e.g., ''passing'' systems) do not store test values outside of the established test limits. Test limits must include both minimum and maximum acceptable values and must be defined so that a test result equal to either test limit is a ''passing'' value, not a ''failing'' value.

(C) For model years 2013 and later, the test results must be standardized such that the name of the monitored component (e.g., catalyst bank 1) can be identified by a generic scan tool and the test results and limits can be scaled and reported by a generic scan tool with the appropriate engineering units.

(D) The test results must be stored until updated by a more recent valid test result or the DTC memory of the OBD system computer is cleared. Upon DTC memory being cleared, test results reported for monitors that have not yet completed with valid test results since the last time the fault memory was cleared must report values of zero for the test result and test limits.

(E) All test results and test limits must always be reported and the test results must be stored until updated by a more recent valid test result or the DTC memory of the OBD system computer is cleared.

(F) The OBD system must store and report unique test results for each separate monitor.

(G) The requirements of this paragraph (k)(4)(v) do not apply to continuous fuel system monitoring, cold start emission reduction strategy monitoring, and continuous circuit monitoring.

(vi) *Software calibration identification (CAL ID).* On all engines, a single software calibration identification number (CAL ID) for each monitor or emission critical control unit(s) must be made available through, for model years 2010 through 2012, the data link connector or, for model years 2013 and later, the standardized data link connector in accordance with the SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications. A unique CAL ID must be used for every emission-related calibration and/or software set having at least one bit of different data from any other emission-related calibration and/or software set. Control units coded with multiple emission or diagnostic calibrations and/or software sets must indicate a unique CAL ID for each variant in a manner that enables an off-board device to determine which variant is being used by the engine. Control units that use a strategy that will result in MIL activation if the incorrect variant is used (e.g., control units that contain variants for manual and automatic transmissions but will activate the MIL if the selected variant does not match the type of transmission mated to the engine) are not required to use unique CAL IDs. Manufacturers may request Administrator approval to respond with more than one CAL ID per diagnostic or emission critical control unit. Administrator approval of the request shall be based on the method used by the manufacturer to ensure each control unit will respond to a scan tool with the CAL IDs in order of highest to lowest priority with regards to areas of the software most critical to emission and OBD system performance.

(vii) *Software calibration verification number (CVN).*

(A) All engines must use an algorithm to calculate a single calibration verification number (CVN) that verifies the on-board computer software integrity for each monitor or emission critical control unit that is electronically reprogrammable. The CVN must be made available through, for model years 2010 through 2012, the data link connector or, for model years 2013 and later, the standardized data link connector in accordance with the SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications. The CVN must indicate whether the emission-related software and/or calibration data are valid and applicable for the given vehicle and CAL ID. For systems having more than one CAL ID as allowed under paragraph (k)(4)(vi) of this section, one CVN must be made available for each CAL ID and must be output to a scan tool in the same order as the corresponding CAL IDs. For 2010 through 2012, manufacturers may use a default value for the CVN if their emissions critical powertrain control modules are not programmable in the field. For all years, manufacturers may use a default value for the CVN if their emissions critical powertrain control modules are one-time programmable or masked read-only memory. Any default CVN shall be 00000000 for systems designed in accordance with the SAE J1979 (as specified in paragraph (k)(1) of this section) specifications, and FFFFFFFFh for systems designed in accordance with the SAE J1939 (as specified in paragraph (k)(1) of this section) specifications.

(B) The CVN algorithm used to calculate the CVN must be of sufficient complexity that the same CVN is difficult to achieve with modified calibration values.

(C) The CVN must be calculated at least once per ignition cycle and stored until the CVN is subsequently updated. Except for immediately after a reprogramming event or a non-volatile memory clear or for the first 30 seconds of engine operation after a volatile memory clear or battery disconnect, the stored value must be made available through, for model years 2010 through 2012, the data link connector to, at a minimum, a manufacturer scan tool or, for model years 2013 and later, the data link connector to a generic scan tool in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications. For model years 2010 through 2012, the stored CVN value shall not be erased when DTC memory is erased or during normal vehicle shut down (i.e., key-off/engine-off). For model years 2013 and later, the stored CVN value shall not be erased when DTC memory is erased by a generic scan tool in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications or during normal vehicle shut down (i.e., key-off/engine-off).

(D) For model years 2013 and later, the CVN and CAL ID combination information must be available for all engines/vehicles in a standardized electronic format that allows for off-board verification that the CVN is valid and appropriate for a specific vehicle and CAL ID.

(viii) *Vehicle identification number (VIN)*.

(A) For model years 2010 through 2012, all vehicles must have the vehicle identification number (VIN) available through the data link connector to, at a minimum, a manufacturer scan tool Only one electronic control unit per vehicle may report the VIN to a scan tool. For model years 2013 and later, all vehicles must have the vehicle identification number (VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications. Only one electronic control unit per vehicle may report the VIN to an SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool.

(B) If the VIN is reprogrammable, all emission-related diagnostic information identified in paragraph (k)(4)(ix)(A) of this section must be erased in conjunction with reprogramming of the VIN.

(ix) *Erasure of diagnostic information*.

(A) For purposes of this paragraph (k)(4)(ix), ''emission-related diagnostic information'' includes all of the following: ready status as required by paragraph (k)(4)(i) of this section; data stream information as required by paragraph (k)(4)(ii) of this section including the number of stored MIL-on DTCs, distance traveled while MIL activated, number of warm-up cycles since DTC memory last erased, and distance traveled since DTC memory last erased; freeze frame information as required by paragraph (k)(4)(iii) of this section; pending, MIL-on, and previous-MIL-on DTCs as required by paragraph (k)(4)(iv) of this section; and, test results as required by paragraph (k)(4)(v) of this section.

(B) For all engines, the emission-related diagnostic information must be erased if commanded by any scan tool and may be erased if the power to the on-board computer is disconnected. If any of the emission-related diagnostic information is commanded to be erased by any scan tool, all emission-related diagnostic information must be erased from all diagnostic or emission critical control units. The OBD system shall not allow a scan tool to erase a subset of the emission-related diagnostic information (e.g., the OBD system shall not allow a scan tool to erase only one of three stored DTCs or only information from one control unit without erasing information from the other control unit(s)).

(5) *In-use performance ratio tracking requirements*.

(i) For each monitor required in paragraphs (g) through (i) of this section to separately report an in-use performance ratio, manufacturers must implement software algorithms to, for model years 2010 through 2012, report a numerator and denominator or, for model years 2013 and later, report a numerator and denominator in the standardized format specified in this paragraph (k)(5) in accordance with the SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications.

(ii) For the numerator, denominator, general denominator, and ignition cycle counters required by paragraph (e) of this section, the following numerical value specifications apply:

(A) Each number shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.

(B) Each number shall be reset to zero only when a non-volatile random access memory (NVRAM) reset occurs (e.g., reprogramming event) or, if the numbers are stored in keep-alive memory (KAM), when KAM is lost due to an interruption in electrical power to the control unit (e.g., battery disconnect). Numbers shall not be reset to zero under any other circumstances including when a scan tool command to clear DTCs or reset KAM is received.

(C) To avoid overflow problems, if either the numerator or denominator for a specific component reaches the maximum value of 65,535 ±2, both numbers shall be divided by two before either is incremented again.

(D) To avoid overflow problems, if the ignition cycle counter reaches the maximum value of 65,535 ±2, the ignition cycle counter shall rollover and increment to zero on the next ignition cycle.

(E) To avoid overflow problems, if the general denominator reaches the maximum value of 65,535 ±2, the general denominator shall rollover and increment to zero on the next drive cycle that meets the general denominator definition.

(F) If a vehicle is not equipped with a component (e.g., oxygen sensor bank 2, secondary air system), the corresponding numerator and denominator for that specific component shall always be reported as zero.

(iii) For the ratio required by paragraph (e) of this section, the following numerical value specifications apply:

(A) The ratio shall have a minimum value of zero and a maximum value of 7.99527 with a resolution of 0.000122.

(B) The ratio for a specific component shall be considered to be zero whenever the corresponding numerator is equal to zero and the corresponding denominator is not zero.

(C) The ratio for a specific component shall be considered to be the maximum value of 7.99527 if the corresponding denominator is zero or if the actual value of the numerator divided by the denominator exceeds the maximum value of 7.99527.

(6) *Engine run time tracking requirements*.

(i) For all gasoline and diesel engines, the manufacturer must implement software algorithms to, for model years 2010 through 2012, track and report individually or, for model years 2013 and later, track and report individually in a standardized format the amount of time the engine has been operated in the following conditions:

(A) Total engine run time.

(B) Total idle run time (with ''idle'' defined as accelerator pedal released by the driver, engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission) or vehicle speed less than or equal to one mile per hour, and power take-off not active).

(C) Total run time with power take off active.

(ii) For each counter specified in paragraph (k)(6)(i) of this section, the following numerical value specifications apply:

(A) Each number shall be a four-byte value with a minimum value of zero, a resolution of one second per bit, and an accuracy of +/− ten seconds per drive cycle.

(B) Each number shall be reset to zero only when a non-volatile memory reset occurs (e.g., reprogramming event). Numbers shall not be reset to zero under any other circumstances including when a scan tool (generic or enhanced) command to clear fault codes or reset KAM is received.

(C) To avoid overflow problems, if any of the individual counters reach the maximum value, all counters shall be divided by two before any are incremented again.

(D) For model years 2010 through 2012, the counters shall be made available to, at a minimum, a manufacturer scan tool and may be rescaled when transmitted from a resolution of one second per bit to no more than three minutes per bit. For model years 2013 and later, the counters shall be made available to a generic scan tool in accordance with the SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section) specifications and may be rescaled when transmitted, if required by the SAE specifications, from a resolution of one second per bit to no more than three minutes per bit.

(7) For 2019 and subsequent model year alternative-fueled engines derived from a diesel-cycle engine, a manufacturer may meet the standardization requirements of paragraph (k) of this section that are applicable to diesel engines rather than the requirements applicable to gasoline engines.

(l) *Monitoring system demonstration requirements for certification*.

(1) *General*.

(i) The manufacturer must submit emissions test data from one or more durability demonstration test engines (test engines).

(ii) The Administrator may approve other demonstration protocols if the manufacturer can provide comparable assurance that the malfunction criteria are chosen based on meeting the malfunction criteria requirements and that the timeliness of malfunction detection is within the constraints of the applicable monitoring requirements.

(iii) For flexible fuel engines capable of operating on more than one fuel or fuel combinations, the manufacturer must submit a plan for providing emission test data. The plan must demonstrate that testing will represent properly the expected in-use fuel or fuel combinations.

(2) *Selection of test engines*.

(i) Prior to submitting any applications for certification for a model year, the manufacturer must notify the Administrator regarding the planned engine families and engine ratings within each family for that model year. The Administrator will select the engine family(ies) and the specific engine rating within the engine family(ies) that the manufacturer shall use as demonstration test engines. The selection of test vehicles for production evaluation testing as specified in paragraph (j)(2) of this section may take place during this selection process.

(ii) *For model years 2010 through 2012.* The manufacturer must provide emissions test data from the OBD parent rating as defined in paragraph (o)(1) of this section.

(iii) *For model years 2013 and later*.

(A) A manufacturer certifying one to five engine families in a given model year must provide emissions test data for a single test engine from one engine rating. A manufacturer certifying six to ten engine families in a given model year must provide emissions test data for a single test engine from two different engine ratings. A manufacturer certifying eleven or more engine families in a given model year must provide emissions test data for a single test engine from three different engine ratings. A manufacturer may forego submittal of test data for one or more of these test engines if data have been submitted previously for all of the engine ratings and/or if all requirements for certification carry-over from one model year to the next are satisfied.

(B) For a given model year, a manufacturer may elect to provide emissions data for test engines from more engine ratings than required by paragraph (l)(2)(iii)(A) of this section. For each additional engine rating tested in that given model year, the number of engine ratings required for testing in one future model year will be reduced by one.

(iv) For the test engine, the manufacturer must use an engine (excluding aftertreatment devices) aged for a minimum of 125 hours fitted with exhaust aftertreatment emission controls aged to be representative of useful life aging. In the event that an accelerated aging procedure is used, the manufacturer is required to submit a description of the accelerated aging process and/or supporting data or use the accelerated aging procedure used for emission certification deterioration factor generation. The process and/or data must demonstrate that deterioration of the exhaust aftertreatment emission controls is stabilized sufficiently such that it represents emission control performance at the end of the useful life.

(3) *Required testing*. Except as otherwise described in this paragraph (l)(3), the manufacturer must perform single malfunction testing based on the applicable test with the components/systems set at their malfunction criteria limits as determined by the manufacturer for meeting the emissions thresholds required in paragraphs (g), (h), and (i) of this section.

(i) *Required testing for diesel-fueled/compression ignition engines*.

(A) *Fuel system*. The manufacturer must perform a separate test for each malfunction limit established by the manufacturer for the fuel system parameters (e.g., fuel pressure, injection timing) specified in paragraphs (g)(1)(ii)(A) through (g)(1)(ii)(C) and/or (g)(1)(ii)(D) of this section, if applicable, of this section. When performing a test for a specific parameter, the fuel system must be operating at the malfunction criteria limit for the applicable parameter only. All other parameters must be operating with normal characteristics. In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction.

(B) *Engine misfire.* For model years 2013 and later, the manufacturer must perform a test at the malfunction limit established by the manufacturer for the monitoring required by paragraph (g)(2)(ii)(B) of this section.

(C) *EGR system.* The manufacturer must perform a separate test for each malfunction limit established by the manufacturer for the EGR system parameters (e.g., low flow, high flow, slow response) specified in paragraphs (g)(3)(ii)(A) through (g)(3)(ii)(C) and in (g)(3)(ii)(E) of this section. In conducting the EGR system slow response demonstration tests, the manufacturer may use computer modifications to cause the EGR system to operate at the malfunction limit if the manufacturer can demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction.

(D) *Turbo boost control system.* The manufacturer must perform a separate test for each malfunction limit established by the manufacturer for the turbo boost control system parameters (e.g., underboost, overboost, response) specified in paragraphs (g)(4)(ii)(A) through (g)(4)(ii)(C) and in (g)(4)(ii)(E) of this section.

(E) *NMHC catalyst.* The manufacturer must perform a separate test for each monitored NMHC catalyst(s). The catalyst(s) being evaluated must be deteriorated to the applicable malfunction limit established by the manufacturer for the monitoring required by paragraph (g)(5)(ii)(A) of this section and using methods established by the manufacturer in accordance with paragraph (l)(7) of this section. For each monitored NMHC catalyst(s), the manufacturer must also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or ''empty'' can). Emissions data are not required for the empty can demonstration.

(F) *NO_X catalyst.* The manufacturer must perform a separate test for each monitored NO_X catalyst(s) (e.g., SCR catalyst). The catalyst(s) being evaluated must be deteriorated to the applicable malfunction criteria established by the manufacturer for the monitoring required by paragraphs (g)(6)(ii)(A) and (g)(6)(ii)(B) of this section and using methods established by the manufacturer in accordance with paragraph (l)(7) of this section. For each monitored NO_X catalyst(s), the manufacturer must also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or ''empty'' can). Emissions data are not required for the empty can demonstration.

(G) *NO_X adsorber.* The manufacturer must perform a test using a NO_X adsorber(s) deteriorated to the applicable malfunction limit established by the manufacturer for the monitoring required by paragraph (g)(7)(ii)(A) of this section. The manufacturer must also demonstrate that the OBD system will detect a NO_X adsorber malfunction with the NO_X adsorber at its maximum level of deterioration (i.e., the substrate(s) completely removed from the container or ''empty'' can). Emissions data are not required for the empty can demonstration.

(H) *Diesel particulate filter.* The manufacturer must perform a separate test using a DPF deteriorated to the applicable malfunction limits established by the manufacturer for the monitoring required by paragraph (g)(8)(ii)(A) and (g)(8)(ii)(B) of this section. For systems using the optional DPF monitoring provision of paragraph (g)(8)(ii)(A) of this section, the manufacturer must perform a separate test using a DPF modified in a manner approved by the Administrator (e.g., drilling of wallflow channel end plugs, drilling of through holes, etc.) and testing at each of the nine test points specified in paragraph (g)(8)(ii)(A) of this section. The manufacturer must also demonstrate that the OBD system will detect a DPF malfunction with the DPF at its maximum level of deterioration (i.e., the filter(s) completely removed from the filter container or ''empty'' can). Emissions data are not required for the empty can demonstration.

(I) *Exhaust gas sensor.* The manufacturer must perform a separate test for each malfunction limit established by the manufacturer for the monitoring required in paragraphs (g)(9)(ii)(A), (g)(9)(iii)(A), and (g)(9)(iv)(A) of this section. When performing a test, all exhaust gas sensors used for the same purpose (e.g., for the same feedback control loop, for the same control feature on parallel exhaust banks) must be operating at the malfunction criteria limit for the applicable parameter only. All other exhaust gas sensor parameters must be operating with normal characteristics.

(J) *VVT system.* The manufacturer must perform a separate test for each malfunction limit established by the manufacturer for the monitoring required in paragraphs (g)(10)(ii)(A) and (g)(10)(ii)(B) of this section. In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit if the manufacturer can demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction.

(K) For each of the testing requirements of this paragraph (l)(3)(i) of this section, if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the applicable emissions thresholds, the manufacturer is not required to perform a demonstration test; however, the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(ii) *Required testing for gasoline-fueled/spark-ignition engines.*

(A) *Fuel system.* For engines with adaptive feedback based on the primary fuel control sensor(s), the manufacturer must perform a test with the adaptive feedback based on the primary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer as required by paragraph (h)(1)(ii)(A) of this section to detect a malfunction before emissions exceed applicable emissions thresholds. For engines with feedback based on a secondary fuel control sensor(s) and subject to the malfunction criteria in paragraph (h)(1)(ii)(A) of this section, the manufacturer must perform a test with the feedback based on the secondary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer as required by paragraph (h)(1)(ii)(A) of this section to detect a malfunction before emissions exceed the applicable emissions thresholds. For other fuel metering or control systems, the manufacturer must perform a test at the criteria limit(s). For purposes of fuel system testing as required by this paragraph (l)(3)(ii)(A), the malfunction(s) induced may result in a uniform distribution of fuel and air among the cylinders. Non uniform distribution of fuel and air used to induce a malfunction shall not cause misfire. In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit. To do so, the manufacturer must be able to demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction.

(B) *Misfire.* The manufacturer must perform a test at the malfunction criteria limit specified in paragraph (h)(2)(ii)(B) of this section.

(C) *EGR system.* The manufacturer must perform a test at each flow limit calibrated to the malfunction criteria specified in paragraphs (h)(3)(ii)(A) and (h)(3)(ii)(B) of this section.

(D) *Cold start emission reduction strategy.* The manufacturer must perform a test at the malfunction criteria for each component monitored according to paragraph (h)(4)(ii)(A) of this section.

(E) *Secondary air system.* The manufacturer must perform a test at each flow limit calibrated to the malfunction criteria specified in paragraphs (h)(5)(ii)(A) and (h)(5)(ii)(B) of this section.

(F) *Catalyst.* The manufacturer must perform a test using a catalyst system deteriorated to the malfunction criteria specified in paragraph (h)(6)(ii) of this section using methods established by the manufacturer in accordance with paragraph (l)(7)(ii) of this section. The manufacturer must also demonstrate that the OBD system will detect a catalyst system malfunction with the catalyst system at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or ''empty'' can). Emission data are not required for the empty can demonstration.

(G) *Exhaust gas sensor.* The manufacturer must perform a test with all primary exhaust gas sensors used for fuel control simultaneously possessing a response rate deteriorated to the malfunction criteria limit specified in paragraph (h)(8)(ii)(A) of this section. The manufacturer must also perform a test for any other primary or secondary exhaust gas sensor parameter under parargraphs (h)(8)(ii)(A) and (h)(8)(iii)(A) of this section that can cause engine emissions to exceed the applicable emissions thresholds (e.g., shift in air/fuel ratio at which oxygen sensor switches, decreased amplitude). When performing additional test(s), all primary and secondary (if applicable) exhaust gas sensors used for emission control must be operating at the malfunction criteria limit for the applicable parameter only. All other primary and secondary exhaust gas sensor parameters must be operating with normal characteristics.

(H) *VVT system.* The manufacturer must perform a test at each target error limit and slow response limit calibrated to the malfunction criteria specified in paragraphs (h)(9)(ii)(A) and (h)(9)(ii)(B) of this section. In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit. To do so, the manufacturer must be able to demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction.

(I) For each of the testing requirements of this paragraph (l)(3)(ii), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could cause an engine's emissions to exceed the applicable emissions thresholds, the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analyses used to determine that only a functional test of the system(s) is required.

(iii) *Required testing for all engines.*

(A) Other emission control systems. The manufacturer must conduct demonstration tests for all other emission control components (e.g., hydrocarbon traps, adsorbers) designed and calibrated to a malfunction limit based on an emissions threshold based on the requirements of paragraph (i)(4) of this section.

(B) For each of the testing requirements of paragraph (l)(3)(iii)(A) of this section, if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the applicable emissions thresholds, the manufacturer is not required to perform a demonstration test; however, the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(iv) The manufacturer may electronically simulate deteriorated components but shall not make any engine control unit modifications when performing demonstration tests unless approved by the Administrator. All equipment necessary to duplicate the demonstration test must be made available to the Administrator upon request.

(4) *Testing protocol.*

(i) *Preconditioning.* The manufacturer must use an applicable cycle for preconditioning test engines prior to conducting each of the emission tests required by paragraph (l)(3) of this section. The manufacturer may perform a single additional preconditioning cycle, identical to the initial one, after a 20-minute hot soak but must demonstrate that such an additional cycle is necessary to stabilize the emissions control system. A practice of requiring a cold soak prior to conducting preconditioning cycles is not permitted.

(ii) *Test sequence.*

(A) The manufacturer must set individually each system or component on the test engine at the malfunction criteria limit prior to conducting the applicable preconditioning cycle(s). If a second preconditioning cycle is permitted in accordance with paragraph (l)(4)(i) of this section, the manufacturer may adjust the system or component to be tested before conducting the second preconditioning cycle. The manufacturer shall not replace, modify, or adjust the system or component after the last preconditioning cycle has been completed.

(B) After preconditioning, the test engine must be operated over the applicable cycle to allow for the initial detection of the tested system or component malfunction. This test cycle may be omitted from the testing protocol if it is unnecessary. If required by the monitoring strategy being tested, a cold soak may be performed prior to conducting this test cycle.

(C) The test engine must then be operated over the applicable exhaust emissions test.

(iii) A manufacturer required to test more than one test engine according to paragraph (l)(2)(iii) of this section may use internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain the emission test data required by this paragraph (l) of this section for all but one of the required test engines. The manufacturer may elect this option if the data from the alternative test procedure are representative of official emissions test results. A manufacturer using this option is still responsible for meeting the malfunction criteria specified in paragraphs (g) through (i) of this section if and when emissions tests are performed in accordance with official test procedures.

(iv) The manufacturer may request approval to use an alternative testing protocol for demonstration of MIL activation if the engine dynamometer emission test cycle does not allow all of a given monitor's enable conditions to be satisfied. The manufacturer may request the use of an alternative engine dynamometer test cycle or the use of chassis testing to demonstrate proper MIL activation. To do so, the manufacturer must demonstrate the technical necessity for using an alternative test cycle and the degree to which the alternative test cycle demonstrates that in-use operation with the malfunctioning component will result in proper MIL activation.

(5) *Evaluation protocol.* Full OBD engine ratings, as defined by paragraph (o)(1) of this section, shall be evaluated according to the following protocol:

(i) For all tests conducted as required by paragraph (l) of this section, the MIL must activate before the end of the first engine start portion of the applicable test.

(ii) If the MIL activates prior to emissions exceeding the applicable malfunction criteria limits specified in paragraphs (g) through (i), no further demonstration is required. With respect to the misfire monitor demonstration test, if the manufacturer has elected to use the minimum misfire malfunction criteria of one percent as allowed in paragraphs (g)(2)(ii)(B), if applicable, and (h)(2)(ii)(B) of this section, no further demonstration is required provided the MIL activates with engine misfire occurring at the malfunction criteria limit.

(iii) If the MIL does not activate when the system or component is set at its malfunction criteria limit(s), the criteria limit(s) or the OBD system is not acceptable.

(A) Except for testing of the catalyst or DPF system, if the MIL first activates after emissions exceed the applicable malfunction criteria specified in paragraphs (g) through (i) of this section, the test engine shall be retested with the tested system or component adjusted so that the MIL will activate before emissions exceed the applicable malfunction criteria specified in paragraphs (g) through (i) of this section. If the component cannot be so adjusted because an alternative fuel or emission control strategy is used when a malfunction is detected (e.g., open loop fuel control used after an oxygen sensor malfunction is detected), the test engine shall be retested with the component adjusted to the worst acceptable limit (i.e., the applicable OBD monitor indicates that the component is performing at or slightly better than the malfunction criteria limit). When tested with the component so adjusted, the MIL must not activate during the test and the engine emissions must be below the applicable malfunction criteria specified in paragraphs (g) through (i) of this section.

(B) In testing the catalyst or DPF system, if the MIL first activates after emissions exceed the applicable emissions threshold(s) specified in paragraphs (g) and (h), the tested engine shall be retested with a less deteriorated catalyst or DPF system (i.e., more of the applicable engine out pollutants are converted or trapped). For the OBD system to be approved, testing shall be continued until the MIL activates with emissions below the applicable thresholds of paragraphs (g) and (h) of this section, or the MIL activates with emissions within a range no more than 20 percent below the applicable emissions thresholds and 10 percent or less above those emissions thresholds.

(iv) If an OBD system is determined to be unacceptable by the criteria of this paragraph (l)(5) of this section, the manufacturer may recalibrate and retest the system on the same test engine. In such a case, the manufacturer must confirm, by retesting, that all systems and components that were tested prior to the recalibration and are affected by it still function properly with the recalibrated OBD system.

(6) *Confirmatory testing.*

(i) The Administrator may perform confirmatory testing to verify the emission test data submitted by the manufacturer as required by this paragraph (l) of this section comply with its requirements and the malfunction criteria set forth in paragraphs (g) through (i) of this section. Such confirmatory testing is limited to the test engine(s) required by paragraph (l)(2) of this section.

(ii) To conduct this confirmatory testing, the Administrator may install appropriately deteriorated or malfunctioning components (or simulate them) in an otherwise properly functioning test engine of an engine rating represented by the demonstration test engine in order to test any of the components or systems required to be tested by paragraph (l) of this section. The manufacturer shall make available, if requested, an engine and all test equipment (e.g., malfunction simulators, deteriorated components) necessary to duplicate the manufacturer's testing. Such a request from the Administrator shall occur within six months of reviewing and approving the demonstration test engine data submitted by the manufacturer for the specific engine rating.

(7) *Catalyst aging.*

(i) *Diesel catalysts.* For purposes of determining the catalyst malfunction limits for the monitoring required by paragraphs (g)(5)(ii)(A), (g)(5)(ii)(B), and (g)(6)(ii)(A) of this section, where those catalysts are monitored individually, the manufacturer must use a catalyst deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning engine operating conditions. For purposes of determining the catalyst malfunction limits for the monitoring required by paragraphs (g)(5)(ii)(A), (g)(5)(ii)(B), and (g)(6)(ii)(A) of this section, where those catalysts are monitored in combination with other catalysts, the manufacturer must submit their catalyst system aging and monitoring plan to the Administrator as part of their certification documentation package. The plan must include the description, emission control purpose, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the applicable malfunction criteria including the deterioration/aging process.

(ii) *Gasoline catalysts.* For the purposes of determining the catalyst system malfunction criteria in paragraph (h)(6)(ii) of this section, the manufacturer must use a catalyst system deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning operating conditions. The malfunction criteria must be established by using a catalyst system with all monitored and unmonitored (downstream of the sensor utilized for catalyst monitoring) catalysts simultaneously deteriorated to the malfunction criteria except for those engines that use fuel shutoff to prevent over-fueling during engine misfire conditions. For such engines, the malfunction criteria must be established by using a catalyst system with all monitored catalysts simultaneously deteriorated to the malfunction criteria while unmonitored catalysts shall be deteriorated to the end of the engine's useful life.

(m) *Certification documentation requirements.*

(1) When submitting an application for certification of an engine, the manufacturer must submit the following documentation. If any of the items listed here are standardized for all of the manufacturer's engines, the

manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its engines.

(i) For the required documentation that is not standardized across all engines, the manufacturer may be allowed to submit documentation for certification from one engine that is representative of other engines. All such engines shall be considered to be part of an OBD certification documentation group. To represent the OBD group, the chosen engine must be certified to the most stringent emissions standards and OBD monitoring requirements and cover all of the emissions control devices for the engines in the group and covered by the submitted documentation. Such OBD groups must be approved in advance of certification.

(ii) Upon approval, one or more of the documentation requirements of this paragraph (m) of this section may be waived or modified if the information required is redundant or unnecessarily burdensome to generate.

(iii) To the extent possible, the certification documentation must use SAE J1930 (as specified in paragraph (k)(1) of this section) or SAE J2403 (as specified in paragraph (k)(1) of this section) terms, abbreviations, and acronyms as specified in paragraph (k)(1) of this section.

(2) Unless otherwise specified, the following information must be submitted as part of the certification application and prior to receiving a certificate.

(i) A description of the functional operation of the OBD system including a complete written description for each monitoring strategy that outlines every step in the decision-making process of the monitor. Algorithms, diagrams, samples of data, and/or other graphical representations of the monitoring strategy shall be included where necessary to adequately describe the information.

(ii) A table including the following information for each monitored component or system (either computer-sensed or computer-controlled) of the emissions control system:

(A) Corresponding diagnostic trouble code.

(B) Monitoring method or procedure for malfunction detection.

(C) Primary malfunction detection parameter and its type of output signal.

(D) Malfunction criteria limits used to evaluate output signal of primary parameter.

(E) Other monitored secondary parameters and conditions (in engineering units) necessary for malfunction detection.

(F) Monitoring time length and frequency of monitoring events.

(G) Criteria for storing a diagnostic trouble code.

(H) Criteria for activating a malfunction indicator light.

(I) Criteria used for determining out-of-range values and input component rationality checks.

(iii) Whenever possible, the table required by paragraph (m)(2)(ii) of this section shall use the following engineering units:

(A) Degrees Celsius for all temperature criteria.

(B) KiloPascals (KPa) for all pressure criteria related to manifold or atmospheric pressure.

(C) Grams (g) for all intake air mass criteria.

(D) Pascals (Pa) for all pressure criteria related to evaporative system vapor pressure.

(E) Miles per hour (mph) for all vehicle speed criteria.

(F) Relative percent (%) for all relative throttle position criteria (as defined in SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section)).

(G) Voltage (V) for all absolute throttle position criteria (as defined in SAE J1979 or SAE J1939 (both as specified in paragraph (k)(1) of this section)).

(H) Per crankshaft revolution (/rev) for all changes per ignition event based criteria (e.g., g/rev instead of g/stroke or g/firing).

(I) Per second (/sec) for all changes per time based criteria (e.g., g/sec).

(J) Percent of nominal tank volume (%) for all fuel tank level criteria.

(iv) A logic flowchart describing the step-by-step evaluation of the enable criteria and malfunction criteria for each monitored emission related component or system.

(v) Emissions test data, a description of the testing sequence (e.g., the number and types of preconditioning cycles), approximate time (in seconds) of MIL activation during the test, diagnostic trouble code(s) and freeze frame information stored at the time of detection, corresponding test results (e.g. SAE J1979 (as specified in paragraph (k)(1) of this section) Mode/Service $06, SAE J1939 (as specified in paragraph (k)(1) of this section) Diagnostic Message 8 (DM8)) stored during the test, and a description of the modified or deteriorated components used for malfunction simulation with respect to the demonstration tests specified in paragraph (l) of this section. The freeze frame data are not required for engines termed ''Extrapolated OBD'' engines.

(vi) For gasoline engines, data supporting the misfire monitor, including:

(A) The established percentage of misfire that can be tolerated without damaging the catalyst over the full range of engine speed and load conditions.

(B) Data demonstrating the probability of detection of misfire events by the misfire monitoring system over the full engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the malfunction criteria established in paragraph (h)(2)(ii)(B) of this section, one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(C) Data identifying all disablement of misfire monitoring that occurs during the FTP. For every disablement that occurs during the cycles, the data shall identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions during which each disablement was present, and which disable condition documented in the certification application caused the disablement.

(D) Manufacturers are not required to use the durability demonstration engine to collect the misfire data required by paragraph (m)(2)(vi) of this section.

(vii) Data supporting the limit for the time between engine starting and attaining the designated heating temperature for after-start heated catalyst systems.

(viii) Data supporting the criteria used to detect a malfunction of the fuel system, EGR system, boost pressure control system, catalyst, NO_X adsorber, DPF, cold start emission reduction strategy, secondary air, evaporative system, VVT system, exhaust gas sensors, and other emission controls that causes emissions to exceed the applicable malfunction criteria specified in paragraphs (g) through (i) of this section. For diesel engine monitors required by paragraphs (g) and (i) of this section that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 2.5 times any of the applicable standards), the test cycle and standard determined by the manufacturer to be the most stringent for each applicable monitor in accordance with paragraph (f)(1) of this section.

(ix) A list of all electronic powertrain input and output signals (including those not monitored by the OBD system) that identifies which signals are monitored by the OBD system. For input and output signals that are monitored as comprehensive components, the listing shall also identify the specific diagnostic trouble code for each malfunction criteria (e.g., out-of-range low, out-of-range high, open circuit, rationality low, rationality high).

(x) A written description of all parameters and conditions necessary to begin closed-loop/feedback control of emission control systems (e.g., fuel system, boost pressure, EGR flow, SCR reductant delivery, DPF regeneration, fuel system pressure).

(xi) A written identification of the communication protocol utilized by each engine for communication with a scan tool (model years 2010 through 2012) or an SAE J1978 or SAE J1939 (both as specified in paragraph (k)(1) of this section) scan tool (model years 2013 and later).

(xii) For model years 2013 and later, a pictorial representation or written description of the diagnostic connector location including any covers or labels.

(xiii) A written description of the method used by the manufacturer to meet the requirements of paragraph (i)(2) of this section (crankcase ventilation system monitoring) including diagrams or pictures of valve and/or hose connections.

(xiv) Build specifications provided to engine purchasers or chassis manufacturers detailing all specifications or limitations imposed on the engine purchaser relevant to OBD requirements or emissions compliance (e.g., cooling system heat rejection rates, allowable MIL locations, connector location specifications). A description of the method or copies of agreements used to ensure engine purchasers or chassis manufacturers will comply with the OBD and emissions relevant build specifications (e.g., signed agreements, required audit/evaluation procedures).

(xv) Any other information determined by the Administrator to be necessary to demonstrate compliance with the requirements of this section.

(3) In addition to the documentation required by paragraphs (m)(1) and (m)(2) of this section, a manufacturer making use of paragraph (a)(5) of this section must submit the following information with their application for certification.

(i) A detailed description of how the OBD system meets the intent of § 86.010–18.

(ii) A detailed description of why the manufacturer has chosen not to design the OBD system to meet the requirements of § 86.010–18 and has instead designed the OBD system to meet the applicable California OBD requirements.

(iii) A detailed description of any deficiencies granted by the California staff and any concerns raised by California staff. A copy of a California Executive Order alone will not be considered acceptable toward meeting this requirement. This description shall also include, to the extent feasible, a plan with timelines for resolving deficiencies and/or concerns.

(n) *Deficiencies.*

(1) Upon application by the manufacturer, the Administrator may accept an OBD system as compliant even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance is infeasible or unreasonable considering such factors as, but not limited to: Technical feasibility of the given monitor and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Unmet requirements shall not be carried over from the previous model year except where unreasonable hardware or software modifications are necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Administrator. Furthermore, EPA will not accept any deficiency requests that include the complete lack of a major diagnostic monitor (''major'' diagnostic monitors being those for exhaust aftertreatment devices, oxygen sensor, air-fuel ratio sensor, NO_X sensor, engine misfire, evaporative leaks, and diesel EGR, if equipped), with the possible exception of the special provisions for alternative fueled engines. For alternative fueled heavy-duty engines (e.g., natural gas, liquefied petroleum gas, methanol, ethanol), manufacturers may request the Administrator to waive specific monitoring requirements of this section for which monitoring may not be reliable with respect to the use of the alternative fuel. At a minimum, alternative fuel engines must be equipped with an OBD system meeting OBD requirements to the extent feasible as approved by the Administrator.

(2) In the event the manufacturer seeks to carry-over a deficiency from a past model year to the current model year, the manufacturer must re-apply for approval to do so. In considering the request to carry-over a deficiency, the Administrator shall consider the manufacturer's progress towards correcting the deficiency. The Administrator may not allow manufacturers to carry over monitoring system deficiencies for more than two model years unless it can be demonstrated that substantial engine hardware modifications and additional lead time beyond two years are necessary to correct the deficiency.

(3) A deficiency shall not be granted retroactively (i.e., after the engine has been certified).

(o) *Implementation schedule.* Except as specifically provided for in this paragraph (o) for small volume manufacturers and alternative fueled engines, the requirements of this section must be met according to the following provisions:

(1) *For model years 2010 through 2012.*

(i) *Full OBD.* The manufacturer must implement an OBD system meeting the applicable requirements of § 86.010–18 on one engine rating within one engine family of the manufacturer's product line. This ''Full OBD'' rating will be known as the ''OBD parent'' rating. The OBD parent rating must be chosen, unless otherwise approved by the Administrator, as the rating having the highest weighted projected U.S. sales within the engine family having the highest weighted projected U.S. sales, with U.S. sales being weighted by the useful life of the engine rating.

(ii) *Extrapolated OBD.* For all other engine ratings within the engine family from which the OBD parent rating has been selected, the manufacturer must implement an OBD system meeting the applicable requirements of § 86.010–18 except that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds shown in Table 1 of paragraph (g) and Table 2 of paragraph (h) of this section. These ''Extrapolated OBD'' engines will be know as the ''OBD child'' ratings. On these OBD child ratings, rather than detecting a malfunction prior to exceeding the emission thresholds, the manufacturer must submit a plan for Administrator review and approval that details the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The plan must demonstrate both the use of good engineering judgment in establishing the malfunction criteria, and robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(iii) Engine families other than those from which the parent and child ratings have been selected, are not subject to the requirements of this section.

(iv) Small volume manufacturers, as defined in § 86.094–14(b)(1) and (2) and as determined using 2010 model year sales, are exempt from the requirements of this § 86.010–18, unless model year 2011 or model year 2012 sales exceed 20,000 units.

(v) Engines certified as alternative fueled engines are exempt from the requirements of this § 86.010–18.

(2) *For model years 2013 through 2015.*

(i) *OBD groups.* The manufacturer shall define one or more OBD groups to cover all engine ratings in all engine families. The manufacturer must submit a grouping plan for Administrator review and approval detailing the OBD groups and the engine families and engine ratings within each group for a given model year.

(ii) *Full OBD.*

(A) For all model year 2010 through 2012 ''Full OBD'' and ''Extrapolated OBD'' engine ratings, the manufacturer must implement an OBD system meeting the applicable requirements of this section.

(B) On one engine rating within each of the manufacturer's OBD groups, the manufacturer must implement an OBD system meeting the applicable requirements of this section. These ''Full OBD'' ratings will be known as the ''OBD parent'' ratings. The OBD parent rating for each OBD group shall be chosen, unless otherwise approved by the Administrator, as the rating having the highest weighted projected U.S. sales within the OBD group, with U.S. sales being weighted by the useful life of the engine rating.

(iii) *Extrapolated OBD.* For all other engine ratings within each OBD group, the manufacturer must implement an OBD system meeting the requirements of this section except that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds shown in Table 1 of paragraph (g) and Table 2 of paragraph (h) of this section. These extrapolated OBD engines will be know as the ''OBD child'' ratings. On these OBD child ratings, rather than detecting a malfunction prior to exceeding the emission thresholds, the manufacturer must submit a plan for Administrator review and approval that details the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The plan must demonstrate both the use of good engineering judgment in establishing the malfunction criteria, and robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(iv) Engines certified as alternative fueled engines shall meet, to the extent feasible, the requirements specified in paragraph (i)(3) of this § 86.010–18. Additionally, such engines shall monitor the NO_X aftertreatment system on engines so equipped and detect a malfunction if:

(A) The NO_X aftertreatment system has no detectable amount of NO_X aftertreatement capability (i.e., NO_X catalyst conversion or NO_X adsorption).

(B) The NO_X aftertreatment substrate is completely destroyed, removed, or missing.

(C) The NO_X aftertreatment assembly is replaced with a straight pipe.

(3) *For model years 2016 through 2018.*

(i) *OBD groups.* The manufacturer shall define one or more OBD groups to cover all engine ratings in all engine families. The manufacturer must submit a grouping plan for Administrator review and approval detailing the OBD groups and the engine families and engine ratings within each group for a given model year.

(ii) *Full OBD.* The manufacturer must implement an OBD system meeting the applicable requirements of this section on all engine ratings in all engine families.

(iii) Engines certified as alternative fueled engines shall meet, to the extent feasible, the requirements specified in paragraph (i)(3) of this § 86.010–18. Additionally, such engines shall monitor the NO_X aftertreatment system on engines so equipped and detect a malfunction if:

(A) The NO_X aftertreatment system has no detectable amount of NO_X aftertreatement capability (i.e., NO_X catalyst conversion or NO_X adsorption).

(B) The NO_X aftertreatment substrate is completely destroyed, removed, or missing.

(C) The NO_X aftertreatment assembly is replaced with a straight pipe.

(4) *For model years 2019 and later.*

(i) The manufacturer must implement an OBD system meeting the applicable requirements of § 86.010–18 on all engines.

(p) *In-use compliance standards.* For monitors required to indicate a malfunction before emissions exceed a certain emission threshold (e.g., 2.5 times any of the applicable standards):

(1) *For model years 2010 through* 2012.

(i) On the full OBD rating (i.e., the parent rating) as defined in paragraph (o)(1) of this section, separate in-use emissions thresholds shall apply. These thresholds are determined by doubling the applicable thresholds as shown in Table 1 of paragraph (g) and Table 2 of paragraph (h) of this section. The resultant thresholds apply only in-use and do not apply for certification or selective enforcement auditing.

(ii) The extrapolated OBD ratings (i.e., the child ratings) as defined in paragraph (o)(1) of this section shall not be evaluated against emissions levels for purposes of OBD compliance in-use.

(iii) Only the test cycle and standard determined and identified by the manufacturer at the time of certification in accordance with paragraph (f) of this section as the most stringent shall be used for the purpose of determining OBD system noncompliance in-use.

(iv) An OBD system shall not be considered noncompliant solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(2) *For model years 2013 through 2015.*

(i) On the full OBD ratings as defined in paragraph (o)(2) of this section, separate in-use emissions thresholds shall apply. These thresholds are determined by doubling the applicable thresholds as shown in Table 1 of paragraph (g) and Table 2 of paragraph (h) of this section. The resultant thresholds apply only in-use and do not apply for certification or selective enforcement auditing.

(ii) The extrapolated OBD ratings as defined in paragraph (o)(2) of this section shall not be evaluated against emissions levels for purposes of OBD compliance in-use.

(iii) Only the test cycle and standard determined and identified by the manufacturer at the time of certification in accordance with paragraph (f) of this section as the most stringent shall be used for the purpose of determining OBD system noncompliance in-use.

(iv) For monitors subject to meeting the minimum in-use monitor performance ratio of 0.100 in paragraph (d)(1)(ii), the OBD system shall not be considered noncompliant unless a representative sample indicates the in-use ratio is below 0.050.

(v) An OBD system shall not be considered noncompliant solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(3) *For model years 2016 through 2018.*

(i) On the engine ratings tested according to (l)(2)(iii) of this section, the certification emissions thresholds shall apply in-use.

(ii) On the manufacturer's remaining engine ratings, separate in-use emissions thresholds shall apply. These thresholds are determined by doubling the applicable thresholds as shown in Table 1 of paragraph (g) and Table 2 of paragraph (h) of this section. The resultant thresholds apply only in-use and do not apply for certification or selective enforcement auditing.

(iii) An OBD system shall not be considered noncompliant solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(4) *For model years 2019 and later.*

(i) On all engine ratings, the certification emissions thresholds shall apply in-use.

(ii) An OBD system shall not be considered noncompliant solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

■ 7. Section 86.010–38 is added to subpart A to read as follows:

§ 86.010–38 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 § 86.099–8, § 86.004–9, § 86.004–10, or § 86.004–11, as applicable, written instructions for the proper maintenance and use of the vehicle (or engine), by the purchaser consistent with the provisions of § 86.004–25, which establishes what scheduled maintenance the Administrator approves as being reasonable and necessary.

(1) The maintenance instructions required by this section shall be in clear, and to the extent practicable, nontechnical language.

(2) 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.

(b) Instructions provided to purchasers under paragraph (a) of this section shall specify the performance of all scheduled maintenance performed by the manufacturer on certification durability vehicles and, in cases where the manufacturer performs less maintenance on certification durability vehicles than the allowed limit, may specify the performance of any scheduled maintenance allowed under § 86.004–25.

(c) Scheduled emission-related maintenance in addition to that performed under § 86.004–25(b) may only be recommended to offset the effects of abnormal in-use operating conditions, except as provided in paragraph (d) of this section. The manufacturer shall be required to demonstrate, subject to the approval of the Administrator, that such maintenance is reasonable and technologically necessary to assure the proper functioning of the emission control system. Such additional recommended maintenance shall be clearly differentiated, in a form approved by the Administrator, from that approved under § 86.004–25(b).

(d) Inspections of emission-related parts or systems with instructions to replace, repair, clean, or adjust the parts or systems if necessary, are not considered to be items of scheduled maintenance which insure the proper functioning of the emission control system. Such inspections, and any recommended maintenance beyond that approved by the Administrator as reasonable and necessary under paragraphs (a), (b), and (c) of this section, may be included in the written instructions furnished to vehicle owners under paragraph (a) of this section: Provided, That such instructions clearly state, in a form approved by the Administrator, that the owner need not perform such inspections or recommended maintenance in order to maintain the emissions defect and emissions performance warranty or manufacturer recall liability.

(e) The manufacturer may choose to include in such instructions an explanation of any distinction between the 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 represented by the engine 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, non-technical language that is understandable to the ultimate purchaser.

(f) If approved by the Administrator, the instructions provided to purchasers under paragraph (a) of this section 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.

(g) Emission control diagnostic service information:

(1) Manufacturers are subject to the provisions of this paragraph (g) beginning in the 1996 model year for manufacturers of light-duty vehicles and light-duty trucks, and beginning in the 2005 model year for manufacturers of heavy-duty vehicles and heavy-duty engines weighing 14,000 pounds gross vehicle weight (GVW) and less that are subject to the OBD requirements of this part.

(2) *General requirements.*

(i) Manufacturers shall furnish or cause to be furnished to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, or the Administrator upon request, any and all information needed to make use of the on-board diagnostic system and such other information, including instructions for making emission-related diagnoses and repairs, including but not limited to service manuals, technical service bulletins, recall service information, bi-directional control information, and training information, unless such information is protected by section 208(c) of the Act as a trade secret. No such information may be withheld under section 208(c) of the Act if that information is provided (directly or indirectly) by the manufacturer to franchised dealers or other persons engaged in the repair, diagnosing, or servicing of motor vehicles or motor vehicle engines.

(ii) *Definitions.* The following definitions apply for this paragraph (g):

(A) Aftermarket service provider means any individual or business engaged in the diagnosis, service, and repair of a motor vehicle or engine, who is not directly affiliated with a manufacturer or manufacturer-franchised dealership.

(B) Bi-directional control means the capability of a diagnostic tool to send messages on the data bus that temporarily overrides the module's control over a sensor or actuator and gives control to the diagnostic tool operator. Bi-directional controls do not create permanent changes to engine or component calibrations.

(C) Data stream information means information (i.e., messages and parameters) originated within the vehicle by a module or intelligent sensors (i.e., a sensor that contains and is controlled by its own module) and transmitted between a network of modules and/or intelligent sensors connected in parallel with either one or more communication wires. The information is broadcast over the communication wires for use by the OBD system to gather information on emissions-related components or systems and from other vehicle modules that may impact emissions, including but not limited to systems such as chassis or transmission. For the purposes of this section, data stream information does not include engine calibration-related information, or any data stream information from systems or modules that do not impact emissions.

(D) Emissions-related information means any information related to the diagnosis, service, and repair of emissions-related components. Emissions-related information includes, but is not limited to, information regarding any system, component or part of a vehicle that controls emissions and any system, component and/or part associated with the powertrain system, including, but not limited to:

(*1*) The engine, the fuel system and ignition system,

(*2*) Information for any system, component or part that is likely to impact emissions, such as transmission systems, and any other information specified by the Administrator to be relevant to the diagnosis and repair of an emissions-related problem; and

(*3*) Any other information specified by the Administrator to be relevant for the diagnosis and repair of an emissions-related failure found through the inspection and maintenance program after such finding has been communicated to the affected manufacturer(s).

(E) Emissions-related training information means any information-related training or instruction for the purpose of the diagnosis, service, and repair of emissions-related components.

(F) Enhanced service and repair information means information which is specific for an original equipment manufacturer's brand of tools and equipment. This includes computer or anti-theft system initialization information necessary for the completion of any emissions-related repair on motor vehicles that employ integral vehicle security systems.

(G) Equipment and tool company means a registered automotive equipment or software company either public or private that is engaged in, or plans to engage in, the manufacture of automotive scan tool reprogramming equipment or software.

(H) Generic service and repair information means information which is not specific for an original equipment manufacturer's brand of tools and equipment.

(I) Indirect information means any information that is not specifically contained in the service literature, but is contained in items such as tools or equipment provided to franchised dealers (or others). This includes computer or anti-theft system initialization information necessary for the completion of any emissions-related repair on motor vehicles that employ integral vehicle security systems.

(J) Intermediary means any individual or entity, other than an original equipment manufacturer, which provides service or equipment to aftermarket service providers.

(K) Manufacturer-franchised dealership means any service provider with which a manufacturer has a direct business relationship.

(L) Third-party information provider means any individual or entity, other than an original equipment manufacturer, who consolidates manufacturer service information and makes this information available to aftermarket service providers.

(M) Third-party training provider means any individual or entity, other than an original equipment manufacturer who develops and/or delivers instructional and educational material for automotive training courses.

(3) *Information dissemination.* By December 24, 2003, each manufacturer was required to provide or cause to be provided to the persons specified in paragraph (g)(2)(i) of this section and to any other interested parties a manufacturer-specific World Wide Web site containing the information specified in paragraph (g)(2)(i) of this section for 1996 and later model year vehicles which have been offered for sale; this requirement does not apply to indirect information, including the information specified in paragraphs (g)(12) through (g)(16) of this section. Upon request and approval of the Administrator, manufacturers who can demonstrate significant hardship in complying with this provision by December 26, 2003, may request an additional six months lead time to meet this requirement. Each manufacturer Web site shall:

(i) Provide access in full-text to all of the information specified in paragraph (g)(5) of this section.

(ii) Be updated at the same time as manufacturer-franchised dealership World Wide Web sites;

(iii) Provide users with a description of the minimum computer hardware and software needed by the user to access that manufacturer's information (e.g., computer processor speed and operating system software). This description shall appear when users first log-on to the home page of the manufacturer Web site.

(iv) Provide Short-Term (24 to 72 hours), Mid-Term (30 day period), and Long-Term (365 day period) Web site subscription options to any person specified in paragraph (g)(2)(i) of this section whereby the user will be able to access the site, search for the information, and purchase, view and print the information at a fair and reasonable cost as specified in paragraph (g)(7) of this section for each of the subscription options. In addition, for each of the subscription options, manufacturers are required to make their entire site accessible for the respective period of time and price. In other words, a manufacturer may not limit any or all of the subscription options to just one make or one model.

(v) Allow the user to search the manufacturer Web site by various topics including but not limited to model, model year, key words or phrases, etc., while allowing ready identification of the latest vehicle calibration. Manufacturers who do not use model year to classify their vehicles in their service information may use an alternate vehicle delineation such as body series. Any manufacturer utilizing this flexibility shall create a cross-reference to the corresponding model year and provide this cross-reference on the manufacturer Web site home page.

(vi) Provide accessibility using common, readily available software and shall not require the use of software, hardware, viewers, or browsers that are not readily available to the general public. Manufacturers shall also provide hyperlinks to any plug-ins, viewers or browsers (e.g., Adobe Acrobat or Netscape) needed to access the manufacturer Web site.

(vii) Allow simple hyper-linking to the manufacturer Web site from government Web sites and automotive-related Web sites.

(viii) Allow access to the manufacturer Web site with no limits on the modem speed by which aftermarket service providers or other interested parties can connect to the manufacturer Web site.

(ix) Possess sufficient server capacity to allow ready access by all users and have sufficient capacity to assure that all users may obtain needed information without undue delay.

(x) Correct or delete broken Web links on a weekly basis.

(xi) Allow for Web site navigation that does not require a user to return to the manufacturer home page or a search engine in order to access a different portion of the site.

(xii) Allow users to print out any and all of the materials required to be made available on the manufacturer Web site including the ability to print it at the user's location.

(4) *Small volume provisions for information dissemination.*

(i) Manufacturers with annual sales of less than 5,000 vehicles had until June 28, 2004 to launch their individual Web sites as required by paragraph (g)(3) of this section.

(ii) Manufacturers with annual sales of less than 1,000 vehicles may, in lieu of meeting the requirement of paragraph (g)(3) of this section, request the Administrator to approve an alternative method by which the required emissions-related information can be obtained by the persons specified in paragraph (g)(2)(i) of this section.

(5) *Required information.* All information relevant to the diagnosis and completion of emissions-related repairs shall be posted on manufacturer Web sites. This excludes indirect information specified in paragraphs (g)(6) and (g)(12) through (g)(16) of this section. To the extent that this information does not already exist in some form for their manufacturer franchised dealerships, manufacturers are required to develop and make available the information required by this section to both their manufacturer franchised dealerships and the aftermarket. The required information includes, but is not limited to:

(i) Manuals, including subsystem and component manuals developed by a manufacturer's third party supplier that are made available to manufacturer franchised dealerships, technical service bulletins (TSBs), recall service information, diagrams, charts, and training materials. Manuals and other such service information from third party suppliers are not required to be made available in full-text on manufacturer Web sites as described in paragraph (g)(3) of this section. Rather, manufacturers must make available on the manufacturer Web site as required by paragraph (g)(3) of this section an index of the relevant information and instructions on how to order such third party information. In the alternative, a manufacturer can create a link from its Web site to the Web site(s) of the third party supplier.

(ii) OBD system information which includes, but is not limited to, the following:

(A) A general description of the operation of each monitor, including a description of the parameter that is being monitored;

(B) A listing of all typical OBD diagnostic trouble codes associated with each monitor;

(C) A description of the typical enabling conditions (either generic or monitor-specific) for each monitor (if equipped) to execute during vehicle operation, including, but not limited to, minimum and maximum intake air and engine coolant temperature, vehicle speed range, and time after engine startup. In addition, manufacturers shall list all monitor-specific OBD drive cycle information for all major OBD monitors as equipped including, but not limited to, catalyst, catalyst heater, oxygen sensor, oxygen sensor heater, evaporative system, exhaust gas re-circulation (EGR), secondary air, and air conditioning system. Additionally, for diesel vehicles under 14,000 pounds. GVWR which also perform misfire, fuel system and comprehensive component monitoring under specific driving conditions (i.e., non-continuous monitoring; as opposed to spark ignition engines that monitor these systems under all conditions or continuous monitoring), the manufacturer shall make available monitor-specific drive cycles. Any manufacturer who develops generic drive cycles, either in addition to, or instead of, monitor-specific drive cycles shall also make these available in full-text on manufacturer Web sites;

(D) A listing of each monitor sequence, execution frequency and typical duration;

(E) A listing of typical malfunction thresholds for each monitor;

(F) For OBD parameters for specific vehicles that deviate from the typical parameters, the OBD description shall indicate the deviation and provide a separate listing of the typical values for those vehicles;

(G) Identification and scaling information necessary to interpret and understand data available to a generic scan tool through ''mode 6,'' pursuant to SAE J1979 (as specified in paragraph (g)(17) of this section).

(H) Algorithms, look-up tables, or any values associated with look-up tables are not required to be made available.

(iii) Any information regarding any system, component, or part of a vehicle monitored by the OBD system that could in a failure mode cause the OBD system to illuminate the malfunction indicator light (MIL);

(iv) Any information on other systems that can effect the emission system within a multiplexed system (including how information is sent between emission-related system modules and other modules on a multiplexed bus);

(v) Manufacturer-specific emissions-related diagnostic trouble codes (DTCs) and any related service bulletins, trouble shooting guides, and/or repair procedures associated with these manufacturer-specific DTCs; and

(vi) Information regarding how to obtain the information needed to perform reinitialization of any vehicle computer or anti-theft system following an emissions-related repair.

(6) *Anti-theft system initialization information.* Computer or anti-theft system initialization information and/or related tools necessary for the proper installation of on-board computers or necessary for the completion of any emissions-related repair on motor vehicles that employ integral vehicle security systems or the repair or replacement of any other emission-related part shall be made available at a fair and reasonable cost to the persons specified in paragraph (g)(2)(i) of this section.

(i) Except as provided under paragraph (g)(6)(ii) of this section, manufacturers must make this information available to persons specified in paragraph (g)(2)(i) of this section, such that such persons will not need any special tools or manufacturer-specific scan tools to perform the initialization. Manufacturers may make such information available through, for example, generic aftermarket tools, a pass-through device, or inexpensive manufacturer-specific cables.

(ii) A manufacturer may request Administrator approval for an alternative means to re-initialize vehicles for some or all model year vehicles through the 2007 model year by September 26, 2003. The Administrator shall approve the request only after the following conditions have been met:

(A) The manufacturer must demonstrate that the availability of such information to aftermarket service providers would significantly increase the risk of vehicle theft.

(B) The manufacturer must make available a reasonable alternative means to install or repair computers, or to otherwise repair or replace an emission-related part.

(C) Any alternative means proposed by a manufacturer cannot require aftermarket technicians to use a manufacturer franchised dealership to obtain information or special tools to re-initialize the anti-theft system. All information must come directly from the manufacturer or a single manufacturer-specified designee.

(D) Any alternative means proposed by a manufacturer must be available to aftermarket technicians at a fair and reasonable price.

(E) Any alternative must be available to aftermarket technicians within twenty-four hours of the initial request.

(F) Any alternative must not require the purchase of a special tool or tools, including manufacturer-specific tools, to complete this repair. Alternatives may include lease of such tools, but only for appropriately minimal cost.

(G) In lieu of leasing their manufacturer-specific tool to meet this requirement, a manufacturer may also release the necessary information to equipment and tool manufacturers for incorporation into aftermarket scan tools. Any manufacturer choosing this option must release the information to equipment and tool manufacturers within 60 days of Administrator approval. Manufacturers may also comply with this requirement using SAE J2534 (as specified in paragraph (g)(17) of this section) for some or all model years through model year 2007.

(7) *Cost of required information.*

(i) All information required to be made available by this section shall be made available at a fair and reasonable price. In determining whether a price is fair and reasonable, consideration may be given to relevant factors, including, but not limited to, the following:

(A) The net cost to the manufacturer-franchised dealerships for similar information obtained from manufacturers, less any discounts, rebates, or other incentive programs.

(B) The cost to the manufacturer for preparing and distributing the information, excluding any research and development costs incurred in designing and implementing, upgrading or altering the onboard computer and its software or any other vehicle part or component. Amortized capital costs for the preparation and distribution of the information may be included.

(C) The price charged by other manufacturers for similar information.

(D) The price charged by manufacturers for similar information prior to the launch of manufacturer Web sites.

(E) The ability of aftermarket technicians or shops to afford the information.

(F) The means by which the information is distributed;

(G) The extent to which the information is used, which includes the number of users, and frequency, duration, and volume of use.

(H) Inflation.

(ii) By August 25, 2003, each manufacturer was required to submit to the Administrator a request for approval of their pricing structure for their Web sites and amounts to be charged for the information required to be made available under paragraphs (g)(3) and (g)(5) of this section. Subsequent to the approval of the manufacturer Web site pricing structure, manufacturers shall notify the Administrator upon the increase in price of any one or all of the subscription options of 20 percent or more above the previously-approved price, taking inflation into account.

(A) The manufacturer shall submit a request to the Administrator that sets forth a detailed description of the pricing structure and amounts, and support for the position that the pricing structure and amounts are fair and reasonable by addressing, at a minimum, each of the factors specified in paragraph (g)(7)(i) of this section.

(B) The Administrator will act upon the request within 180 days following receipt of a complete request or following receipt of any additional information requested by the Administrator.

(C) The Administrator may decide not to approve, or to withdraw approval for a manufacturer's pricing structure and amounts based on a conclusion that this pricing structure and/or amounts are not, or are no longer, fair and reasonable, by sending written notice to the manufacturer explaining the basis for this decision.

(D) In the case of a decision by the Administrator not to approve or to withdraw approval, the manufacturer shall within three months following notice of this decision, obtain Administrator approval for a revised pricing structure and amounts by following the approval process described in this paragraph (g)(7)(ii).

(8) *Unavailable information.* Any information which is not provided at a fair and reasonable price shall be considered unavailable, in violation of these regulations and section 202(m)(5) of the Clean Air Act.

(9) *Third-party information providers.* By December 24, 2003, manufacturers shall, for model year 2004 and later vehicles and engines, make available to third-party information providers as defined in paragraph (g)(2)(ii) of this section with whom they engage in licensing or business arrangements;

(i) The required emissions-related information as specified in paragraph (g)(5) of this section either:

(A) Directly in electronic format such as diskette or CD–ROM using non-proprietary software, in English; or

(B) Indirectly via a Web site other than that required by paragraph (g)(3) of this section;

(ii) For any manufacturer who utilizes an automated process in their manufacturer-specific scan tool for diagnostic fault trees, the data schema, detail specifications, including category types/codes and vehicle codes, and data format/content structure of the diagnostic trouble trees.

(iii) Manufacturers can satisfy the requirement of paragraph (g)(9)(ii) of this section by making available diagnostic trouble trees on their manufacturer Web sites in full-text.

(iv) Manufacturers are not responsible for the accuracy of the information distributed by third parties. However, where manufacturers charge information intermediaries for information, whether through licensing agreements or other arrangements, manufacturers are responsible for inaccuracies contained in the information they provide to third-party information providers.

(10) *Required emissions-related training information.* By December 24, 2003, for emissions-related training information, manufacturers were required to:

(i) Video tape or otherwise duplicate and make available for sale on manufacturer Web sites within 30 days after transmission any emissions-related training courses provided to manufacturer franchised dealerships via the Internet or satellite transmission;

(ii) Provide on the manufacturer Web site an index of all emissions-related training information available for purchase by aftermarket service providers for 1994 and newer vehicles. For model years subsequent to 2003, the required information must be made available for purchase within 3 months of model introduction and then must be made available at the same time it is made available to manufacturer franchised dealerships, whichever is earlier. The index shall describe the title of the course or instructional session, the cost of the video tape or duplicate, and information on how to order the item(s) from the manufacturer Web site. All of the items available must be shipped within 24 hours of the order being placed and are to be made available at a fair and reasonable price as described in paragraph (g)(7) of this section. Manufacturers unable to meet the 24 hour shipping requirement under circumstances where orders exceed supply and additional time is needed by the distributor to reproduce the item being ordered, may exceed the 24 hour shipping requirement, but in no instance can take longer than 14 days to ship the item.

(iii) Provide access to third-party training providers as defined in paragraph (g)(2)(ii) of this section all emission-related training courses transmitted via satellite or Internet offered to their manufacturer franchised dealerships. Manufacturers may not charge unreasonable up-front fees to third-party training providers for this access, but may require a royalty, percentage, or other arranged fee based on per-use enrollment/subscription basis. Manufacturers may take reasonable steps to protect any copyrighted information and are not required to provide this information to parties that do not agree to such steps.

(11) *Timeliness and maintenance of information dissemination.*

(i) General Requirements. Subsequent to the initial launch of the manufacturer's Web site, manufacturers must make the information required under paragraph (g)(5) of this section available on their Web site within six months of model introduction, or at the same time it is made available to manufacturer franchised dealerships, whichever is earlier. After this six-month period, the information must be available and updated on the manufacturer Web site at the same time that the updated information is made available to manufacturer franchised dealerships, except as otherwise specified in this section.

(ii) *Archived information.* Beginning with the 1996 model year, manufacturers must maintain the required information on their Web sites in full-text as defined in paragraph (g)(5) of this section for a minimum of 15 years after model introduction. Subsequent to this fifteen year period, manufacturers may archive the information in the manufacturer's format of choice and provide an index of the archived information on the manufacturer Web site and how it can be obtained by interested parties. Manufacturers shall index their available information with a title that adequately describes the contents of the document to which it refers. Manufacturers may allow for the ordering of information directly from their Web site, or from a Web site hyperlinked to the manufacturer Web site. In the alternative, manufacturers shall list a phone number and address where aftermarket service providers can call or write to obtain the desired information. Manufacturers must also provide the price of each item listed, as well as the price of items ordered on a subscription basis. To the extent that any additional information is added or changed for these model years, manufacturers shall update the index as appropriate. Manufacturers will be responsible for ensuring that all information, including information that is distributed through information distributors, is provided within one regular business day of receiving the order. Items that are less than 20 pages (e.g. technical service bulletins) shall be faxed, if requested, to the requestor and manufacturers are required to deliver the information overnight if requested and paid for by the ordering party. Archived information must be made available on demand and at a fair and reasonable price.

(12) *Reprogramming information.*

(i) For model years 1996 and later, manufacturers shall make available to the persons specified in paragraph (g)(2)(i) of this section all emissions-related recalibration or reprogramming events (including driveability reprogramming events that may affect emissions) in the format of its choice at the same time they are made available to manufacturer franchised dealerships. This requirement takes effect on September 25, 2003, and within 3 months of model introduction for all new model years.

(ii) For model years 1996 and later manufacturers shall provide persons specified in paragraph (g)(2)(i) of this section with an efficient and cost-effective method for identifying whether the calibrations on vehicles are the latest to be issued. This requirement takes effect on September 25, 2003, and within 3 months of model introduction for all new model years.

(iii) For all 2004 and later OBD vehicles equipped with reprogramming capability, manufacturers shall comply with SAE J2534 (as specified in paragraph (g)(17) of this section). Any manufacturer who cannot comply with SAE J2534 in model year 2004 may request one year additional lead time from the Administrator.

(iv) For model years 2004 and later, manufacturers shall make available to aftermarket service providers the necessary manufacturer-specific software applications and calibrations needed to initiate pass-through reprogramming. This software shall be able to run on a standard personal computer that utilizes standard operating systems as specified in SAE J2534 (as specified in paragraph (g)(17) of this section).

(v) For model years prior to 2004, manufacturers may use SAE J2534 (as specified in paragraph (g)(17) of this section) as described above, provided they make available to the aftermarket any additional required hardware (i.e. cables). Manufacturers may not require the purchase or use of a manufacturer-specific scan tool to receive or use this additional hardware. Manufacturers must also make available the necessary manufacturer-specific software applications and calibrations needed to initiate pass-through reprogramming. Manufacturers must also make available to equipment and tool companies any information needed to develop aftermarket equivalents of the manufacturer-specific hardware.

(vi) Manufacturers may take any reasonable business precautions necessary to protect proprietary business information and are not required to provide this information to any party that does not agree to these reasonable business precautions. The requirement to make hardware available and to release the information to equipment and tool companies takes effect on September 25, 2003, and within 3 months of model introduction for all new model years.

(vii) Manufacturers who cannot comply with paragraphs (g)(12)(v) and (g)(12)(vi) of this section shall make available to equipment and tool companies by September 25, 2003 the following information necessary for reprogramming the Electronic Control Unit (ECU):

(A) The physical hardware requirements for reprogramming events or tools (e.g. system voltage requirements, cable terminals/pins, connections such as RS232 or USB, wires, etc.).

(B) ECU data communication (e.g. serial data protocols, transmission speed or baud rate, bit timing requirements, etc.).

(C) Information on the application physical interface (API) or layers (descriptions for procedures such as connection, initialization, performing and verifying programming/download, and termination).

(D) Vehicle application information or any other related service information such as special pins and voltages for reprogramming events or additional vehicle connectors that require enablement and specifications for the enablement.

(E) Information that describes what interfaces or combinations of interfaces are used to deliver calibrations from database media (e.g. PC using CDROM to the reprogramming device e.g. scan tool or black box).

(viii) A manufacturer can propose an alternative to the requirements of paragraph (g)(12)(vii) of this section for how aftermarket service providers can reprogram an ECU. The Administrator will approve this alternative if the manufacturer demonstrates all of the following:

(A) That it cannot comply with paragraph (g)(12)(v) of this section for the vehicles subject to the alternative plan;

(B) That a very small percentage of its vehicles in model years prior to 2004 cannot be reprogrammed with the provisions described in paragraph (g)(12)(v) of this section, or that releasing the information to tool companies would likely not result in this information being incorporated into aftermarket tools; and

(C) That aftermarket service providers will be able to reprogram promptly at a reasonable cost.

(ix) In meeting the requirements of paragraphs (g)(12)(v) through (g)(12)(vii) of this section, manufacturers may take any reasonable business precautions necessary to protect proprietary business information and are not required to provide this information to any party that does not agree to these reasonable business precautions.

(13) *Generic and enhanced information for scan tools.* By September 25, 2003, manufacturers shall make available to equipment and tool companies all generic and enhanced service information including bi-directional control and data stream information as defined in paragraph (g)(2)(ii) of this section. This requirement applies for 1996 and later model year vehicles.

(i) The information required by paragraph (g)(13) of this section shall be provided electronically using common document formats to equipment and tool companies with whom they have appropriate licensing, contractual, and/or confidentiality arrangements. To the extent that a central repository for this information (e.g. the TEK–NET library developed by the Equipment and Tool Institute) is used to warehouse this information, the Administrator shall have free unrestricted access. In addition, information required in paragraph (g)(13) of this section shall be made available to equipment and tool companies who are not otherwise members of any central repository and shall have access if the non-members have arranged for the appropriate licensing, contractual and/or confidentiality arrangements with the manufacturer and/or a central repository.

(ii) In addition to the generic and enhanced information defined in paragraph (g)(2)(ii) of this section, manufacturers shall also make available the following information necessary for developing generic diagnostic scan tools:

(A) The physical hardware requirements for data communication (e.g. system voltage requirements, cable terminals/pins, connections such as RS232 or USB, wires, etc.),

(B) ECU data communication (e.g. serial data protocols, transmission speed or baud rate, bit timing requirements, etc.),

(C) Information on the application physical interface (API) or layers. (i.e., processing algorithms or software design descriptions for procedures such as connection, initialization, and termination),

(D) Vehicle application information or any other related service information such as special pins and voltages or additional vehicle connectors that require enablement and specifications for the enablement.

(iii) Any manufacturer who utilizes an automated process in its manufacturer-specific scan tool for diagnostic fault trees shall make available to equipment and tool companies the data schema, detail specifications, including category types/codes and vehicle codes, and data format/content structure of the diagnostic trouble trees.

(iv) Manufacturers can satisfy the requirement of paragraph (g)(13)(iii) of this section by making available diagnostic trouble trees on their manufacturer Web sites in full-text.

(14) *Availability of manufacturer-specific scan tools.* Manufacturers shall make available for sale to the persons specified in paragraph (g)(2)(i) of this section their own manufacturer-specific diagnostic tools at a fair and reasonable cost. These tools shall also be made available in a timely fashion either through the manufacturer Web site or through a manufacturer-designated intermediary. Manufacturers who develop different versions of one or more of their diagnostic tools that are used in whole or in part for emission-related diagnosis and repair shall insure that all emission-related diagnosis and repair information is available for sale to the aftermarket at a fair and reasonable cost. Manufacturers shall provide technical support to aftermarket service providers for the tools described in this section, either themselves or through a third party of its choice. Factors for determining fair and reasonable cost include, but are not limited to:

(i) The net cost to the manufacturer's franchised dealerships for similar tools obtained from manufacturers, less any discounts, rebates, or other incentive programs;

(ii) The cost to the manufacturer for preparing and distributing the tools, excluding any research and development costs;

(iii) The price charged by other manufacturers of similar sizes for similar tools;

(iv) The capabilities and functionality of the manufacturer tool;

(v) The means by which the tools are distributed;

(vi) Inflation.

(vii) The ability of aftermarket technicians and shops to afford the tools.

(15) *Changing content of manufacturer-specific scan tools.* Manufacturers who opt to remove non-emissions related content from their manufacturer-specific scan tools and sell them to the persons specified in paragraph (g)(2)(i) of this section shall adjust the cost of the tool accordingly lower to reflect the decreased value of the scan tool. All emissions-related content that remains in the manufacturer-specific tool shall be identical to the information that is contained in the complete version of the manufacturer-specific tool. Any manufacturer who wishes to implement this option must request approval from the Administrator prior to the introduction of the tool into commerce.

(16) *Special tools.*

(i) Manufacturers who have developed special tools to extinguish the malfunction indicator light (MIL) for Model Years 1994 through 2003 shall make available the necessary information to equipment and tool companies to design a comparable generic tool. This information was required to be made available to equipment and tool companies no later than September 25, 2003.

(ii) Manufacturers are prohibited from requiring special tools to extinguish the malfunction indicator light (MIL) beginning with Model Year 2004.

(17) *Reference materials.* Manufacturers shall conform with the following Society of Automotive Engineers (SAE) standards. These documents are incorporated by reference, see § 86.1. Anyone may inspect copies at the U.S. EPA or at the National Archives and Records Administration (NARA). For information on the availability of this material at U.S. EPA, NARA, or the standard making body directly, refer to § 86.1.

(i) SAE J1930, Revised May 1998. For Web-based delivery of service information, manufacturers shall comply with this industry standard. This recommended practice standardizes various terms, abbreviations, and acronyms associated with on-board diagnostics. Manufacturers shall comply with SAE J1930 beginning with Model Year 2004.

(ii) SAE J1979, Revised September 1997. For identification and scaling information necessary to interpret and understand data available to a generic scan tool through ''mode 6,'' manufacturers shall comply with this industry standard. This recommended practice describes the implementation of the diagnostic test modes for emissions-related test data. Manufacturers shall comply with this industry standard beginning with Model Year 2004.

(iii) SAE J2284–3, May 2001. For allowing ECU and equipment and tool manufacturers to satisfy the needs of multiple end users with minimum modification to a basic ECU design, manufacturers shall comply with this industry standard which establishes standard ECU physical layer, data link layer, and media design criteria. Manufacturers may comply with SAE J2284–3 beginning with model year

2003 and shall comply with SAE J2284–3 beginning with model year 2008.

(iv) SAE J2534, February 2002. For pass-through reprogramming capabilities, manufacturers shall comply with this industry standard which provides technical specifications and information that manufacturers must supply to equipment and tool companies to develop aftermarket pass-through reprogramming tools. Manufacturers shall comply with SAE J2534 beginning with model year 2004.

(18) *Reporting requirements.* Manufacturers shall provide to the Administrator reports on an annual basis within 30 days of the end of the calendar year and upon request of the Administrator, that describe the performance of their individual Web sites. These annual reports shall be submitted to the Administrator electronically utilizing non-proprietary software in the format as agreed to by the Administrator and the manufacturers. Manufacturers may request Administrator approval to report on parameters other than those described below if the manufacturer can demonstrate that those alternate parameters will provide sufficient and similar information for the Administrator to effectively evaluate the manufacturer Web site. These annual reports shall include, at a minimum, monthly measurements of the following parameters:

(i) Total successful requests (measured in number of files including graphic interchange formats (GIFs) and joint photographic expert group (JPEG) images, i.e., electronic images such as wiring or other diagrams or pictures). This is defined as the total successful request counts of all the files which have been requested, including pages, graphics, etc.

(ii) Total failed requests (measured in number of files). This is defined as the total failed request counts of all the files which were requested but failed because they could not be found or were read-protected. This includes pages, graphics, etc.

(iii) Average data transferred per day (measured by bytes). This is defined as average amount of data transferred per day from one place to another.

(iv) Daily Summary (measured in number of files/pages by day of week). This is defined as the total number of requests each day of the week, over the time period given at the beginning of the report.

(v) Daily report (measured in number of files/pages by the day of the month). This is defined as how many requests there were in each day of a specific month.

(vi) Browser Summary (measured in number of files/pages by browser type, i.e., Netscape, Internet Explorer). This is defined as the versions of a browser by vendor.

(vii) Any other information deemed necessary by the Administrator to determine the adequacy of a manufacturer Web site.

(19) *Prohibited acts, liability and remedies.*

(i) It is a prohibited act for any person to fail to promptly provide or cause a failure to promptly provide information as required by this paragraph (g), or to otherwise fail to comply or cause a failure to comply with any provision of this paragraph (g).

(ii) Any person who fails or causes the failure to comply with any provision of this paragraph (g) is liable for a violation of that provision. A corporation is presumed liable for any violations of this subpart that are committed by any of its subsidiaries, affiliates or parents that are substantially owned by it or substantially under its control.

(iii) Any person who violates a provision of this paragraph (g) shall be subject to a civil penalty of not more than $32,500 per day for each violation. This maximum penalty is shown for calendar year 2004. Maximum penalty limits for later years may be set higher based on the Consumer Price Index, as specified in 40 CFR part 19. In addition, such person shall be liable for all other remedies set forth in Title II of the Clean Air Act, remedies pertaining to provisions of Title II of the Clean Air Act, or other applicable provisions of law.

(h) The manufacturer shall furnish or cause to be furnished to the purchaser of each new motor engine subject to the standards prescribed in § 86.004–10 or § 86.004–11, as applicable, the following:

(1) Instructions for all maintenance needed after the end of the useful life of the engine for critical emissions-related components as provided in § 86.004–25(b), including recommended practices for diagnosis, cleaning, adjustment, repair, and replacement of the component (or a statement that such component is maintenance free for the life of the engine) and instructions for accessing and responding to any emissions-related diagnostic codes that may be stored in on-board monitoring systems;

(2) A copy of the engine rebuild provisions contained in § 86.004–40.

(i) For each new diesel-fueled engine subject to the standards prescribed in § 86.007–11, as applicable, the manufacturer shall furnish or cause to be furnished to the ultimate purchaser a statement that ''This engine must be operated only with ultra low-sulfur diesel fuel (meeting EPA specifications for highway diesel fuel, including a 15 ppm sulfur cap).''

(j) Emission control diagnostic service information for heavy-duty engines used in vehicles over 14,000 pounds gross vehicle weight (GVW)

(1) Manufacturers of heavy-duty engines used in applications weighing more than 14,000 pounds gross vehicle weight (GVW) that are subject to the applicable OBD requirements of this subpart A are subject to the provisions of this paragraph (j) beginning in the 2010 model year. The provisions of this paragraph (j) apply only to those heavy-duty engines subject to the applicable OBD requirements.

(2) Upon Administrator approval, manufacturers of vehicles may alternatively comply with all service information and tool provisions found in § 86.1808–01 that are applicable to 2001 and subsequent model year vehicles weighing less than 14,000 pounds gross vehicle weight (GVW). Upon Administrator approval, manufacturers that produce engines for use in vehicles between 8,500 and 14,000 pounds may, for those engines, alternatively comply with all service information and tool provisions in § 86.010–38(j) that are applicable to 2010 and subsequent model year vehicles over 14,000 pounds. Implementation dates must comply with the service information provision dates applicable to engines in vehicles between 8,500 and 14,000 pounds.

(3) *General Requirements*

(i) Manufacturers shall furnish or cause to be furnished to any person engaged in the repairing or servicing of heavy-duty engines, or the Administrator upon request, any and all information needed to make use of the on-board diagnostic system and such other information, including instructions for making emission-related diagnosis and repairs, including but not limited to service manuals, technical service bulletins, recall service information, bi-directional control information, and training information, unless such information is protected by section 208(c) as a trade secret. Manufacturers may take steps to restrict warranty and customer assurance plan information used only for the purpose of providing such manufacturer covered repairs to only those repair locations authorized by the manufacturer. No such information may be withheld under section 208(c) of the Act if that information is provided (directly or indirectly) by the manufacturer to franchised dealers, authorized service networks, or other persons engaged in the repair, diagnosing, or servicing of heavy-duty engines.

(ii) *Definitions.* The following definitions apply for this paragraph (j):

(A) *Aftermarket service provider* means any individual or business engaged in the diagnosis, service, and repair of a heavy-duty engine, who is not directly affiliated with a manufacturer or manufacturer franchised dealership, or authorized service network.

(B) *Authorized service network* means a group of independent service and repair facilities that are recognized by engine manufacturers as being capable of performing repairs to factory specification, including warranty repair work.

(C) *Bi-directional control* means the capability of a diagnostic tool to send messages on the data bus that temporarily overrides the module's control over a sensor or actuator and gives control to the diagnostic tool operator. Bi-directional controls do not create permanent changes to engine or component calibrations.

(D) *Data stream information* means information (i.e., messages and parameters) originated within the engine by a module or intelligent sensors (i.e., a sensor that contains and is controlled by its own module) and transmitted between a network of modules and/or intelligent sensors connected in parallel with either one or more communication wires. The information is broadcast over the communication wires for use by the OBD system to gather information on emissions-related components or systems and from other engine modules that may impact emissions. For the purposes of this section, data stream information does not include engine calibration related information, or any data stream information from systems or modules that do not impact emissions.

(E) *Emissions-related information* means any information related to the diagnosis, service, and repair of emissions-related components. Emissions-related information includes, but is not limited to, information regarding any system, component or part of an engine that controls emissions and that is part of the diagnostic strategy for an OBD monitor, but not limited to: The engine, the fuel system and ignition system; information for any system, component or part that is likely to impact emissions, and any other information specified by the Administrator to be relevant to the diagnosis and repair of an emissions-related problem; any other information specified by the Administrator to be relevant for the diagnosis and repair of an emissions-related failure found through an evaluation of vehicles in-use and after such finding has been communicated to the affected manufacturer(s).

(F) *Emissions-related training information* means any information related training or instruction for the purpose of the diagnosis, service, and repair of emissions-related components.

(G) *Enhanced service and repair information* means information which is specific for an original equipment manufacturer's brand of tools and equipment. This includes computer or anti-theft system initialization information necessary for the completion of any emissions-related repair on engines that employ integral security systems.

(H) *Equipment and Tool Company* means a registered equipment or software company either public or private that is engaged in, or plans to engage in, the manufacture of scan tool reprogramming equipment or software.

(I) *Generic service and repair information* means information which is not specific for an original equipment manufacturer's brand of tools and equipment.

(J) *Indirect information* means any information that is not specifically contained in the service literature, but is contained in items such as tools or equipment provided to franchised dealers or authorized service networks (or others). This includes computer or anti-theft system initialization information necessary for the completion of any emissions-related repair on engines that employ integral security systems.

(K) *Intermediary* means any individual or entity, other than an original equipment manufacturer, which provides service or equipment to aftermarket service providers.

(L) *Manufacturer franchised dealership* means any service provider with which a manufacturer has a direct business relationship.

(M) *Recalibration* means the process of downloading to an engine's on-board computer emissions-related revisions of on-board computer application software and calibration parameters with default configurations. Recalibration is not dependent on the use of the vehicle identification number (VIN) in determining vehicle configuration.

(N) *Reconfiguration* means the process of enabling or adjusting engine features or engine parameters associated with such features to adapt a heavy-duty engine to a particular vehicle and/or application.

(O) *Third party information provider* means any individual or entity, other than an original equipment manufacturer, who consolidates manufacturer service information and makes this information available to aftermarket service providers.

(P) *Third party training provider* means any individual or entity, other than an original equipment manufacturer who develops and/or delivers instructional and educational material for training courses.

(4) *Information dissemination.* By July 1, 2010 each manufacturer shall provide or cause to be provided to the persons specified in paragraph (j)(3)(i) of this section and to any other interested parties a manufacturer-specific World Wide Web site containing the information specified in paragraph (j)(3)(i) of this section for 2010 and later model year engines which have been certified to the OBD requirements specified in § 86.010–18 and are offered for sale; this requirement does not apply to indirect information, including the information specified in paragraphs (j)(13) through (j)(17) of this section. Upon request and approval of the Administrator, manufacturers who can demonstrate significant hardship in complying with this provision by August 27, 2009, may request an additional six months lead time to meet this requirement. Each manufacturer Web site shall:

(i) Provide access in full-text to all of the information specified in paragraph (j)(6) of this section.

(ii) Be updated at the same time as manufacturer franchised dealership or authorized service network World Wide Web sites.

(iii) Provide users with a description of the minimum computer hardware and software needed by the user to access that manufacturer's information (e.g., computer processor speed and operating system software). This description shall appear when users first log-on to the home page of the manufacturer's Web site.

(iv) Upon Administrator approval, implement a range of time periods for online access to any person specified in paragraph (j)(3)(i) of this section whereby the user will be able to access the site, search for the information, and purchase, view and print the information at a fair and reasonable cost as specified in paragraph (j)(8) of this section for each of the options. In addition, for each of the range of time periods, manufacturers are required to make their entire site accessible for the respective period of time and price. In other words, a manufacturer may not limit Web site access to just one make or one model.

(v) Allow the user to search the manufacturer Web site by various topics including but not limited to model, model year, key words or phrases, etc., while allowing ready identification of the latest calibration. Manufacturers who do not use model year to classify their engines in their service information may use an alternate delineation such as body series. Any manufacturer utilizing this flexibility shall create a cross-reference to the corresponding model year and provide this cross-reference on the manufacturer Web site home page.

(vi) Provide accessibility using common, readily available software and shall not require the use of software, hardware, viewers, or browsers that are not readily available to the general public. Manufacturers shall also provide hyperlinks to any plug-ins, viewers or browsers (e.g. Adobe Acrobat or Netscape) needed to access the manufacturer Web site.

(vii) Allow simple hyper-linking to the manufacturer Web site from Government Web sites and automotive-related Web sites.

(viii) Possess sufficient server capacity to allow ready access by all users and has sufficient capacity to assure that all users may obtain needed information without undue delay.

(ix) Correct or delete any reported broken Web links on a weekly basis.

(x) Allow for Web site navigation that does not require a user to return to the manufacturer home page or a search engine in order to access a different portion of the site.

(xi) Allow users to print out any and all of the materials required to be made available on the manufacturers Web site that can be reasonably printed on a standard printer, including the ability to print it at the user's location.

(5) *Small volume provisions for information dissemination.*

(i) Manufacturers with total annual sales of less than 5,000 engines shall have until July 1, 2011 to launch their individual Web sites as required by paragraph (j)(4) of this section.

(ii) Manufacturers with total annual sales of less than 1,000 engines may, in lieu of meeting the requirement of paragraph (j)(4) of this section, request the Administrator to approve an alternative method by which the required emissions-related information can be obtained by the persons specified in paragraph (j)(3)(i) of this section.

(6) *Required information.* All information relevant to the diagnosis and completion of emissions-related repairs shall be posted on manufacturer Web sites. This excludes indirect information specified in paragraphs (j)(7) and (j)(13) through (j)(17) of this section. To the extent that this information does not already exist in some form for their manufacturer franchised dealerships or authorized service networks, manufacturers are required to develop and make available the information required by this section to both their manufacturer franchised dealerships or authorized service networks and the aftermarket. The required information includes, but is not limited to:

(i) Manuals, including subsystem and component manuals developed by a manufacturer's third party supplier that are made available to manufacturer franchised dealerships or authorized service networks, technical service bulletins (TSBs), recall service information, diagrams, charts, and training materials. Informal recall service information such as engineering notes and/or sketches are not required to be made available as long as this information is not made available to manufacturer franchised dealerships or authorized service networks in the form of manuals. Manuals and other such service information from third party suppliers are not required to be made available in full-text on manufacturer Web sites as described in paragraph (j)(4) of this section. Rather, manufacturers must make available on the manufacturer Web site as required by paragraph (j)(4) of this section an index of the relevant information and instructions on how to order such information. In the alternate, a manufacturer can create a link from its Web site to the Web site(s) of the third party supplier.

(ii) OBD system information which includes, but is not limited to, the following:

(A) A general description of the operation of each monitor, including a description of the parameter that is being monitored;

(B) A listing of all typical OBD diagnostic trouble codes associated with each monitor;

(C) A description of the typical enabling conditions (either generic or monitor-specific) for each monitor (if equipped) to execute during engine operation, including, but not limited to, minimum and maximum intake air and engine coolant temperature, speed range, and time after engine startup. In addition, manufacturers shall list all monitor-specific OBD drive cycle information for all major OBD monitors as equipped including, but not limited to, catalyst, catalyst heater, oxygen sensor, oxygen sensor heater, evaporative system, exhaust gas re-circulation (EGR), secondary air, and air conditioning system. Additionally, for diesel engines which also perform misfire, fuel system and comprehensive component monitoring under specific driving conditions (i.e., non-continuous monitoring; as opposed to spark ignition engines that monitor these systems under all conditions or continuous monitoring), the manufacturer shall make available monitor-specific drive cycles for these monitors. Any manufacturer who develops generic drive cycles, either in addition to, or instead of, monitor-specific drive cycles shall also make these available in full-text on manufacturer Web sites;

(D) A listing of each monitor sequence, execution frequency and typical duration;

(E) A listing of typical malfunction thresholds for each monitor;

(F) For OBD parameters for specific engines that deviate from the typical parameters, the OBD description shall indicate the deviation and provide a separate listing of the typical values for those engines;

(G) Identification and scaling information necessary to interpret and understand data available through Diagnostic Message 8 pursuant to SAE J1939–73 (as specified in paragraph (j)(17) of this section), or through Service/Mode $06 pursuant to SAE J1979 (as specified in paragraph (j)(17) of this section).

(H) Algorithms, look-up tables, or any values associated with look-up tables are not required to be made available.

(iii) Any information regarding any system, component, or part of a engine monitored by the OBD system that could in a failure mode cause the OBD system to illuminate the malfunction indicator light (MIL);

(iv) Manufacturer-specific emissions-related diagnostic trouble codes (DTCs) and any related service bulletins, troubleshooting guides, and/or repair procedures associated with these manufacturer-specific DTCs; and

(v) Information regarding how to obtain the information needed to perform reinitialization of any computer or anti-theft system following an emissions-related repair.

(7) *Anti-theft System Initialization Information.* Computer or anti-theft system initialization information and/or related tools necessary for the proper installation of on-board computers or necessary for the completion of any emissions-related repair on engines that employ integral security systems or the repair or replacement of any other emission-related part shall be made available at a fair and reasonable cost to

the persons specified in paragraph (j)(3)(i) of this section.

(i) Except as provided under paragraph (j)(7)(ii) of this section, manufacturers must make this information available to persons specified in paragraph (j)(3)(i) of this section, such that such persons will not need any special tools or manufacturer-specific scan tools to perform the initialization. Manufacturers may make such information available through, for example, generic aftermarket tools, a pass-through device, or inexpensive manufacturer specific cables.

(ii) A manufacturer may request Administrator approval for an alternative means to re-initialize engines for some or all model years through the 2013 model year by July 27, 2009. The Administrator shall approve the request only after the following conditions have been met:

(A) The manufacturer must demonstrate that the availability of such information to aftermarket service providers would significantly increase the risk of theft.

(B) The manufacturer must make available a reasonable alternative means to install or repair computers, or to otherwise repair or replace an emission-related part.

(C) Any alternative means proposed by a manufacturer cannot require aftermarket technicians to use a manufacturer franchised dealership or authorized service networks to obtain information or special tools to re-initialize the anti-theft system. All information must come directly from the manufacturer or a single manufacturer-specified designee.

(D) Any alternative means proposed by a manufacturer must be available to aftermarket technicians at a fair and reasonable price.

(E) Any alternative must be available to aftermarket technicians within twenty-four hours of the initial request.

(F) Any alternative must not require the purchase of a special tool or tools, including manufacturer-specific tools, to complete this repair. Alternatives may include lease of such tools, but only for appropriately minimal cost.

(G) In lieu of leasing their manufacturer-specific tool to meet this requirement, a manufacturer may also choose to release the necessary information to equipment and tool manufacturers for incorporation into aftermarket scan tools. Any manufacturer choosing this option must release the information to equipment and tool manufacturers within 60 days of Administrator approval.

(8) *Cost of required information.*

(i) All information required to be made available by this section, shall be made available at a fair and reasonable price. In determining whether a price is fair and reasonable, consideration may be given to relevant factors, including, but not limited to, the following:

(A) The net cost to the manufacturer franchised dealerships or authorized service networks for similar information obtained from manufacturers, less any discounts, rebates, or other incentive programs;

(B) The cost to the manufacturer for preparing and distributing the information, excluding any research and development costs incurred in designing and implementing, upgrading or altering the onboard computer and its software or any other engine part or component. Amortized capital costs for the preparation and distribution of the information may be included;

(C) The price charged by other manufacturers for similar information;

(D) The price charged by manufacturers for similar information prior to the launch of manufacturer Web sites;

(E) The ability of the average aftermarket technician or shop to afford the information;

(F) The means by which the information is distributed;

(G) The extent to which the information is used, which includes the number of users, and frequency, duration, and volume of use; and

(H) Inflation.

(ii) Manufacturers must submit to EPA a request for approval of their pricing structure for their Web sites and amounts to be charged for the information required to be made available under paragraphs (j)(4) and (j)(6) of this section at least 180 days in advance of the launch of the web site. Subsequent to the approval of the manufacturer Web site pricing structure, manufacturers shall notify EPA upon the increase in price of any one or all of the subscription options of 20 percent or more above the previously approved price, taking inflation into account.

(A) The manufacturer shall submit a request to EPA that sets forth a detailed description of the pricing structure and amounts, and support for the position that the pricing structure and amounts are fair and reasonable by addressing, at a minimum, each of the factors specified in paragraph (j)(8)(i) of this section.

(B) EPA will act upon on the request within180 days following receipt of a complete request or following receipt of any additional information requested by EPA.

(C) EPA may decide not to approve, or to withdraw approval for a manufacturer's pricing structure and amounts based on a conclusion that this pricing structure and/or amounts are not, or are no longer, fair and reasonable, by sending written notice to the manufacturer explaining the basis for this decision.

(D) In the case of a decision by EPA not to approve or to withdraw approval, the manufacturer shall within three months following notice of this decision, obtain EPA approval for a revised pricing structure and amounts by following the approval process described in this paragraph.

(9) *Unavailable information.* Any information which is not provided at a fair and reasonable price shall be considered unavailable, in violation of these regulations and section 202(m)(5) of the Clean Air Act.

(10) *Third party information providers.* (i) By January 1, 2011 manufacturers shall, for model year 2010 and later engines, make available to third-party information providers as defined in paragraph (j)(3)(ii) of this section with whom they may wish to engage in licensing or business arrangements, the required emissions-related information as specified in paragraph (j)(6) of this section either:

(A) Directly in electronic format such as diskette or CD-ROM using non-proprietary software, in English; or

(B) Indirectly via a Web site other than that required by paragraph (j)(4) of this section

(ii) Manufacturers are not responsible for the accuracy of the information distributed by third parties. However, where manufacturers charge information intermediaries for information, whether through licensing agreements or other arrangements, manufacturers are responsible for inaccuracies contained in the information they provide to third party information providers.

(11) *Required emissions-related training information.* By January 1, 2011, for emissions-related training information, manufacturers shall:

(i) Video tape or otherwise duplicate and make available for sale on manufacturer Web sites within 30 days after transmission any emissions-related training courses provided to manufacturer franchised dealerships or authorized service networks via the Internet or satellite transmission. Manufacturers shall not be required to duplicate transmitted emissions-related training courses if anyone engaged in the repairing or servicing of heavy-duty engines has the opportunity to receive the Internet or satellite transmission, even if there is a cost associated with the equipment required to receive the transmission;

(ii) Provide on the manufacturer Web site an index of all emissions-related training information available for purchase by aftermarket service providers for 2010 and newer engines. The required information must be made available for purchase within 3 months of model introduction and then must be made available at the same time it is made available to manufacturer franchised dealerships or authorized service networks, whichever is earlier. The index shall describe the title of the course or instructional session, the cost of the video tape or duplicate, and information on how to order the item(s) from the manufacturer Web site. All of the items available must be shipped within 3 business day of the order being placed and are to made available at a fair and reasonable price as described in paragraph (j)(8) of this section. Manufacturers unable to meet the 3 business day shipping requirement under circumstances where orders exceed supply and additional time is needed by the distributor to reproduce the item being ordered, may exceed the 3 business day shipping requirement, but in no instance can take longer than 14 days to ship the item.

(12) *Timeliness and maintenance of information dissemination.*

(i) Subsequent to the initial launch of the manufacturer's Web site, manufacturers must make the information required under paragraph (j)(6) of this section available on their Web site within six months of model introduction, or at the same time it is made available to manufacturer franchised dealerships or authorized service networks, whichever is earlier. After this six month period, the information must be available and updated on the manufacturer Web site at the same time that the updated information is made available to manufacturer franchised dealerships or authorized service networks, except as otherwise specified in this section.

(ii) *Archived information.* Manufacturers must maintain the required information on their Web sites in full-text as defined in paragraph (j)(6) of this section for a minimum of 15 years after model introduction. Subsequent to this fifteen year period, manufacturers may archive the information in the manufacturer's format of choice and provide an index of the archived information on the manufacturer Web site and how it can be obtained by interested parties. Manufacturers shall index their available information with a title that adequately describes the contents of the document to which it refers. Manufacturers may allow for the ordering of information directly from their Web site, or from a Web site hyperlinked to the manufacturer Web site. In the alternate, manufacturers shall list a phone number and address where aftermarket service providers can call or write to obtain the desired information. Manufacturers must also provide the price of each item listed, as well as the price of items ordered on a subscription basis. To the extent that any additional information is added or changed for these model years, manufacturers shall update the index as appropriate. Manufacturers will be responsible for ensuring that their information distributors do so within one regular business day of receiving the order. Items that are less than 20 pages (e.g. technical service bulletins) shall be faxed to the requestor and distributors are required to deliver the information overnight if requested and paid for by the ordering party. Archived information must be made available on demand and at a fair and reasonable price.

(13) *Recalibration Information.*

(i) Manufacturers shall make available to the persons specified in paragraph (j)(3)(i) of this section all emissions-related recalibration or reprogramming events (including driveability reprogramming events that may affect emissions) in the format of their choice at the same time they are made available to manufacturer franchised dealerships or authorized service networks. This requirement applies on July 1, 2013.

(ii) Manufacturers shall provide persons specified in paragraph (j)(3)(i) of this section with an efficient and cost-effective method for identifying whether the calibrations on engines are the latest to be issued. This requirement applies on July 1, 2013.

(iii) For all 2013 and later OBD engines equipped with reprogramming capability, manufacturers shall comply with either SAE J2534–1 (as specified in paragraph (j)(17 of this section), or the Technology and Maintenance Council's (TMC) Recommended Practice TMC RP 1210B (as specified in paragraph (j)(17) of this section).

(iv) For model years 2013 and later, manufacturers shall make available to aftermarket service providers the necessary manufacturer-specific software applications and calibrations needed to initiate pass-through reprogramming. This software shall be able to run on a standard personal computer that utilizes standard operating systems as specified in either SAE J2534–1 (as specified in paragraph (j)(17) of this section) or TMC RP 1210B (as specified in paragraph (j)(17) of this section).

(v) Manufacturers may take any reasonable business precautions necessary to protect proprietary business information and are not required to provide this information to any party that does not agree to these reasonable business precautions. The requirements to make hardware available and to release the information to equipment and tool companies apply on July 1, 2013, and within 3 months of model introduction for all new model years.

(14) *Generic and enhanced information for scan tools.* By July 1, 2013, manufacturers shall make available to equipment and tool companies all generic and enhanced service information including bi-directional control and data stream information as defined in paragraph (j)(3(ii) of this section. This requirement applies for 2013 and later model year engines.

(i) The information required by this paragraph (j)(14) shall be provided electronically using common document formats to equipment and tool companies with whom they have appropriate licensing, contractual, and/or confidentiality arrangements. To the extent that a central repository for this information (e.g. the TEK–NET library developed by the Equipment and Tool Institute) is used to warehouse this information, the Administrator shall have free unrestricted access. In addition, information required by this paragraph (j)(14) shall be made available to equipment and tool companies who are not otherwise members of any central repository and shall have access if the non-members have arranged for the appropriate licensing, contractual and/or confidentiality arrangements with the manufacturer and/or a central repository.

(ii) In addition to the generic and enhanced information defined in paragraph (j)(3)(ii) of this section, manufacturers shall also make available the following information necessary for developing generic diagnostic scan tools:

(A) The physical hardware requirements for data communication (e.g., system voltage requirements, cable terminals/pins, connections such as RS232 or USB, wires, etc.),

(B) Electronic Control Unit (ECU) data communication (e.g., serial data protocols, transmission speed or baud rate, bit timing requirements, etc.),

(C) Information on the application physical interface (API) or layers. (i.e., processing algorithms or software design descriptions for procedures such as connection, initialization, and termination),

(D) Engine application information or any other related service information such as special pins and voltages or additional connectors that require enablement and specifications for the enablement.

(iii) Any manufacturer who utilizes an automated process in their manufacturer-specific scan tool for diagnostic fault trees shall make available to equipment and tool companies the data schema, detail specifications, including category types/ codes and codes, and data format/ content structure of the diagnostic trouble trees.

(iv) Manufacturers can satisfy the requirement of paragraph (j)(14)(iii) of this section by making available diagnostic trouble trees on their manufacturer Web sites in full-text.

(v) Manufacturers shall make all required information available to the requesting equipment and tool company within 14 days after the request to purchase has been made unless the manufacturer requests Administrator approval to refuse to disclose such information to the requesting company or requests Administrator approval for additional time to comply. After receipt of a request and consultation with the affected parties, the Administrator shall either grant or refuse the petition based on the evidence submitted during the consultation process:

(A) If the evidence demonstrates that the engine manufacturer has a reasonably based belief that the requesting equipment and tool company could not produce safe and functionally accurate tools that would not cause damage to the engine, the petition for non-disclosure will be granted. Engine manufacturers are not required to provide data stream and bi-directional control information that would permit an equipment and tool company's products to modify an EPA-certified engine or transmission configuration.

(B) If the evidence does not demonstrate that the engine manufacturer has a reasonably-based belief that the requesting equipment and tool company could not produce safe and functionally accurate tools that would not cause damage to the engine, the petition for non-disclosure will be denied and the engine manufacturer, as applicable, shall make the requested information available to the requesting equipment and tool company within 2 days of the denial.

(vi) If the manufacturer submits a request for Administrator approval for additional time, and satisfactorily demonstrates to the Administrator that the engine manufacturer is able to comply but requires additional time within which to do so, the Administrator shall grant the request and provide additional time to fully and expeditiously comply.

(vii) Manufacturers may require that tools using information covered under paragraph (j)(14) of this section comply with the Component Identifier message specified in SAE J1939–71 (as specified in paragraph (j)(17) of this section) as Parameter Group Number (PGN) 65249 (including the message parameter's make, model, and serial number) and the SAE J1939–81 (as specified in paragraph (j)(17) of this section) Address Claim PGN.

(viii) Manufacturers are not required to make available to equipment and tool companies any information related to reconfiguration capabilities or any other information that would make permanent changes to existing engine configurations.

(15) *Availability of manufacturer-specific scan tools.* (i) Manufacturers shall make available for sale to the persons specified in paragraph (j)(3)(i) of this section their own manufacturer-specific diagnostic tools at a fair and reasonable cost. These tools shall also be made available in a timely fashion either through the manufacturer Web site or through a manufacturer-designated intermediary. Upon Administrator approval, manufacturers will not be required to make available manufacturer-specific tools with reconfiguration capabilities if they can demonstrate to the satisfaction of the Administrator that these tools are not essential to the completion of an emissions-related repair, such as recalibration. As a condition of purchase, manufacturers may request that the purchaser take all necessary training offered by the engine manufacturer. Any required training materials and classes must comply with the following:

(A) Similar training must be required by the engine manufacturer for the use of the same tool by its franchised dealerships or authorized service networks;

(B) The training must be substantially similar to such training in terms of material covered and the length of training;

(C) The training must be made available within six months after a tool request has been made;

(D) The training must be made available at a fair and reasonable price.

(ii) Manufacturers shall ship purchased tools in a timely manner after a request and training, if any, has been completed. Any required training materials and classes must be made available at a fair and reasonable price. Manufacturers who develop different versions of one or more of their diagnostic tools that are used in whole or in part for emission-related diagnosis and repair shall also insure that all emission-related diagnosis and repair information is available for sale to the aftermarket at a fair and reasonable cost. Factors for determining fair and reasonable cost include, but are not limited to:

(A) The net cost to the manufacturer's franchised dealerships or authorized service network for similar tools obtained from manufacturers, less any discounts, rebates, or other incentive programs;

(B) The cost to the manufacturer for preparing and distributing the tools, excluding any research and development costs;

(C) The price charged by other manufacturers of similar sizes for similar tools;

(D) The capabilities and functionality of the manufacturer tool;

(E) The means by which the tools are distributed;

(F) Inflation;

(G) The ability of aftermarket technicians and shops to afford the tools.

Manufacturers shall provide technical support to aftermarket service providers for the tools described in this section, either themselves or through a third-party of their choice.

(16) *Changing content of manufacturer-specific scan tools.* Manufacturers who opt to remove non-emissions related content from their manufacturer-specific scan tools and sell them to the persons specified in paragraph (j)(3)(i) of this section shall adjust the cost of the tool accordingly lower to reflect the decreased value of the scan tool. All emissions-related content that remains in the manufacturer-specific tool shall be identical to the information that is contained in the complete version of the manufacturer-specific tool. Any manufacturer who wishes to implement this option must request approval from the Administrator prior to the introduction of the tool into commerce.

(17) *Reference Materials.* Manufacturers shall conform with the following industry standards. These documents are incorporated by reference in § 86.1. Anyone may inspect copies at the U.S. EPA or at the National Archives and Records Administration (NARA). For information on the availability of this material at U.S. EPA, NARA, or the standard making bodies directly, refer to § 86.1.

(i) SAE J1939–71, Revised January 2008. For providing a means for the application processes to access the OSI environment, manufacturers shall comply with this industry standard.

(ii) SAE J1939–73, Revised September 2006. For identification and scaling information necessary to interpret and understand data available through Diagnostic Message 8, manufacturers shall comply with this industry standard. In the alternate, manufacturers may comply with Service/Mode $06 pursuant to SAE J1979, Revised May 2007. These recommended practices describe the implementation of diagnostic test modes for emissions related test data. Manufacturers shall comply with either SAE J1939–73 or SAE J1979 beginning with Model Year 2013.

(iii) SAE J1939–81, Revised May 2003. For management of source addresses and the association of those address with an actual function and with the detection and reporting of network realized errors, manufacturers shall comply with this industry standard.

(iv) SAE J2403, Revised August 2007. For Web-based delivery of service information, manufacturers shall comply with this industry standard which standardizes various terms, abbreviations, and acronyms associated with on-board diagnostics. Manufacturers shall comply with SAE J2403 beginning with the Model Year 2013.

(v) TMC RP 1210B, Revised June 2007. For pass-thru reprogramming capabilities, manufacturers shall comply with Technology and Maintenance Council's (TMC) Recommended Practice TMC RP 1210B. In the alternate, manufacturers may comply with SAE J2534–1, Revised December 2004. These recommended practices provide technical specifications and information that manufacturers must supply to equipment and tool companies to develop aftermarket pass-thru reprogramming tools. Manufacturers shall comply with either TMC RP 1210B or SAE J2534–1 beginning with Model Year 2013.

(18) *Reporting Requirements.* Performance reports that adequately demonstrate that each manufacturers website meets the information requirements outlined in paragraphs (j)(6)(i) through (j)(6)(vi) of this section shall be submitted to the Administrator annually or upon request by the Administrator. These reports shall indicate the performance and effectiveness of the websites by using commonly used Internet statistics (e.g., successful requests, frequency of use, number of subscriptions purchased, etc.). Manufacturers shall provide to the Administrator reports on an annual basis within 30 days of the end of the calendar year. These annual reports shall be submitted to the Administrator electronically utilizing non-proprietary software in the format as agreed to by the Administrator and the manufacturers.

(19) *Prohibited Acts, Liability and Remedies.*

(i) It is a prohibited act for any person to fail to promptly provide or cause a failure to promptly provide information as required by this paragraph (j), or to otherwise fail to comply or cause a failure to comply with any provision of this subsection.

(ii) Any person who fails or causes the failure to comply with any provision of this paragraph (j) is liable for a violation of that provision. A corporation is presumed liable for any violations of this subpart that are committed by any of its subsidiaries, affiliates or parents that are substantially owned by it or substantially under its control.

(iii) Any person who violates a provision of this paragraph (j) shall be subject to a civil penalty of not more than $ 31,500 per day for each violation. This maximum penalty is shown for calendar year 2002. Maximum penalty limits for later years may be set higher based on the Consumer Price Index, as specified in 40 CFR part 19. In addition, such person shall be liable for all other remedies set forth in Title II of the Clean Air Act, remedies pertaining to provisions of Title II of the Clean Air Act, or other applicable provisions of law.

(iv) Manufacturers will not have any emissions warranty, in-use compliance, defect reporting or recall liability for service on a heavy-duty engine that is not undertaken by the manufacturer, for any damage caused by their own tools in the hands of independent service providers, or for the use and misuse of third party tools.

■ 8. Section 86.1806–05 is amended by revising the section heading, paragraphs (a)(3), (h) introductory text, (h)(1)(v), (h)(1)(vii), (i), and (j) and adding new paragraphs (h)(2)(iv), (n) and (o) to read as follows:

§ 86.1806–05 On-board diagnostics for vehicles less than or equal to 14,000 pounds GVWR.

(a) * * *

(3) An OBD system demonstrated to fully meet the requirements in, through model year 2006, § 86.004–17 and, for model years 2007 and later, § 86.007–17 may be used to meet the requirements of this section, provided that such an OBD system also incorporates appropriate transmission diagnostics as may be required under this section, and provided that the Administrator finds that a manufacturer's decision to use the flexibility in this paragraph (a)(3) is based on good engineering judgement.

* * * * *

(h) The following documents are incorporated by reference, see § 86.1. Anyone may inspect copies at the U.S. EPA or at the National Archives and Records Administration (NARA). For information on the availability of this material at U.S. EPA, NARA, or the standard making bodies directly, refer to § 86.1.

(1) * * *

(v) SAE J1930, Revised April 2002. All acronyms, definitions and abbreviations shall be formatted according to this industry standard. Alternatively, manufacturers may use SAE J2403, Revised August 2007.

* * * * *

(vii) As an alternative to the above standards, heavy-duty vehicles may conform to the specifications of these SAE standards: SAE J1939–11, Revised October 1999; SAE J1939–13, July 1999; SAE J1939–21, Revised April 2001; SAE J1939–31, Revised December 1997; SAE J1939–71, Revised August 2002; SAE J1939–73, Revised June 2001; SAE J1939–81, July 1997.

(2) * * *

(iv) ISO 15765–4:2005(E), January 15, 2005. Beginning with the 2008 model year and beyond, this industry standard shall be the only acceptable protocol used for standardized on-board to off-board communications for vehicles below 8500 pounds. For vehicles 8500 to 14000 pounds, either this ISO industry standard or the SAE standards listed in paragraph (h)(1)(vii) of this section shall be the only acceptable protocols used for standardized on-board to off-board communications.

(i) *Deficiencies and alternative fueled vehicles.* Upon application by the manufacturer, the Administrator may accept an OBD system as compliant even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: Technical feasibility of the given monitor and lead time and production cycles including phase-in or phase-out of vehicle designs and programmed upgrades of computers. Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Administrator. Furthermore, EPA will not accept any deficiency requests that include the complete lack of a major diagnostic monitor (''major'' diagnostic monitors being those for exhaust aftertreatment devices, oxygen sensor, air-fuel ratio sensor, NO_X sensor, engine misfire, evaporative leaks, and diesel EGR, if equipped), with the possible exception of the special provisions for alternative fueled engines. For alternative fueled vehicles (e.g., natural gas, liquefied petroleum gas, methanol, ethanol), manufacturers may request the Administrator to waive specific monitoring requirements of this section for which monitoring may not be reliable with respect to the use of the alternative fuel. At a minimum, alternative fuel engines must be equipped with an OBD system meeting OBD requirements to the extent feasible as approved by the Administrator.

(j) *California OBDII compliance option.* Through the 2006 model year, for light-duty vehicles, light-duty trucks, and heavy-duty vehicles weighing 14,000 pounds GVWR or less, demonstration of compliance with California OBDII requirements (Title 13 California Code of Regulations § 1968.2 (13 CCR 1968.2)), as modified, approved and filed on April 21, 2003 (incorporated by reference, see § 86.1), shall satisfy the requirements of this section, except that compliance with 13 CCR 1968.2(e)(4.2.2)(C), pertaining to 0.02 inch evaporative leak detection, and 13 CCR 1968.2(d)(1.4), pertaining to tampering protection, are not required to satisfy the requirements of this section. Also, the deficiency provisions of 13 CCR 1968.2(i) do not apply. In addition, demonstration of compliance with 13 CCR 1968.2(e)(16.2.1)(C), to the extent it applies to the verification of proper alignment between the camshaft and crankshaft, applies only to vehicles equipped with variable valve timing. Beginning with the 2007 model year, for light-duty vehicles, light-duty trucks, and heavy-duty vehicles weighing 14,000 pounds GVWR or less, demonstration of compliance with California OBD II requirements (Title 13 California Code of Regulations § 1968.2 (13 CCR 1968.2)), approved on November 9, 2007 (incorporated by reference, see § 86.1), shall satisfy the requirements of this section, except that compliance with 13 CCR 1968.2(e)(4.2.2)(C), pertaining to 0.02 inch evaporative leak detection, and 13 CCR 1968.2(d)(1.4), pertaining to tampering protection, are not required to satisfy the requirements of this section. Also, the deficiency provisions of 13 CCR 1968.2(k) do not apply. In addition, demonstration of compliance with 13 CCR 1968.2(e)(15.2.1)(C), to the extent it applies to the verification of proper alignment between the camshaft and crankshaft, applies only to vehicles equipped with variable valve timing. For all model years, the deficiency provisions of paragraph (i) of this section and the evaporative leak detection requirement of paragraph (b)(4) of this section, if applicable, apply to manufacturers selecting this paragraph for demonstrating compliance.

* * * * *

(n) For 2007 and later model year diesel complete heavy-duty vehicles, in lieu of the malfunction descriptions of paragraph (b) of this section, the malfunction descriptions of this paragraph (n) shall apply. The OBD system must detect and identify malfunctions in all monitored emission-related powertrain systems or components according to the following malfunction definitions as measured and calculated in accordance with test procedures set forth in subpart B of this part (chassis-based test procedures), excluding those test procedures defined as ''Supplemental'' test procedures in § 86.004–2 and codified in §§ 86.158, 86.159, and 86.160.

(1) *Catalysts and diesel particulate filters (DPF).*

(i) If equipped, reduction catalyst deterioration or malfunction before it results in exhaust emissions exceeding, for model years 2007 through 2009, 4 times the applicable NO_X standard and, for model years 2010 through 2012, the applicable NO_X standard+0.6 g/mi and, for model years 2013 and later, the applicable NO_X standard+0.3 g/mi. Further, if equipped, oxidation catalyst (not to include the DPF), deterioration or malfunction before it results in exhaust NMHC emissions exceeding, for 2010 through 2012 model years, 2.5 times the applicable NMHC standard and, for 2013 and later model years, 2 times the applicable NMHC standard. Monitoring of oxidation catalysts is not required through the 2009 model year. These catalyst monitoring need not be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold. As an alternative to the oxidation catalyst monitoring requirement, the monitor can be designed to detect oxidation catalyst deterioration or malfunction before it results in an inability to achieve a temperature rise of 100 degrees C, or to reach the necessary DPF regeneration temperature, within 60 seconds of initiating an active DPF regeneration. Further, oxidation catalyst deterioration or malfunction when the DOC is unable to sustain the necessary regeneration temperature for the duration of the regeneration event. The OBD or control system must abort the regeneration if the regeneration temperature has not been reached within five minutes of initiating an active regeneration event, and if the regeneration temperature cannot be sustained for the duration of the regeneration event.

(ii) If equipped with a DPF, for all model years, catastrophic failure of the device must be detected. Any DPF whose complete failure results in exhaust emissions exceeding 1.5 times the applicable PM standard or family emissions limit (FEL) must be monitored for such catastrophic failure. This monitoring need not be done if the manufacturer can demonstrate that a catastrophic failure of the system will not result in exceedance of the threshold. Further, if equipped with a DPF, the OBD system shall detect DPF deterioration or malfunction before it results in exhaust emissions exceeding, for 2010 through 2012 model years, 4 times the applicable PM standard and, for 2013 and later model years, the applicable PM standard +0.04 g/mi.

(2) *Engine misfire.* Lack of cylinder combustion must be detected.

(3) *Exhaust gas sensors.*

(i) *Oxygen sensors and air-fuel ratio sensors downstream of aftertreatment devices.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 4 times the applicable PM standard, or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard and, for 2013 and later model years, the applicable PM standard+0.04 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard.

(ii) *Oxygen sensors and air-fuel ratio sensors upstream of aftertreatment devices.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 4 times the applicable PM standard, or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2010 through 2012 model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2013 and later model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard, or 2 times the applicable CO standard.

(iii) *NO_X sensors.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 5 times the applicable PM standard, or 4 times the applicable NO_X standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.6 g/mi and, for 2013 and later model years, the applicable PM standard+0.04 g/mi, or the applicable NO_X standard+0.3 g/mi.

(4) [Reserved.]

(5) *Other emission control systems and components.* Any deterioration or malfunction occurring in an engine system or component directly intended to control emissions, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding any of the following levels: For 2007 through 2009 model years, 4 times the applicable PM standard, or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2013 and later model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard, or 2 times the applicable CO standard. A functional check, as described in paragraph (n)(6) of this section, may satisfy the requirements of this paragraph (n)(5) provided the manufacturer can demonstrate that a malfunction would not cause emissions to exceed the applicable levels. This demonstration is subject to Administrator approval. For engines equipped with crankcase ventilation (CV), monitoring of the CV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the CV system is unlikely to fail.

(6) *Other emission-related powertrain components.* Any other deterioration or malfunction occurring in an electronic emission-related powertrain system or component not otherwise described in paragraphs (n)(1) through (n)(5) of this section that either provides input to or receives commands from the on-board computer and has a measurable impact on emissions; monitoring of components required by this paragraph (n)(6) must be satisfied by employing electrical circuit continuity checks and rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters), and functionality checks for computer output components (proper functional response to computer commands) except that the Administrator may waive such a rationality or functionality check where the manufacturer has demonstrated infeasibility. Malfunctions are defined as a failure of the system or component to meet the electrical circuit continuity checks or the rationality or functionality checks.

(7) *Performance of OBD functions.* Any sensor or other component deterioration or malfunction which renders that sensor or component incapable of performing its function as part of the OBD system must be detected and identified on engines so equipped.

(o) For 2007 and later model year diesel complete heavy-duty vehicles, in lieu of the certification provisions of paragraph (k) of this section, the certification provisions of this paragraph (o) shall apply. For test groups required to have an OBD system, certification will not be granted if, for any test vehicle approved by the Administrator in consultation with the manufacturer, the malfunction indicator light does not illuminate under any of the following circumstances, unless the manufacturer can demonstrate that any identified OBD problems discovered during the Administrator's evaluation will be corrected on production vehicles.

(1)(i) If monitored for emissions performance—a reduction catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in exhaust emissions exceeding, for 2007 through 2009 model years, 4 times the applicable NO_X standard and, for 2010 through 2012 model years, the applicable NO_X standard+0.6 g/mi and, for 2013 and later model years, the applicable NO_X standard+0.3 g/mi. Also if monitored for emissions performance-an oxidation catalyst (not to include the DPF) is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in exhaust NMHC emissions exceeding, for 2010 through 2012 model years, 2.5 times the applicable NMHC standard and, for 2013 and later model years, 2 times the applicable NMHC standard. If monitored for exotherm performance for 2010 and later model years, an oxidation catalsyt is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in an inability to achieve a 100 degree C temperature rise, or the necessary regeneration temperature, within 60 seconds of initiating a DPF regeneration.

(ii) If monitored for performance—a DPF is replaced with a DPF that has catastrophically failed, or an electronic simulation of such. Further, a DPF is replaced with a deteriorated or defective DPF, or an electronic simulation of such, resulting in exhaust PM emissions exceeding, for 2010 through 2012 model years, 4 times the applicable PM standard and, for 2013 and later model years, the applicable PM standard+0.04 g/mi.

(2) An engine misfire condition is induced and is not detected.

(3)(i) If so equipped, any oxygen sensor or air-fuel ratio sensor located downstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 4 times the applicable PM standard, or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard and, for 2013 and later model years, the applicable PM standard+0.04 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard.

(ii) If so equipped, any oxygen sensor or air-fuel ratio sensor located upstream of aftertreatment devices is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 4 times the applicable PM standard, or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2010 through 2012 model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2013 and later model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard, or 2 times the applicable CO standard.

(iii) If so equipped, any NO_X sensor is replaced with a deteriorated or defective sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 5 times the applicable PM standard, or 4 times the applicable NO_X standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.6 g/mi and, for 2013 and later model years, the applicable PM standard+0.04 g/mi, or the applicable NO_X standard+0.3 g/mi.

(4) [Reserved.]

(5) A malfunction condition is induced in any emission-related engine system or component, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding any of the following levels: for 2007 through 2009 model years, 4 times the applicable PM standard or 3 times the applicable NO_X standard, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2010 through 2012 model years, 4 times the applicable PM standard, or the applicable NO_X standard+0.3 g/mi, or 2.5 times the applicable NMHC standard, or 2.5 times the applicable CO standard and, for 2013 and later model years, the applicable PM standard+0.02 g/mi, or the applicable NO_X standard+0.3 g/mi, or 2 times the applicable NMHC standard, or 2 times the applicable CO standard.

(6) A malfunction condition is induced in an electronic emission-related powertrain system or component not otherwise described in this paragraph (o) that either provides input to or receives commands from the on-board computer resulting in a measurable impact on emissions.

■ 9. Section 86.1863–07 is amended by revising paragraphs (b) and (c) to read as follows:

§ 86.1863–07 Optional chassis certification for diesel vehicles.

* * * * *

(b) For OBD, diesel vehicles optionally certified under this section are subject to the OBD requirements of § 86.1806–05 and superseding sections.

(c) Diesel vehicles optionally certified under this section may be tested using the test fuels, sampling systems, or analytical systems specified for diesel engines in Subpart N of this part or in 40 CFR part 1065.

* * * * *

PART 89—CONTROL OF EMISSIONS FROM NEW AND IN-USE NONROAD COMPRESSION-IGNITION ENGINES

■ 10. The authority citation for part 89 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart A—[Amended]

■ 11. Section 89.1 is amended by revising paragraph (b)(5) to read as follows:

§ 89.1 Applicability.

* * * * *

(b) * * *

(5) *Hobby engines.* This part does not apply for engines installed in reduced-scale models of vehicles that are not capable of transporting a person.

* * * * *

PART 90—CONTROL OF EMISSIONS FROM NONROAD SPARK-IGNITION ENGINES AT OR BELOW 19 KILOWATTS

■ 12. The authority citation for part 90 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart G—[Amended]

■ 13. Section 90.611 is revised to read as follows:

§ 90.611 Importation for purposes other than resale.

The provisions of 40 CFR 1054.630 apply for importation of nonconforming engines for personal use.

PART 1027—FEES FOR ENGINE, VEHICLE, AND EQUIPMENT COMPLIANCE PROGRAMS

■ 14. The authority citation for part 1027 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

■ 15. Section 1027.105 is amended by revising the equation in paragraph (c)(1)(i) and the equation in paragraph (c)(1)(ii) to read as follows.

§ 1027.105 How much are the fees?

* * * * *

(c) * * *

(1) * * *

(i) * * *

$$\text{Certificate Fee}_{CY} = \left[\left(Op + L \cdot \frac{CPI_{CY-2}}{CPI_{2006}}\right)\right] \cdot \frac{1.169}{\left[\left(cert\#_{MY-2} + cert\#_{MY-3}\right) \cdot 0.5\right]}$$

* * * * *

(ii) * * *

$$\text{Certificate Fee}_{CY} = \left[\left((Op + L) \cdot \frac{CPI_{CY-2}}{CPI_{2002}}\right)\right] \cdot \frac{1.169}{\left[\left(cert\#_{MY-2} + cert\#_{MY-3}\right) \cdot 0.5\right]}$$

* * * * *

PART 1033—CONTROL OF EMISSIONS FROM LOCOMOTIVES

■ 16. The authority citation for part 1033 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart B—[Amended]

■ 17. Section 1033.150 is amended by revising Table 1 in paragraph (f) to read as follows.

§ 1033.150 Interim provisions.

* * * * *

(f) * * *

TABLE 1 TO § 1033.150—IN-USE ADJUSTMENTS FOR TIER 4 LOCOMOTIVES

Fraction of useful life already used	In-use adjustments (g/bhp-hr)	
	For model year 2017 and earlier Tier 4 NO_X standards	For model year 2017 and earlier Tier 4 PM standards
0 < MW-hrs ≤ 50% of UL	0.7	0.01
50 < MW-hrs ≤ 75% of UL	1.0	0.01
MW-hrs > 75% of UL	1.3	0.01

* * * * *

Subpart F—[Amended]

■ 18. Section 1033.515 is amended by revising paragraph (c)(5) to read as follows.

§ 1033.515 Discrete-mode steady-state emission tests of locomotives and locomotive engines.

* * * * *

(c) * * *

(5) Begin proportional sampling of PM emissions at the beginning of each sampling period and terminate sampling within ± 5 seconds of the specified time in each test mode. If the PM sample is not sufficiently large, take one of the following actions consistent with good engineering judgment:

(i) Extend the sampling period up to a maximum of 15 minutes.

(ii) Group the modes in the same manner as the phases of the ramped modal cycle and use three different dilution settings for the groups. Use one setting for both idle modes, one for dynamic brake through notch 5, and one for notches 6 through 8. For each group, ensure that the mode with the highest exhaust flow (typically normal idle, notch 5, and notch 8) meets the criteria for minimum dilution ratio in 40 CFR part 1065.

* * * * *

■ 19. Section 1033.520 is amended by removing Tables 1 and 2 in paragraph (e)(7), and adding a new paragraph (g) to read as follows:

§ 1033.520 Alternative ramped modal cycles.

* * * * *

(g) The following tables define applicable ramped modal cycles for line-haul and switch locomotives:

TABLE 1 TO § 1033.520—LINE-HAUL LOCOMOTIVE RAMPED MODAL CYCLE

RMC test phase	Weighting factor	RMC mode	Time in mode (seconds)	Notch setting
Pre-test idle	NA	NA	600 to 900	Lowest idle setting[1]
Phase 1 (Idle test)	0.380	A	600	Low Idle.[2]
		B	600	Normal Idle.
Phase Transition				
Phase 2	0.389	C	1000	Dynamic Brake.[3]
		1	520	Notch 1.
		2	520	Notch 2.
		3	416	Notch 3.
		4	352	Notch 4.
		5	304	Notch 5.
Phase Transition				
Phase 3	0.231	6	144	Notch 6.
		7	111	Notch 7.
		8	600	Notch 8.

[1] See paragraph (d) of this section for alternate pre-test provisions.
[2] Operate at normal idle for modes A and B if not equipped with multiple idle settings.
[3] Operate at normal idle if not equipped with a dynamic brake.

TABLE 2 TO § 1033.520—SWITCH LOCOMOTIVE RAMPED MODAL CYCLE

RMC test phase	Weighting factor	RMC mode	Time in mode (seconds)	Notch setting
Pre-test idle	NA	NA	600 to 900	Lowest idle setting [1]
Phase 1 (Idle test)	0.598	A	600	Low Idle.[2]
		B	600	Normal Idle.
Phase Transition				
Phase 2	0.377	1	868	Notch 1.
		2	861	Notch 2.
		3	406	Notch 3.
		4	252	Notch 4.
		5	252	Notch 5.
Phase Transition				
Phase 3	0.025	6	1080	Notch 6.
		7	144	Notch 7.
		8	576	Notch 8.

[1] See paragraph (d) of this section for alternate pre-test provisions.
[2] Operate at normal idle for modes A and B if not equipped with multiple idle settings.

Subpart G—[Amended]

■ 20. Section 1033.640 is amended by revising paragraph (a)(2) to read as follows.

§ 1033.640 Provisions for repowered and refurbished locomotives.

(a) * * *

(2) Refurbished locomotives are locomotives that contain more unused parts than previously used parts. As described in this section, a locomotive containing more unused parts than previously used parts may be deemed to be either remanufactured or freshly manufactured, depending on the total amount of unused parts on the locomotive. Note that § 1033.901 defines refurbishment of a pre-1973 locomotive to be an upgrade of the locomotive.

* * * * *

■ 21. Section 1033.645 is amended by revising paragraph (a) to read as follows.

§ 1033.645 Non-OEM component certification program.

* * * * *

(a) *Applicability.* This section applies only for components that are commonly replaced during remanufacturing. It does not apply for other types of components that are replaced during a locomotive's useful life, but not typically replaced during remanufacture. Certified components may be used for remanufacturing or other maintenance.

(1) The following components are eligible for approval under this section:

(i) Cylinder liners.

(ii) Pistons.

(iii) Piston rings.

(iv) Heads

(v) Fuel injectors.

(vi) Turbochargers

(vii) Aftercoolers and intercoolers.

(2) Catalysts and electronic controls are not eligible for approval under this section.

(3) We may determine that other types of components can be certified under this section, consistent with good engineering judgment.

* * * * *

PART 1042—CONTROL OF EMISSIONS FROM NEW AND IN-USE MARINE COMPRESSION-IGNITION ENGINES AND VESSELS

■ 22. The authority citation for part 1042 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart B—[Amended]

■ 23. Section 1042.101 is amended by revising Table 1 in paragraph (a)(3) to read as follows:

§ 1042.101 Exhaust emission standards.

(a) * * *

(3) * * *

TABLE 1 TO § 1042.101—TIER 3 STANDARDS FOR CATEGORY 1 ENGINES BELOW 3700 kW [A]

Power density and application	Displacement (L/cyl)	Maximum engine power	Model year	PM (g/kW-hr)	NO_X + HC (g/kW-hr) [b]
All	disp. < 0.9	kW < 19	2009+	0.40	7.5
		19 ≤ kW < 75	2009–2013	0.30	7.5
			2014+	0.30	4.7
Commercial engines with kW/L ≤ 35 [b].	disp. < 0.9	kW ≥ 75	2012+	0.14	5.4
	0.9 ≤ disp. < 1.2	all	2013+	0.12	5.4
	1.2 ≤ disp. < 2.5	kW < 600	2014–2017	0.11	5.6
			2018+	0.10	5.6
		kW ≥ 600	2014+	0.11	5.6
	2.5 ≤ disp. < 3.5	kW < 600	2013–2017	0.11	5.6
			2018+	0.10	5.6
		kW ≥ 600	2013+	0.11	5.6
	3.5 ≤ disp. < 7.0	kW < 600	2012–2017	0.11	5.8
			2018+	0.10	5.8
		kW ≥ 600	2012+	0.11	5.8

TABLE 1 TO § 1042.101—TIER 3 STANDARDS FOR CATEGORY 1 ENGINES BELOW 3700 KW [a]—Continued

Power density and application	Displacement (L/cyl)	Maximum engine power	Model year	PM (g/kW-hr)	NO_X + HC (g/kW-hr) [b]
Commercial engines with kW/L > 35 and all recreational engines [b].	disp. < 0.9	kW ≥ 75	2012+	0.15	5.8
	0.9 ≤ disp. < 1.2	all	2013+	0.14	5.8
	1.2 ≤ disp. < 2.5		2014+	0.12	5.8
	2.5 ≤ disp. < 3.5		2013+	0.12	5.8
	3.5 ≤ disp. < 7.0		2012+	0.11	5.8

[a] No Tier 3 standards apply for commercial Category 1 engines at or above 3700 kW. See § 1042.1(c) and paragraph (a)(6) of this section for the standards that apply for these engines.

[b] The applicable NO_X + HC standards specified for Tier 2 engines in Appendix I of this part continue to apply instead of the values noted in the table for commercial engines at or above 2000 kW. FELs for these engines may not be higher than the Tier 1 NO_X standard specified in Appendix I of this part.

* * * * *

Subpart G—[Amended]

■ 24. Section 1042.635 is amended by revising paragraphs (a) and (b) and removing and reserving paragraph (c) to read as follows:

§ 1042.635 National security exemption.

* * * * *

(a) An engine is exempt without a request if it will be used or owned by an agency of the federal government responsible for national defense, where the vessel in which it is installed has armor, permanently attached weaponry, specialized electronic warfare systems, unique stealth performance requirements, and/or unique combat maneuverability requirements. This applies to both remanufactured and freshly manufactured marine engines.

(b) Manufacturers may request a national security exemption for engines not meeting the conditions of paragraph (a) of this section, as long as the request is endorsed by an agency of the federal government responsible for national defense. Agencies of the federal government responsible for national defense may request exemptions for remanufactured engines. In your request, explain why you need the exemption.

(c) [Reserved].

* * * * *

Subpart I—[Amended]

■ 25. Section 1042.850 is amended by adding paragraph (d) to read as follows:

§ 1042.850 Exemptions and hardship relief.

* * * * *

(d) Other exemptions specified in subpart G of this part and 40 CFR part 1068, subparts C and D also apply to remanufactured engines. For example, the national security exemption applies to remanufactured engines as described in § 1042.635.

PART 1048—CONTROL OF EMISSIONS FROM NEW, LARGE NONROAD SPARK-IGNITION ENGINES

■ 26. The authority citation for part 1048 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart A—[Amended]

■ 27. Section 1048.15 is amended by revising paragraph (a) to read as follows:

§ 1048.15 Do any other regulation parts apply to me?

(a) Part 1060 of this chapter describes standards and procedures for controlling evaporative emissions from engines fueled by gasoline or other volatile liquid fuels and the associated fuel systems. These requirements apply to engine manufacturers as specified in this part 1048. Part 1060 applies optionally for equipment manufacturers and fuel-system component manufacturers for certifying their products.

* * * * *

Subpart I—[Amended]

■ 28. Section 1048.801 is amended by revising the definition for ‘‘Constant-speed engine’’ to read as follows:

§ 1048.801 What definitions apply to this part?

* * * * *

Constant-speed engine means an engine that is certified only for constant-speed operation. This may include engines that allow the operator to adjust the set point for fixing the appropriate governed speed. See subparts B and C of this part for specific provisions related to certifying engines only for constant-speed operation. Engines whose constant-speed governor function is removed or disabled are no longer constant-speed engines.

* * * * *

PART 1054—CONTROL OF EMISSIONS FROM NEW, SMALL NONROAD SPARK-IGNITION ENGINES AND EQUIPMENT

■ 29. The authority citation for part 1054 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart G—[Amended]

■ 30. Section 1054.690 is amended by revising paragraph (a) to read as follows:

§ 1054.690 What bond requirements apply for certified engines?

(a) Before introducing certified engines into U.S. commerce, you must post a bond to cover any potential compliance or enforcement actions under the Clean Air Act unless you demonstrate to us in your application for certification that you are able to meet any potential compliance- or enforcement-related obligations, as described in this section. See paragraph (j) of this section for the requirements related to importing engines that have been certified by someone else. Note that you might also post bond under this section to meet your obligations under § 1054.120.

* * * * *

PART 1060—CONTROL OF EVAPORATIVE EMISSIONS FROM NEW AND IN-USE NONROAD AND STATIONARY EQUIPMENT

■ 31. The authority citation for part 1060 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart B—[Amended]

■ 32. Section 1060.102 is amended by revising paragraph (d)(1) to read as follows:

§ 1060.102 What permeation emission control requirements apply for fuel lines?

* * * * *

(d) * * *

(1) EPA Low-Emission Fuel Lines must have permeation emissions at or below 10 $g/m^2/day$ when measured according to the test procedure described in § 1060.510. Fuel lines that comply with this emission standard are deemed to comply with all the emission standards specified in this section.

* * * * *

■ 33. Section 1060.103 is amended by revising paragraph (d) to read as follows:

§ 1060.103 What permeation emission control requirements apply for fuel tanks?

* * * * *

(d) For purposes of this part, fuel tanks do not include fuel lines that are subject to § 1060.102, petcocks designed for draining fuel, grommets used with fuel lines, or grommets used with other hose or tubing excluded from the definition of ''fuel line.'' Fuel tanks include other fittings (such as fuel caps, gaskets, and O-rings) that are directly mounted to the fuel tank.

* * * * *

■ 34. Section 1060.105 is amended by revising paragraph (c)(2) to read as follows:

§ 1060.105 What diurnal requirements apply for equipment?

* * * * *

(c) * * *

(2) They must remain sealed up to a positive pressure of 24.5 kPa (3.5 psig); however, they may contain air inlets that open when there is a vacuum pressure inside the tank. Such fuel tanks may not contain air outlets that vent to the atmosphere at pressures below 34.5 kPa (5.0 psig).

* * * * *

Subpart F—[Amended]

■ 35. Section 1060.501 is amended by revising paragraph (e) to read as follows:

§ 1060.501 General testing provisions.

* * * * *

(e) Accuracy and precision of mass balances must be sufficient to ensure accuracy and precision of two percent or better for emission measurements for products at the maximum level allowed by the standard. The readability of the display may not be coarser than half of the required accuracy and precision. Examples are shown in the following table for a digital readout:

	Example #1	Example #2	Example #3
Applicable standard	1.5 $g/m^2/day$	1.5 $g/m^2/day$	15 $g/m^2/day$.
Internal surface area	1.15 m^2	0.47 m^2	0.015 m^2.
Length of test	14.0 days	14.0 days	14.1 days.
Maximum allowable mass change	24.15 g	9.87 g	3.173 g.
Required accuracy and precision	±0.483 g or better	±0.197 g or better	±0.0635 g or better.
Required readability	0.1 g or better	0.1 g or better	0.01 g or better.

■ 36. Section 1060.510 is revised to read as follows:

§ 1060.510 How do I test EPA Low-Emission Fuel Lines for permeation emissions?

For EPA Low-Emission Fuel Lines, measure emissions according to SAE J2260, which is incorporated by reference in § 1060.810.

■ 37. Section 1060.515 is amended by revising paragraphs (a)(1) and (c) to read as follows:

§ 1060.515 How do I test EPA Nonroad Fuel Lines and EPA Cold-Weather Fuel Lines for permeation emissions?

* * * * *

(a) * * *

(1) For EPA Nonroad Fuel Lines, use Fuel CE10, which is Fuel C as specified in ASTM D471 (incorporated by reference in § 1060.810) blended with ethanol such that the blended fuel has 10.0 ± 1.0 percent ethanol by volume.

* * * * *

(c) Measure fuel line permeation emissions using the equipment and procedures for weight-loss testing specified in SAE J30 or SAE J1527 (incorporated by reference in § 1060.810). Start the measurement procedure within 8 hours after draining and refilling the fuel line. Perform the emission test over a sampling period of 14 days.

* * * * *

PART 1065—ENGINE-TESTING PROCEDURES

■ 38. The authority citation for part 1065 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart G—[Amended]

■ 39. Section 1065.672 is amended by revising paragraph (d)(2) to read as follows:

§ 1065.672 Drift correction.

* * * * *

(d) * * *

(2) Correct for drift using the following equation:

$$x_{idriftcorrected} = x_{refzero} + \left(x_{refspan} - x_{refzero}\right) \cdot \frac{2x_i - \left(x_{prezero} + x_{postzero}\right)}{\left(x_{prespan} + x_{postspan}\right) - \left(x_{prezero} + x_{postzero}\right)}$$

Eq. 1065.672-1

Where:

$x_{idriftcorrected}$ = concentration corrected for drift.

$x_{refzero}$ = reference concentration of the zero gas, which is usually zero unless known to be otherwise.

$x_{refspan}$ = reference concentration of the span gas.

$x_{prespan}$ = pre-test interval gas analyzer response to the span gas concentration.

$x_{postspan}$ = post-test interval gas analyzer response to the span gas concentration.

x_i or $\bar{x}$ = concentration recorded during test, before drift correction.

$x_{prezero}$ = pre-test interval gas analyzer response to the zero gas concentration.

$x_{postzero}$ = post-test interval gas analyzer response to the zero gas concentration.

Example:

$x_{refzero}$ = 0 µmol/mol

$x_{refspan}$ = 1800.0 µmol/mol

$x_{prespan}$ = 1800.5 µmol/mol

$x_{postspan}$ = 1695.8 µmol/mol

x_i or $\bar{x}$ = 435.5 µmol/mol

$x_{prezero}$ = 0.6 µmol/mol

$x_{postzero} = -5.2$ µmol/mol

$$x_{idriftcorrected} = 0 + (1800.0 - 0) \cdot \frac{2 \cdot 435.5 - (0.6 + (-5.2))}{(1800.5 + 1695.8) - (0.6 + (-5.2))}$$

$x_{idriftcorrected} = 450.2$ µmol/mol

* * * * *

Subpart K—[Amended]

■ 40. Section 1065.1001 is amended by revising the definition for ''Constant-speed operation'' to read as follows:

§ 1065.1001 Definitions.

* * * * *

Constant-speed operation means engine operation with a governor that automatically controls the operator demand to maintain engine speed, even under changing load. Governors do not always maintain speed exactly constant. Typically speed can decrease (0.1 to 10) % below the speed at zero load, such that the minimum speed occurs near the engine's point of maximum power. (Note: An engine with an adjustable governor setting may be considered to operate at constant speed, subject to our approval. For such engines, the governor setting is considered an adjustable parameter.)

* * * * *

PART 1068—GENERAL COMPLIANCE PROVISIONS FOR NONROAD PROGRAMS

■ 41. The authority citation for part 1068 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart C—[Amended]

■ 42. Section 1068.201 is amended by revising paragraph (h) to read as follows:

§ 1068.201 Does EPA exempt or exclude any engines/equipment from the prohibited acts?

* * * * *

(h) You may ask us to modify the administrative requirements for the exemptions described in this subpart or in subpart D of this part. We may approve your request if we determine that such approval is consistent with the intent of this part. For example, waivable administrative requirements might include some reporting requirements, but would not include any eligibility requirements or use restrictions.

* * * * *

■ 43. Section 1068.225 is amended by revising paragraphs (a) and (b) and removing and reserving paragraph (c) to read as follows:

§ 1068.225 What are the provisions for exempting engines/equipment for national security?

(a) An engine/equipment is exempt without a request if it will be used or owned by an agency of the federal government responsible for national defense, where the equipment in which it is installed has armor, permanently attached weaponry, or other substantial features typical of military combat.

(b) Manufacturers may request a national security exemption for engines/equipment not meeting the conditions of paragraph (b) of this section as long as the request is endorsed by an agency of the federal government responsible for national defense. In your request, explain why you need the exemption.

(c) [Reserved].

* * * * *

Subpart D—[Amended]

■ 44. Section 1068.325 is amended as follows:

■ a. By revising paragraph (g).

■ b. By redesignating paragraph (i) as paragraph (j).

■ c. By adding and reserving paragraph (i).

§ 1068.325 What are the temporary exemptions for imported engines/equipment?

* * * * *

(g) You may import an engine if another company already has a certificate of conformity and will be modifying the engine to be in its final, certified configuration under the provisions of § 1068.262. You may also import a partially complete engine by shipping it from one of your facilities to another under the provisions of § 1068.260(c). If you are importing a used engine that becomes new as a result of importation, you must meet all the requirements that apply to original engine manufacturers under § 1068.262.

* * * * *

(i) [Reserved]

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