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Test Procedures for Highway and Nonroad Engines and Omnibus Technical Amendments

Draft Technical Support Document

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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Chapter 1: Highway engines (40 CFR parts 85 and 86)

I. Ramped-modal testing

Manufacturers must meet emission standards using a Supplemental Emission Test (SET) starting in 2007. The SET measures emissions during 13 separate steady-state modes of engine operation. For the laboratory-based SET specified in §86.1360-2007, we propose that the 13-mode test cycle be run using a Ramped-Modal Cycle (RMC), which is discussed below.

An RMC operates at the same engine speeds and loads as in conventional discrete-mode testing, but the modes are connected by gradual ramps in engine speed and/or torque for a single, continuous emission-sampling period. For the RMC we are proposing for the SET, the steady-state modes would be connected with twenty-second linear speed transitions and linear torque transitions, which is consistent with the transition time currently allowed in §86.1360-2007. The difference is that these transitions would also be sampled as part of the SET. That is, emission sampling would start at the beginning of an RMC and would not stop until its last mode was completed.

The RMC for the SET would involve a different sequence of modes than is currently specified in §86.1360-2007. For example, the first mode, which is engine idle, would be split so that half of the idle mode occurs at the beginning of the test and half occurs at the end of the test. This helps facilitate certain technical aspects of emission sampling. Instead of using weighting factors for each steady-state mode, an RMC specifies different time durations for each mode. Time durations of the modes and transitions are proportioned to the established modal weighting factors in §86.1360-2007. The information needed to run the SET as an RMC is given in the table below.

There are several advantages to running the SET as an RMC. First, we anticipate that manufacturers will use aftertreatment systems with discrete regeneration events to meet the emission standards for 2007 and later model year heavy-duty diesel engines (January 18, 2001, 66 FR 5002). Under the current procedure for conducting an SET in §86.1360-2007, manufacturers sample emissions for an unspecified time duration near the end of each of thirteen individual two-minute modes (except idle, which is four minutes). The result is thirteen separate measurements that must be combined mathematically to yield an overall emission result in g/hp-hr. Because discrete aftertreatment regeneration events typically cause short but large increases in emissions, the current procedure in §86.1360-2007 may not be repeatable—a regeneration event may or may not be sampled in a given mode. For sampling low concentrations of PM, this effect is exaggerated because sample times per mode may be as short as twenty seconds. Furthermore, without specific start and stop times for sampling each mode, an anticipated regeneration event may be intentionally or unintentionally included or excluded. With an RMC, this variability is removed by requiring emissions sampling for the entire forty-minute cycle.

The RMC involves one emission measurement rather than 13 separate measurements for each mode. The more frequent, separate measurements can cause inaccuracy, especially at low emission levels, since dead volumes in the sampling system and delayed sampling can cause the system to assign one mode's emissions to a different mode. The RMC avoids this by collecting the total emissions into a single sample and dividing by the total work done over the test period. A single measurement also substantially reduces the resource burden to conduct testing.

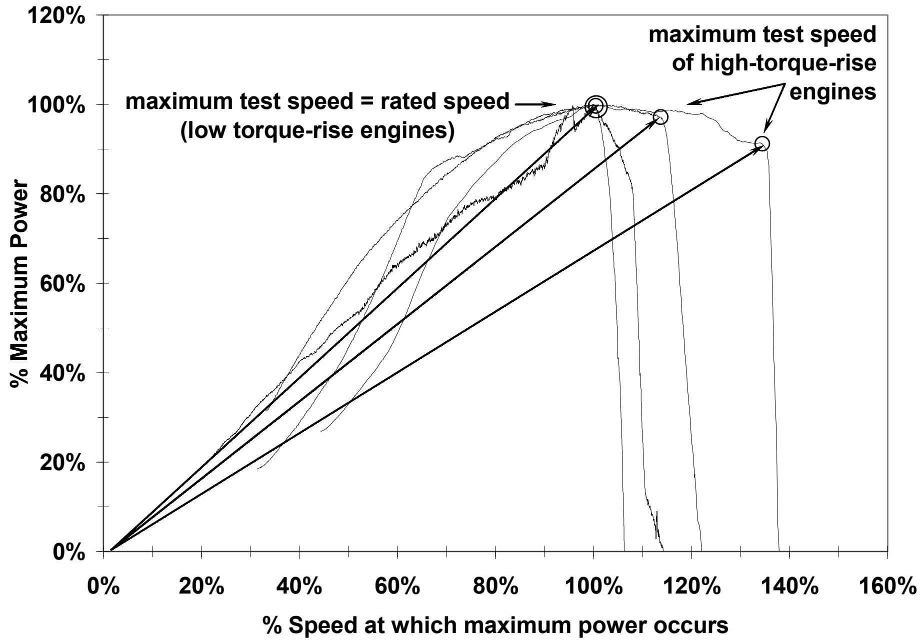
The RMC enables the use of batch sampling systems such as bag samplers. This is an advantage at low emissions, because these sampling systems are capable of quantifying lower levels than continuous sampling systems.

The longer sampling period for RMC testing also increases the total collected mass of pollutants. This is especially significant because the heavy-duty highway diesel PM standard, effective in 2007, approaches current PM microbalance quantification limits. Sampling for 40 minutes over the RMC increases the total collected PM by 500 percent compared with the conventional discrete-mode procedure.

II. Maximum test speed

Because maximum test speed in part 1065 differs from rated speed in part 86, we are considering a change to adjust how maximum test speed is applied to heavy-duty highway diesel engines. These speeds are used to transform normalized speeds into reference speeds for emission testing. For heavy-duty highway diesel engines, we require emission testing over the sequence speeds and torques in 40 CFR part 86, Appendix I, paragraph (f)(2), where rated speed is represented by 100 % speed (40 CFR 86.1333-90(g)).

Rated speed and maximum test speed can differ. Rated speed may be declared by the manufacturer within or above the speed range between the lowest and highest speed at which an engine generates 98 % maximum power. As stated in 40 CFR 86.1333-90(g), "[Rated speed] is generally intended to represent the rpm at which maximum brake horsepower occurs." In contrast, maximum test speed is the speed that lies farthest from the zero-speed, zero-power point on an engine power map that is normalized to 100 % power and 100 % speed at that power. Four such engine maps are illustrated below. For engines with low torque-rise, maximum test speed is at maximum power. So for these engines, there is little difference between maximum test speed and rated speed. Note that torque-rise means an increase in maximum torque from maximum power to maximum torque. We have observed, however, that all modern heavy-duty highway diesel engines have high torque-rise, which causes maximum test speed to be (15 to 35) % higher than rated speed. For these engines, a general shift toward higher test speeds is intentional in order to test these engines over their complete operating ranges.



The highest percent speed in the part 86 test sequence, however, is not 100 %, but 111.91 % at the 392nd second of the 1200-second sequence. There are also several other occurrences of speeds greater than 100 %. Coupled with a speed transformation using maximum test speed, these normalized speeds in excess of 100 % might not represent in-use operation of high torque-rise engines. We request comment on whether or not speeds above maximum test speed are representative of in-use operation. We also request comment on ways to ensure representative testing over the part 86 test sequence. We request comment on whether or not we should specify that maximum test speed should be equal to 112 % speed for this particular sequence. This would shift the prescribed speeds that are in excess of 100 % to be no greater than 99.92 % of maximum test speed. This adjustment would prevent excessive speeds, while ensuring our intent to specify maximum test speed to test an engine over its complete operating range.

Chapter 2: Land-based nonroad diesel engines (40 CFR parts 89 and 1039)

As described in the preamble, we are proposing to clarify the standards applicable to Independent Commercial Importers under Part 89 Subpart G, which are also referenced in §1039.660. We are proposing to make clear that the applicable standards for nonroad diesel engines imported by ICIs are those that applied during the year of the original production of the engine. The current regulations were written when Part 89 was new and there was only one Tier of standards. At that time, there were only two categories of engines– those produced before the date of applicable standards and those produced after. Engines produced before any applicable standards are clearly unregulated under the Act and may be imported without any modification (although that does not mean they can be freely installed in any piece of equipment). For those that were produced after the effective date of applicable standards, there was no question as to which set of standards applied (what we now call Tier 1). Unfortunately, no amendments were made to the ICI provisions as first Tier 2, then Tier 3 and finally Tier 4 standards were promulgated.

In the preamble, we explain that we are correcting text in the ICI provisions applicable to motor vehicles and motor vehicle engines to make clear that the applicable standards for those vehicles and engines are those of the original production year. There we set forth, from a 1996 final rule, that "many older vehicles cannot be modified to meet current year standards without extraordinary cost, which makes the conversion financially unfeasible for many owners of such vehicles." Particularly with the stringency of the Tier 4 standards, we believe that this statement also applies to past model year nonroad engines that might be imported by ICIs. Thus, we believe that the appropriate standards are those from the original year of production. However, as a precaution against the ICI program being used to circumvent new standards for large numbers of motor vehicles and motor vehicle engines, we are proposing to cap each ICI's usage of the program at a total of 50 light-duty vehicles and trucks, 50 motorcycles, and 5 motor vehicle engines in cases where the year of production standards are less stringent than the standards that apply during the year of modification.

We have issued only three certificates of conformity for nonroad engine ICIs in the history of our nonroad regulations, and each of those ICIs imported only a small number of engines. There are currently no ICIs with valid nonroad engine certificates. Additionally, the regulations generally require that, after certification, every third engine imported by an ICI be tested on an engine dynamometer under the federal test procedure (FTP). For these reasons, we do not believe that specifying original production year standards for these engines will lead to significant importation of older nonroad equipment or engines in the Tier 4 timeframe as a way to avoid incremental costs associated with Tier 4 engines. Still, as a precaution, we are proposing to cap the number of nonroad diesel engines that may be imported by an ICI in a given model year at 5 per year where the original production year standards are less stringent than those that apply during the year of modification. We believe this cap eliminates any concern that the goals of the Tier 4 program might be jeopardized, without impacting the current activities of any ICI.. We request comment on the appropriateness and size of this cap. We believe it is appropriate to take this action to provide the opportunity for ICIs to participate in the U.S. market. They have historically been small businesses and their existence may help to increase equipment choices available in the U.S. We believe, for example, that ICIs could at some point provide a mechanism for the importation of unique and highly specialized machines where volumes are so small that the original engine manufacturer elects not to certify, so that the equipment might not be otherwise available in the U.S. We intend to monitor the usage of the ICI provisions when aftertreatment-based standards take effect for nonroad engines. If we believe that the ICI provisions are being misused, or adversely impacting air quality in a particular location, we will consider addressing the problem through future rulemaking.

Chapter 3: Marine diesel engines (40 CFR part 94)

This chapter contains an explanation of several changes and clarifications we are proposing to apply to our marine diesel engine emission control program. We are adding a definition of amphibious vehicle and clarifying the meaning of auxiliary marine engine. We are also clarifying the application of certain certification flexibility provisions. These changes and clarifications are necessary to address issues that were raised by manufacturers and vessel owners as they implement this program.

It should be noted that the proposed revisions described below do not affect the requirements contained in Annex VI, Air Pollution, to the International Convention on the Prevention of Pollution from Ships, 1978, as modified by the protocol of 1978 relating thereto. Engine manufacturers, boat builders, and vessel operators would still be subject to those requirements once the Annex goes into force.[A]

3.1 Definition of Amphibious Vehicle (94.2)

3.1.1 Background

In our original nonroad diesel and marine engine emission control programs, we adopted a definition of marine vessel that is consistent with the General Provisions of 1 U.S.C. 3. (see 40 CFR 89.2, 91.2, and 94.2). According to that definition, "the word 'vessel' includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water."

In our recreational vehicle rule (67 FR 68242, November 8, 2002), we adopted a different definition of marine vessel for our standards for spark-ignition nonroad engines (40 CFR Parts 90 and 1048). According to this definition, a marine vessel is "a vehicle that is capable of operation in water but is not capable of operation out of water." This definition also specifies that "amphibious vehicles are not marine vessels." (40 CFR 90.2 and 40 CFR 1048.801). This modification was intended to address certain kinds of all-terrain vehicles that can be used on both land and water. These include the Argo and the Max all-terrain vehicles, which are offroad

[A]Annex VI has been ratified by the required number of countries (15 countries representing at least 50 percent of the world's merchant shipping tonnage) and will enter into force May 20, 2005. The countries that have ratified are: Bahamas, Bangladesh, Barbados, Denmark, Germany, Greece, Liberia, Marshall Islands, Norway, Panama, Samoa, Singapore, Spain, Sweden, and Vanuatu, representing about 55 percent of the world's merchant shipping tonnage. More information about this Convention can be found on our website, www.epa.gov/otaq/marine.htm and on the International Maritime Organization website, www.imo.org.

utility vehicles that can also be used in water. The body design of these nonroad vehicles allows them to float. They are propelled through the water by their tires, which can act as linear propellers, or by a jet or other type of propeller. These vehicles are designed to carry up to six passengers or two passengers plus a payload and are often used as utility or research vehicles in wetlands and swampy areas. Some are also marketed for recreational fishing in such areas. Because these vehicles are primary intended for use on land, however, we determined that it is appropriate that they be certified to the applicable ATV or offroad utility vehicle standards.

We have since learned that there are similar amphibious vehicles that use compression-ignition engines. These include small vehicles like the Supacat as well as larger vehicles like the DUKW, LARC, and ALVIS STALWART.[B] The existence of these land/sea vehicles leads us to reconsider the definition of marine vessel in our other nonroad programs with the goal of treating such vessels the same across our programs and to have a uniform definition.

3.1.2 Definition of Amphibious Vehicle

For the purpose of our mobile source emission control program, we are proposing to define amphibious vehicle as a vehicle with two or more wheels or with tracks and which is designed to be operated primarily on land but is also capable of operating in water. Amphibious vehicles would not be considered marine vessels and would be subject to the emission standards that apply to the land-based equivalent of the vehicle. We believe this approach is appropriate because it would subject all vehicles of a similar nature to the same set of emission standards. Otherwise, a manufacturer who makes available a marine-capable version of a land-based vehicle would have to certify the vehicle to two different standards.

We propose to add this definition to our land-based compression-ignition nonroad engine regulations (40 CFR 89), our spark-ignition marine engine regulations (40 CFR 91), our compression-ignition marine engine regulations (40 CFR 94), our spark-ignition nonroad engine <19 kW regulations (40 CFR 90), our spark-ignition nonroad engine >19 kW regulations (40 CFR 1048), and our recreational engine and vehicle regulations (40 CFR 1051). We also propose to make the necessary changes to the definition of marine vessel in those regulations.

[B]According to the U.S. Coast Guard, the three main types of vehicles used in the amphibious industry today were originally designed as military transports and are known as DUKWs (D=1942; U=Utility; K=Front Wheel Drive; and W=Two rear driving axels), LARCs (Lighter, Amphibious, Resupply, Cargo), and ALVIS STALWARTs. DUKWs were originally manufactured in the early 1940s for the U.S. Army, while LARCs were manufactured for the Navy. STALWARTs were manufactured for the British Army in the late 1960s. See Navigation and Vessel Inspection Circular No. 1-01, Inspection of Amphibious Passenger Carrying Vehicles, COMDTPUB P16700.4 NVIC 1-01, 11 December 2000.

3.1.3 Applicable Emission Standards

Amphibious vehicles can be street-legal, such as excursion vehicles for tourism purposes (e.g., TrolleyBoats) or designed only for off-highway use (e.g., Argo, Max, DUKW). To determine which engine standards apply, we would look to the land-based application. Under this approach, any vehicle that meets our definition of "motor vehicle" in 85.1703(a) would have to meet the highway emission standards that would otherwise be applicable to the vehicle if it were not capable of operating in water. So, for example, a street-legal TrolleyBoat would have to have an engine that meets our standards for heavy-duty highway diesel engines.

If an amphibious vehicle is not street-legal, i.e., it is designed only for off-highway use, then it must meet the emission standards in effect for a similar nonroad vehicle. If it has a compression-ignition engine (e.g., a DUKW), it must be certified to meet our nonroad diesel engine standards. If it has a spark-ignition engine, it must be certified to meet the applicable nonroad standards: all-terrain vehicle standards, small SI (<19 kW) standards, or large (>19 kW) SI standards (see table X.1-1).

Table X.1-1
Application of Nonroad to Amphibious Vehicles

Cycle	Terrain	Vehicle Characteristics	Applicable Standards
Spark-ignition	Rough	Saddle and handlebar	ATV
	Rough	No saddle, <25 mph	Small SI
	Rough	No saddle, >25 mph	ATV
	Non-rough	<19 kW	Small SI
	Non-rough	>19 kW	Large SI
Compression-Ignition	Rough or non-rough	Any	Nonroad CI

The proposed definition of amphibious vehicle and revision of our definition of marine vessel are intended solely for the purpose of our national emission control programs. These definitions do not affect in any way how these vehicles are treated by the United States Coast Guard or any other federal, state, or local agency that may have requirements for the safety, registration, or operation of such vehicles. It also does not affect the requirements for amphibious vessels under MARPOL Annex VI. Specifically, after the Annex comes into force, amphibious vessels with diesel engines above 130 kW will be required to have MARPOL-compliant engines as demonstrated by an Engine International Air Pollution Prevention (EIAPP) certificate and related documentation (Technical File and Record Book of Engine Parameters). In addition, vessels above 400 gross tons will be required to have an International Air Pollution Prevention (IAPP) certificate. These requirements are described in our rulemaking for marine diesel engines at or above 30 liters per cylinder, which is available on our website, <www.epa.gov/otaq/marine.htm>.

3.1.4 Hovercraft

We have learned that there are small hydrofoils (hovercraft) that can also operate on land as well as water. One example is the Griffon Hovercraft, which weighs 825 to 2,200 lbs and can carry 5 to 80 passengers.

A hovercraft would not be considered to be an amphibious vehicle under the above definition because it has neither wheels nor tracks. Instead, it would be considered a marine vessel and its engines would be subject to our marine engine emission control program. To meet these requirements, a hovercraft manufacturer could either purchase and install a certified marine engine or take advantage of our marine engine dresser provision. This provision allows an engine manufacturer, post-manufacturer marinizer, or boat builder to install a certified land-based or highway engine on a marine vessel as long as the engine has a valid certificate of conformity, it is properly labeled, and no changes are made to the engine that could reasonably be expected to increase its emissions. There are certain conditions associated with this flexibility: the original engine label must be clearly visible; a supplemental label must be affixed to the engine identifying it as a dressed engine, and certain information must be submitted to EPA with respect to the engine and the identity of the manufacturer. Section 3.4, below, has additional information about our engine dresser program.

3.2 Auxiliary Engines (94.2)

3.2.1 Background

In our December 1999 marine diesel engine rulemaking, we adopted a definition of “marine engine” that is based on whether an engine is installed or intended to be installed on a marine vessel (40 CFR 94.2). Some manufacturers have requested further interpretation of the phrase “installed or intended to be installed” as used in the definition to determine whether their engines are subject to emission standards for land-based or marine engines.

The definition adopted in 1999 states:

> Marine engine means an engine that is installed or intended to be installed on a marine vessel. This definition does not include portable auxiliary engines for which the fueling, cooling and exhaust systems are not integral parts of the vessel. (64 FR 73334)

In our rule, we explained some background we considered in adopting this definition:

> In the final land-based nonroad engine rule, we determined that a portable auxiliary engine used onboard a marine vessel should not be considered a marine engine (October 23, 1998, 63 FR 56967). Instead, a portable auxiliary engine is considered to be a land-based engine subject to the requirements of 40 CFR Part 89. To distinguish a marine auxiliary engine installed on a marine vessel from a land-based portable auxiliary engine used on a marine vessel, we specified in that rulemaking that an auxiliary engine is installed on a marine vessel

> if its fuel, cooling, or exhaust systems are an integral part of the vessel. These auxiliary engines are therefore not fundamentally different than land-based engines and we regulate them under 40 CFR Part 89. (64 FR 73302, discussing EPA's determination in "Summary and Analysis of Comments: Control of Emissions from Nonroad Diesel Engines," August 1998, p. 92)

The regulatory text and explanation in the final rule permit some narrow amount of portability for an engine to be considered "installed or to be installed on a marine vessel" and thus a marine engine. However, this portability is limited to engines that have systems that are integral to the vessel. If the engine does not have systems that are integral to the vessel, it would be considered a land-based nonroad engine.

3.2.2 Clarification of "portable"

Since we finalized the above definition, we learned that there continues to be confusion about what is meant by "portable" in our definition of marine engine. At least one engine manufacturer sought further clarification about whether, for example, an engine that is attached to a barge would be considered portable.

EPA would not consider an engine "installed" if it can easily be removed from a vessel to provide power to another application without modifications. In this case, a pump engine that is bolted onto the main deck of a boat or barge would not be considered installed if it could be readily disconnected from the pump machinery and lifted off the vessel to power a pump (or other device) elsewhere. Such an engine operates more as a stand-alone auxiliary engine than a marine engine. In contrast, EPA would consider an engine installed if it is mounted in such a way that would require significant effort to remove the engine (i.e., there is more to the mounting than a few brackets or straps).

The one exception to this "removability" interpretation of the regulation is for those engines that can easily be removed from a vessel, but whose fueling, cooling or exhaust systems are integral to the vessel. Such an engine, though conceptually portable because of its relationship to the vessel, cannot operate without a connection to the vessel. For example, if a portable engine could be designed with a quick-connect access to the onboard fuel supply or with other hardware that would allow the engine to tie into the vessel's cooling or exhaust systems, EPA would consider such an engine installed. Even though it is portable, such an engine could not generally operate without the fueling or other systems available on the vessel. In other words, it could not be operated once it is removed from the vessel.

3.2.3 Regulatory revision

The clarification described in this section does not require further regulatory text in 40 CFR 94. However, we are adding this definition to our other nonroad programs, including our land-based compression-ignition nonroad engine regulations (40 CFR 89), our spark-ignition marine engine regulations (40 CFR 91), our spark-ignition nonroad engine <19 kW regulations (40 CFR 90), and our spark-ignition nonroad engine >19 kW regulations (40 CFR 1048).

3.3 Certification of Marine Auxiliary Engines (94.912)

3.3.1 Background

The general industry practice is to produce marine engines by modifying land-based engines so they are suitable for marine application. The most important changes usually relate to tuning the power characteristics for marine propulsion, adapting the engine for use with water-based cooling, and changing various parts for improved corrosion resistance or compliance with Coast Guard requirements. However, manufacturers have also informed us that they sometimes sell engines for marine auxiliary service that are identical to land-based engines.

3.3.2 Streamlined certification for marine auxiliary engines

To avoid the regulatory and compliance burdens associated with certifying identical auxiliary marine engines under two separate programs, land-based and marine, we are proposing to allow streamlined certification. Under this approach, manufacturers would be able to include auxiliary marine diesel engines in a land-based engine family certified under 40 CFR part 89 or 1039, with the following conditions:

- The marine engine must be identical in all material respects to a land-based engine covered by a valid certificate of conformity;
- The marine engine may not be used as a propulsion engine;
- The engine must have the emission control information label required under the land-based program, including additional information to identify the engine as certified also for marine auxiliary purposes;
- The number of marine engines in the engine family must be smaller than the number of land-based engines; and
- The application for certification must identify the possibility of marine auxiliary installations, including projected sales of marine engines; if the projected marine sales are substantial, we may ask for the year-end report of production volumes to include actual marine auxiliary engine sales.

The requirement that the marine engine be identical in all material respect to a land-based engine covered by a valid certificate of conformity means that there must be no changes to the engine for use in the marine application. There can be no changes to the fuel system, the turbocharger, the cooling system requirements or any other characteristic. The engine must be able to be used interchangeably in a marine or land-based application without modification.

The proposed streamlined certification for auxiliary engines is intended solely for the purpose of our national emission control programs. This streamlined certification does not affect in any way how these engines are treated by the United States Coast Guard or any other federal, state, or local agency that may have requirements for the safety, registration, or other operation of such engines. It also does not affect the requirements for auxiliary engines under MARPOL

Annex VI.[C] Specifically, after the Annex comes into force, any diesel engine above 130 kW installed on a marine vessel constructed on or after January 1, 2000, and any engine above 130 kW that undergoes a substantial conversion on or after January 1, 2000, will be required to be MARPOL-compliant as demonstrated by an Engine International Air Pollution Prevention (EIAPP) certificate and related documentation (Technical File and Record Book of Engine Parameters). Therefore, engine manufacturers who take advantage of the streamlined certification for auxiliary engines and who may sell those engines for use on vessels subject to MARPOL Annex VI should make sure they obtain the necessary MARPOL Annex VI certification when they apply for certification of their land-based family. The MARPOL Annex VI requirements are described in our rulemaking for marine diesel engines at or above 30 liters per cylinder, which is available on our website, <www.epa.gov/otaq/marine.htm>.

3.4 Engine Dressing Provisions (94.907)

3.4.1 Background

Some companies produce marine engines by modifying new, land-based engines and modifying for installation on a marine vessel. This can be done in a way that does not affect emissions. For example, the modifications may consist of adding a generator or reduction gears for propulsion. It can also involve installing a new marine cooling system that meets original manufacturer specifications and duplicates the cooling characteristics of the land-based engine, but with a different cooling medium (i.e., water). This is similar to the process of buying certified land-based engines to make a generator or other equipment. This simplified approach of producing an engine can be described as dressing an engine for a particular marine application. Because the modified land-based engine is subsequently used on a marine vessel, however, it would be considered marine diesel engines pursuant to our definition of marine engine.

We included a provision in our final commercial marine diesel engine rule that exempts engines from the marine certification requirements if the marinizing company meets the following conditions (64 CFR 73303, December 29, 1999; see 40 CFR 907):

- The engine being dressed, (the "base" engine) must be a heavy-duty highway, land-based nonroad, or locomotive engine, certified pursuant to 40 CFR 86, 40 CFR 89, or 40 CFR 92. The base engine must be certified to the standards that apply at the time the base engine manufacturer completes assembly of the engine. We don't allow stockpiling of uncertified engines.

[C]MARPOL Annex VI is Annex VI, Air Pollution, to the International Convention on the Prevention of Pollution from Ships, 1978, as modified by the protocol of 1978 relating thereto. More information about this Convention can be found on our website, www.epa.gov/otaq/marine.htm and on the International Maritime Organization website, www.imo.org.

- The dressing process must not involve any changes that can reasonably be expected to increase engine emissions. This includes a requirement that engine cooling and aftercooling systems stay within the ranges specified by the original engine manufacturer.

- The original emissions-related label must remain on the engine.
- The dressing company must report annually to us the models that are exempt under this provision.
- The engine model must not be primarily for marine application.

It should be noted that the goal of our engine dressing provisions is to eliminate the burden of certification and other compliance requirements where we have confidence that an engine already certified to comparable standards for another program will meet marine engine emission standards. However, the certificate holder for the base engine continues to be liable, under the terms of the original certification, for the emissions performance of the dressed engine.

3.4.2 Regulatory Changes

The engine dresser provisions as they are currently written can be exercised by engine manufacturers, including post-manufacturer marinizers.[D] We are proposing to expand the list of companies who can use this flexibility to boat builders who produce a marine engine by installing a non-marine engine on a vessel without substantially modifying it. This provision is intended to cover circumstances, like the hovercraft example described in section 3.2, above, in which a vessel manufacturer uses a highway or nonroad engine on a vessel but does not modify it in any way that could affect its emissions. In the hovercraft example, the engine is used to run an air compressor that inflates the floating platform and generates air turbulence to propel the vessel forward. The engine does not require marine engine cooling systems, it is not adjusted to provide more power, and it requires no special fuel handling systems. A similar situation exists for airboats, where a highway or nonroad engine is used to run a large fan to propel the vessel forward. Because such engines are installed on a vessel they are considered to be marine engines. Under our existing programs, the boat builder manufacturer would have to certify the engines as marine engines even if they have a certificate of conformity under our highway or nonroad emission control programs because they do not qualify as engine manufacturers or post-manufacturer marinizers. Our proposed revision will make it clear that these vessel manufacturers would also qualify for the engine dressing exemption.

In addition, we are clarifying the provision regarding the requirement to demonstrate that the engine model is not primarily used in marine applications. This demonstration requires that the engine manufacturer show that fewer than 50 percent of the engine model's total sales for the model year are dressed engines. This includes engines dressed by others as well as the manufacturer of the base engine. This can be shown based on sales information. Engine

[D]Post-manufacturer marinizers are companies that produce a marine engine by modifying a non-marine engine and vessel manufacturers that substantially modify marine engines.

dressers who are not also the manufacturer of the base engine must get the original manufacturer to confirm that the engine is not primarily a marine engine.

We are also clarifying the requirements related to generating and using emission credits with these engines. Engines adapted for marine use through the engine dressing provisions may not generate or use emission credits under part 94. However, they may generate credits or use credits under the averaging, banking, and trading (ABT) provisions of the program under which they are originally regulated (highway, land-based nonroad, locomotive).

3.4.3 Requirement to Submit Emission Data

Under our existing program, base engine manufacturers utilizing the dressing exemption must submit marine-specific emission data on their dressed marine engines. In addition, we may request marine-specific data from the original engine manufacturer if another company is dressing their engines for marine application. We are not proposing to change this provision.

We intend to use this data for program oversight, to determine the validity of the exemption. This is important because marine engines are not operated in the same way as highway or land-based nonroad engines. This is reflected in the different duty cycles used for certification testing.

Specifically, we will use the test data to evaluate the extent to which the highway or land-based nonroad engines can be expected to achieve our marine engine emission limits when operated as marine engines. If we find that highway or land-based nonroad engines exceed the marine standards based on the marine duty cycle we will consider suspending this flexibility. The suspension of this flexibility would not affect marine engines already in the fleet, unless there is a substantial emission exceedence.

Using the data obtained under the engine dresser flexibility program to evaluate the validity of the exemption suggests that engine manufacturers will need to design their highway or land-based nonroad engine certification test programs to include the marine duty cycle if the engine may be sold into a marine application. We do not believe this will be burdensome, especially considering that the alternative is to do a full certification application for the marine engine.

As discussed above, land-based engines that are credit-users are eligible for the engine dressing exemption. Although they are properly certified, such dressed marine diesel engines may exceed the marine emission standards. We will take ABT credit use into account when we evaluate the validity of the program.

3.4.4 Other engine dressing provisions remain unchanged

The other components of our engine dressing provisions remain unchanged. These include the following:

- Any certified heavy-duty highway, nonroad, or locomotive engine will be eligible for the dressing exemption.
- The marine not-to-exceed (NTE) zone provisions do not apply to dressed engines, unless NTE provisions are in place for the certified base engine.
- Engines that qualify as dressed engines are considered to have a certificate under regulatory programs for both land-based and marine engines.
- If we find that a company with an engine dressing exemption does not, in fact, meet the criteria spelled out in the regulations, the engines are not exempt and we may pursue enforcement for selling uncertified marine engines and/or tampering with certified engines.
- The engine dressing company must put a supplemental label on each exempted engine stating the name of the dressing company and the fact that the engine was marinized without affecting emission controls. This will make clear that the engine is acceptable for use in a marine vessel. In addition, dressing companies will need to give us minimal notification that they are modifying certified engines. This can be done once annually for a company's whole range of dressed marine engines.

In addition to the labeling requirement, we encourage engine manufacturers to inform companies dressing their engines of these requirements. This will not only aid us in educating affected companies, it may help protect engine manufacturers from exposure to liability if their engines are ever found in a marine vessel without proper documentation.

The dressing provisions are intended solely for the purpose of our national emission control programs. This streamlined certification does not affect in any way how these engines are treated by the United States Coast Guard or any other federal, state, or local agency that may have requirements for the safety, registration, or other operation of such engines. It also does not affect the requirements for engines under MARPOL Annex VI.[E] Specifically, after the Annex comes into force, any diesel engine above 130 kW installed on a marine vessel constructed on or after January 1, 2000, and any engine above 130 kW that undergoes a substantial conversion on or after January 1, 2000, will be required to be MARPOL-compliant as demonstrated by an Engine International Air Pollution Prevention (EIAPP) certificate and related documentation (Technical File and Record Book of Engine Parameters). Therefore, engine manufacturers who take advantage of the engine dressing provisions and who may sell those engines for use on vessels subject to MARPOL Annex VI should make sure they obtain the necessary MARPOL Annex VI certification when they apply for certification of their land-based family. The MARPOL Annex VI requirements are described in our rulemaking for marine diesel engines at or above 30 liters per cylinder, which is available on our website, <www.epa.gov/otaq/marine.htm>.

[E]MARPOL Annex VI is Annex VI, Air Pollution, to the International Convention on the Prevention of Pollution from Ships, 1978, as modified by the protocol of 1978 relating thereto. More information about this Convention can be found on our website, www.epa.gov/otaq/marine.htm and on the International Maritime Organization website, www.imo.org.

3.5 Engine Repowers (94.1103(b))

We have received several requests for clarification about vessel repowers. Much of the existing confusion results from the fact that our marine engine program and the Annex VI program are slightly different and have different results depending on whether the engine used to repower the vessel is new or used.

3.5.1 Repowering With a New Engine

If a vessel owner is going to replace an existing engine on an existing vessel with a *new* engine, then the new engine must comply with the requirements of MARPOL Annex VI and the EPA program. Under MARPOL Annex VI, the engine must meet the Regulation 13 NOx limits (it must have a Statement of Voluntary Compliance or an EIAPP). Under the EPA program, the engine must comply with the emission limits that are in effect when the repower occurs. Note that if the replacement engine is certified to our Tier 2 standards it should also have a Statement of Voluntary Compliance or EIAPP and therefore will meet both the MARPOL Annex VI NOx requirements and the EPA requirements.

We provide an exemption in 40 CFR 941103(b)(3) which would allow a vessel owner to replace an existing engine with a new uncertified engine or a new engine certified to an earlier standard engine if it can be demonstrated that no new engine that is certified to the emission limits in effect at that time is produced by any manufacturer with the appropriate physical or performance characteristics needed to repower the vessel. In other words, if a new certified engine is not available that can be used, an engine manufacturer may produce a replacement engine that does not meet all of the requirements of our marine emission control program. For example, if an vessel has twin uncertified engines and it becomes necessary to replace one of them, the vessel owner can request approval for an engine manufacture to produce a new uncertified engine if it can be demonstrated that the vessel will not function properly if the engines are not identically matched.

There are certain conditions for this exemption. The replacement engine must meet standards at least as stringent as those of the original engine. So, for example, if the original engine is a pre-Tier 1 engine, then the replacement engine would not have to meet emission limits. If it is a Tier 1 engine, it would not have to meet the Tier 2 limits if those are the limits in place when the replacement occurs. In addition, the engine manufacturer must take possession of the original engine or make sure it is destroyed. Also, the replacement engine must be clearly labeled to show that it does not comply with the standards and that sale or installation of the engine for any purpose other than as a replacement engine is a violation of federal law and subject to civil penalty. Our regulations contain the information that must be on the label; we are adding a provision to cover the case where the engine meets a previous tier of standards.

Engines that qualify for this exemption are still subject to the Annex VI engine requirements. This means that if the vessel is subject to MARPOL Annex VI, the new replacement engine must be certified to the Annex VI NOx limits.

3.5.2 Repowering With a Used (Rebuilt) Engine

If a vessel owner replaces an existing engine with a used (rebuilt) engine, then that replacement engine is not required to be certified to our marine standards.

It should be noted, however, that if a vessel owner is going to replace an existing engine on an existing vessel constructed on or after January 1 2000 with a used (rebuilt) engine, the engine must comply with the requirements of MARPOL Annex VI. Under these requirements, the Annex VI NOx limits would apply if the used (rebuilt) engine undergoes a major conversion. This means it is substantially modified during the rebuilding process (e.g.,more was done than simply replacing used parts with identical new part) or it has a maximum continuous rating more than 10 percent higher than the old engine. If the original engine is being replaced by an identical used (rebuilt) engine, then there are no Annex VI emission requirements for the used (rebuilt) engine.

The MARPOL Annex VI requirements apply to diesel marine engines above 130 kW. If the engine is not a diesel engine or is a diesel engine at or below 130 kW, then there are no requirements for the used (rebuilt) engine under Annex VI.

3.5.3 Disposal of the Replaced Engine

Our current regulations require the engine manufacturer to take possession of the engine that is replaced. We are revising this provision to allow the manufacturer to confirm that the engine has been destroyed instead.

3.6 Other Revisions

3.6.1 Excluded and Exempted Engines (94.904)

We are proposing to add a new provision to Subpart J, Exclusion and Exemption Provisions, to allow an engine manufacturer to take an action with respect to an exempted or excluded engine that would otherwise be prohibited, such as selling it. Before the engine manufacturer can take such an action, the engine must either be certified or modified to make it identical to an engine that is already covered by a certificate.

3.6.2 Requirements Applicable to Vessel Manufacturers, Owners, and Operators (94.1001)

We are proposing to revise the applicability provisions in Section 94.1001 in Subpart K, Requirements Applicable to Vessel Manufacturers, Owners, and Operators, to specify that some of the requirements in that subpart apply to manufacturers, owners, and operators of marine vessels that contain engines with per-cylinder displacement of at least 2.5 liters.

Currently, the provisions in this subpart apply only to manufacturers, owners, and operators of marine vessels that contain engines with per-cylinder displacement at or above 30 liters.

This change is necessary because engines with per-cylinder displacement between 2.5 and 30 liters were erroneously left out of this provision when we extended mandatory Tier 1 standards to these engines in our 2003 rule for marine diesel engines at or above 30 liters per cylinder.

Chapter 4: Locomotives (40 CFR part 92)

As summarized in the preamble, we are proposing the following changes to 40 CFR part 92:

§92.1 (a) & (d)	Add paragraph (d) to clarify that subpart L applies to everyone.
§92.2	Change "unique" to "specific" in definition of calibration.
§92.2	Add "manufactured" to paragraph (5) of definition of new locomotive
§92.2	Add "percent" to definition of repower
§92.114(d)(2)	Allow lower backpressures
§92.123 (a)(2)(ii)	Delete the word "not"
Table B124-1	Clarify that 15 minute maximum refers to time after lowest idle setting is reached
§92.132(d)	Correct equation: $KH= [C1+C2exp((- .0143)(10.714))]/ [C1+C2exp((-0.0143)(1000H))]$
§92.203(d)	Correct reference from §92.208 to §92.204.
§92.205(a)&(e), §92.210(d)(2)&(#), §92.215(b)	Correct reference from "subpart" to "part"
§92.208(a)	Change "in which" to "for which".
§92.210	Make reference plural in paragraph (b)(1), and add paragraph (b)(2) to clarify that manufacturers making engine modifications within an engine family must show that the modified engines still meet emission standards.
§92.215(a)(2)(i)(A)	Correct typo in "process"
§92.216	Delete paragraph (a)(2) to allow the Office of Air and Radiation to represent itself at hearings.
§92.212	Correct typo in (b)(2)(v)(G), replace "Locomotive" with "Engine" in (c)(2)(v)(A), and correct the applicable manufacture date in (c)(2)(v)(D)(2).
§92.512(e)	Delete "is made"
§92.906(a)	Delete "as defined in §92.2".
§92.1106(a)	Correct the penalty for tampering to be based on each engine in violation, as opposed to each engine and each day.
Appendix IV to part 92	Correct "13-mode" to "10-mode"

Chapter 5: Small nonroad spark-ignition engines (40 CFR part 90)

We have adopted a new approach to define maximum engine power in 40 CFR part 1039 for nonroad diesel engines for purposes of defining the applicability of standards. This definition includes a detailed procedure for determining this value. The current approach for Small SI engines is to rely on a definition of "gross power" that describes generally how to characterize an engine's maximum power. We request comment on adopting the new definition of maximum engine power in 40 CFR part 90. This would have the advantage of harmonizing our treatment of this basic tool to characterize engines and would allow for consistent treatment across programs.

The regulations for nonroad diesel engines include the following provisions to define maximum engine power in 40 CFR 1039.140:

> (a) An engine configuration's maximum engine power is the maximum brake power point on the nominal power curve for the engine configuration, as defined in this section. Round the power value to the nearest whole kilowatt.
> (b) The nominal power curve of an engine configuration is the relationship between maximum available engine brake power and engine speed for an engine, using the mapping procedures of 40 CFR part 1065, based on the manufacturer's design and production specifications for the engine. This information may also be expressed by a torque curve that relates maximum available engine torque with engine speed.
> (c) The nominal power curve must be within the range of the actual power curves of production engines considering normal production variability. If after production begins it is determined that your nominal power curve does not represent production engines, we may require you to amend your application for certification under §1039.225.

Chapter 6: Large nonroad spark-ignition engines (40 CFR part 1048)

We adopted emission standards for Large SI engines in November 2002 (67 FR 68242). The regulations in 40 CFR part 1048 were our first attempt to draft emission-control regulations in plain-language format. In the recent final rule for nonroad diesel engines, we went through a similar process, including extensive interaction with a different set of manufacturers. This process led us to adopt regulatory provisions in 40 CFR part 1039 that differ from those in part 1048. Since the process of meeting standards, applying for certificates, and complying with other emission-related requirements has a lot of commonality across programs, we have a strong interest in adopting consistent provisions and uniform terminology as much as possible. As a result, we are proposing extensive changes in part 1048 to align with the regulations in part 1039.

Many of the changes we are proposing for part 1048 involve relatively minor wording differences. Several other changes involve new or revised language to express a regulatory provision more clearly without changing the underlying policy. There are also some minor organizational changes to move certain provisions to a different location that better reflects their relationship to the overall process of certifying engines. We believe it is important to make these changes to avoid a situation where we unintentionally apply slightly different provisions to different categories of engines. These changes that are intended to involve no change in policy are not listed here.[F]

The following tables highlight many of the specific changes we are proposing to part 1048.

I. Subpart A—Overview and Applicability

Reference	Proposed Change
1048.1	We now state that the part 1048 requirements apply to Large SI engines, rather than to the manufacturers of Large SI engines.
1048.5	We no longer state that aircraft engines are excluded from emission standards under 40 CFR part 1048, since we have changed the definition of nonroad engine to clarify that aircraft are not considered nonroad engines.

[F] See “Redline Version of 40 CFR Part 1048 Showing Proposed Changes,” EPA memo from Alan Stout to Docket OAR-2004-0017, July 5, 2004.

II. Subpart B—Emission Standards and Related Requirements

Reference	Proposed Change
1048.101(a)	In the November 2002 final rule, we excluded engines above 560 kW from transient emission standards on an interim basis, primarily to defer this decision to the rulemaking for nonroad diesel engines. Consistent with that rulemaking, we are affirming this decision as a long-term provision and are accordingly moving it from 1048.145 to 1048.101. These engines must still design for controlling transient emissions, but are not subject to the transient emission standards (see 1048.205).
1048.101(g)	The provision for a shorter useful life now includes provisions to clarify how a manufacturer can select and support some alternate useful life period. We also identify this as a shorter useful life in operating hours, not in years. Note that we are requesting comment on additional changes to this provision, as described in the preamble.
1048.105	We are exempting marine auxiliary engines from the evaporative emission standards, since we are separately pursuing evaporative controls for marine systems, which will eventually extend to fuel systems for both propulsion and auxiliary engines.
1048.115(a)	Provisions related to controlling crankcase emissions more carefully explain how to account for crankcase emissions in those cases where manufacturers add crankcase emissions to measured exhaust emissions.
1048.115(g)	The prohibition regarding defeat devices originally specified that an emission-control strategy that is active during testing over the specific duty cycles would not be considered a defeat device. We have expanded that to include field-testing operation by excluding operation that occurs during all testing under the procedures of Part 1048, Subpart F.
1048.120(a)	The scope of the warranty now explicitly includes secondary purchasers to make clear that the emission-related warranty is fully transferrable throughout the specified warranty period. Also, the scope of the warranty includes the engine and all its emission-related components.
1048.120(b)	Warranty periods are clarified: (1) If mechanical warranties are offered without charge, the emission-related warranty for the corresponding components (or the whole engine, as applicable) may not be shorter than the mechanical warranty. (2) If manufacturers offer an extended warranty for an extra charge, the emission-related warranty may not be shorter than that, but only for those particular engines. (3) We clarify that the warranty period starts when the engine is first placed into service.
1048.120(c)	We clarify that the warranty includes components such as catalysts that are manufactured by another company, even if the component is shipped separately and the certifying manufacturer never takes possession of those components.
1048.120(e)	We add a requirement for manufacturers to describe the emission-related warranty provisions that apply to their engines in the owners manual.
1048.125(c)	The rule originally allowed for extra maintenance for special situations. We are clarifying this to point out that manufacturers must make clear to the operator that this additional maintenance is tied to some special situation.
1048.125(g)	This provision was originally adopted as §1048.120(d). We have modified this to more carefully track provisions in the Clean Air Act. In particular, this provision now clarifies that owners must generally pay for scheduled maintenance, with an exception for relatively expensive parts that have been added to meet emission standards and that are not needed for proper engine performance.
1048.125(h)	Consistent with §1048.125(g), we now require manufacturers to communicate the owner's obligations to properly maintain their engines.

1048.130(d)	We have added a provision allowing manufacturers to communicate installation instructions to engine installers other than sending a copy of the instructions along with each engine. Manufacturers would describe in their application for certification that they would, for example, post their installation instructions on a publicly available web site.
1048.135(c)	We have modified the requirements for the emission control information label: (1) We now allow manufacturers to apply the corporate name and trademark from another company, (2) The manufacturing date need not be on the label, as long as the manufacturer keeps records that allow us to find out the manufacturing date, (3) The maintenance specifications may be omitted from the label if there is not enough room on the label and the information is instead printed in the owners manual. (4) Useful life must be included only if it is different than the default value specified in §1048.101(g).
1048.135(d)	We are adding a provision to specifically allow manufacturers to include additional label information related to meeting other emission standards, or properly maintaining engines.
1048.135(g)	We are adding a requirement for engine manufacturers to supply duplicate labels to equipment manufacturers that need them and to keep basic records to document the transactions. We have already adopted corresponding limits on what equipment manufacturers must do to properly apply these duplicate labels and prevent abuse, such as proliferation of counterfeit labels.
1048.139	We are adding a new section that describes more precisely how to determine maximum engine power. This applies to any provision in the regulations that relates to engine power, such as the applicability to engines above 19 kW. Maximum engine power values also serve to define a unique engine configuration (within normal production tolerances). If manufacturers want to include engines with different values for maximum engine power in an engine family, they would treat those as separate engine configurations.
1048.140	We are adding a new set of voluntary emission standards that would allow a manufacturer to qualify for the Blue Sky designation. Some manufacturers have expressed an interest in using automotive engines in nonroad applications. The additional voluntary standards are intended to more closely reflect the emission-control potential of a modern automotive engine (light-duty or heavy-duty) when produced for nonroad applications. We are also interested in aligning our voluntary standards with those under consideration by the California Air Resources Board.
1048.145(a)	We are clarifying the provisions related to family banking. For example, we are adding a requirement that manufacturers start producing early engines by September 1, 2006 to reduce the compliance burden in 2007. This prevents manufacturers from reducing their burden by producing engines marginally earlier than is required under the Tier 2 standards. Once a manufacturer qualifies, all the engines produced before January 1, 2007 would count toward reducing the Tier 2 compliance burden. We also clarify that the “late” engines would need to continue to be certified to Tier 1 emission standards, with all the associated requirements. Finally, we require manufacturers opting into family banking to report at the end of each year how many “early” or “late” engines they produced in the preceding year.

III. Subpart C—Certifying Engine Families

Reference	Proposed Change
1048.201(g)	We are including a clearer statement that we may require manufacturers to deliver test engines to a particular facility for our testing.
1048.205(a)	We are clarifying the direction to describe emission-control systems to require that manufacturers identify each unique configuration.

1048.205(b)	We are adding a clarifying note to include part numbers for emission-related components. This information, which is already commonly included in applications, helps us to manage the information related to the certified configuration, especially as it relates to running changes in an engine family.
1048.205(b)(11)	The instructions for completing the certification application now include detailed items related to auxiliary emission-control devices. This clarifies the manufacturers' existing responsibility to describe their emission-control systems.
1048.205(r)	Consistent with the Tier 4 final rule for nonroad diesel engines, we require manufacturers of engines above 560 kW to show how they control transient emissions. This gives us an opportunity in the certification process to ensure that engines are designed with control strategies that are similar to those for smaller engines and to ensure that engines have no defeat devices.
1048.205(t)	In addition to the existing requirement to describe adjustable parameters, we are including a requirement to describe how the adjustment limits are effective in preventing operators from making inappropriate adjustments.
1048.250(b)	We are adding a requirement to keep records related to production figures by separate assembly plants and lists of engine identification numbers in each engine family.

IV. Subpart D— Production-line Testing

1048.310(g)	Clarify that the maximum testing rate of 1 percent for production-line testing applies only after testing the minimum number of engines specified.

V. Subpart F—Test Procedures

Reference	Proposed Change
1048.501(a)	We are allowing testing with partial-flow dilute sampling. This approach is generally used for larger diesel engines, but some laboratories may also be set up to use partial-flow sampling for Large SI engines.
1048.501(a)	We no longer specify that testing must include measurement of CO_2 emissions. However, if manufacturers use equipment and procedures that require measurement of CO_2 emissions, then this information must be included in the application for certification (see §1048.205).
1048.505	We adopted conventional duty cycles and procedures for steady-state testing in the November 2002 final rule. We are supplementing these procedures with an option to test engines using a different kind of steady-state testing. Ramped modal cycles incorporate the same testing modes (in engine speed and load) into a single, continuous sampling period that involves gradual ramps to transition from one mode to the next. See the related supporting document for additional explanation of the development of ramped-modal testing.[7] We are not requiring ramped-modal testing instead of conventional discrete-mode testing, since the emission-control systems on Large SI engines generally do not have technologies that are time-sensitive (such as aftertreatment devices that undergo regeneration events), nor are emission levels so low that it is difficult to get accurate measurements over relatively short sampling periods.

[7] Final Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, U.S. EPA, May 2004, EPA420-R-04-0xx (Docket OAR-2004-0017-00xx).

VI. Subpart G—Compliance Provisions

Reference	Proposed Change
1048.605	We have made changes to this section to clarify the responsibilities of the original manufacturer of the engine and that of the "engine dressing" company. We also clarify the ABT responsibilities relative to engines or vehicles that are certified under the motor-vehicle program and used in nonroad applications.
1048.610	This section includes the same changes made in 1048.605 and adds a criterion such that adding 500 pounds to the weight of the vehicle is considered to be a substantial change to the engine. This is consistent with the approach we have taken in guidance documents under current regulations. The requirement to avoid changing the emission-control system now includes the refueling controls, since the vehicle is being used in nonroad service in its certified configuration; no engine installation is required.
1048.625	Provisions related to engines burning noncommercial fuels have been modified to clarify the engine manufacturer's responsibilities under this section. We have also modified the definition of noncommercial fuel to include fuel that is, for example, captured from an oil well and sold without processing the fuel to conform to any standardized specifications for commercial fuels.
1048.630	We are adding provisions describing a process by which manufacturers may produce engines that will be used solely for competition. These are consistent with provisions we have adopted for nonroad diesel engines.
1048.635	We are adding provisions that will allow manufacturers to place another company's brand name on the emission control information label. This is consistent with provisions we have adopted for nonroad diesel engines.

VII. Subpart I—Definitions and Other Reference Information

Reference	Proposed Change
1048.801	Brake power: We are revising the definition to focus on power required to fuel, lubricate, heat, and cool the engine, rather than on the components that do these things. This is necessary to address the ambiguity that would result from a single component such as a heat exchanger that cools the engine in addition to providing cooling for other purposes.
1048.801	We are revising the definition for constant-speed engines to clarify the that there are two distinct types of constant-speed governing. We also differentiate between constant-speed engines (certified using constant-speed duty cycles) and constant-speed operation (any kind of engine operation that is governed to stay at a constant-speed). This distinction is necessary because some engines that are not restricted to constant-speed certification may be installed in constant-speed applications.
1048.801	Noncommercial fuel: We have broadened this definition slightly to allow naturally emitted gases (such as from a landfill) to continue to be noncommercial fuels even if they are sold to an operator, as long as the product is not modified or processed in a way that would allow it to meet applicable standards for commercial fuels.
1048.801	Round: We are changing our rounding specification from ASTM E29 to NIST Special Publication 811. Our understanding is that these two publications have equivalent specifications.
1048.820	We are revising these provisions to clarify that we handle confidential information that we gather from manufacturers during inspections the same way that we handle what manufacturers send to us.

1048.825	We are adding details to better define the process for requesting hearings under part 1048. For example, manufacturers would need to send a written request within 30 days of an EPA judgment. Also, we would limit hearings to substantial factual issues. These are consistent with longstanding regulatory provisions from other programs.

Chapter 7: Recreational vehicles (40 CFR part 1051)

We are considering several adjustments to the test procedures, definitions, and other provisions related to the emission-control program for recreational vehicles.

1. Evaporative Emission Family Definition

Manufacturers certify their fuel systems by grouping them into emission families that have similar emission characteristics. The emission family definition is fundamental to the certification process and to a large degree determines the amount of testing required for certification. In the preamble for recreational vehicle FRM (67 FR 68242, November 8, 2002), we stated that "the regulations include specific characteristics for grouping emission families for each category of tanks and hoses. For fuel tanks, key parameters include wall thickness, material used (including additives such as pigments, plasticizers, and UV inhibitors), and the emission-control strategy applied. For hoses, key parameters include material, wall thickness, and emission-control strategy applied."

However, the regulatory text simply states "evaporative emission controls" as a subset of the engine family without detailing specific characteristics. We are proposing to modify §1051.230(b)(8) to include the key parameters discussed above. Types of evaporative emission controls include, but would not be limited to, permeation barriers, surface treatments, and barrier platelets (i.e. Selar®).

In addition we are restructuring this section to distinguish between exhaust and evaporative emission families. Currently, the regulations state that "you may ask us to create separate families for exhaust emissions and evaporative emissions." We are proposing that the primary approach be to have separate exhaust and evaporative emission families with the option for the manufacturer to combine these families into a single emission family.

2. Sealing the Fuel Tank During Permeation Testing

§1051.515 of the regulations specifies that the fuel tank must be sealed during the preconditioning fuel soak and permeation test. In §1051.515(a)(5), we expanded on how a tank may be sealed by stating: "Seal the fuel tank using nonpermeable fittings, such as metal or Teflon™." This statement, as it is written, has led to some confusion. One manufacturer was under the impression that they could seal all openings in the fuel tank with metal fittings including those openings that would be sealed in some other way in production vehicles.

However, the intent of this statement was only to allow nonpermeable plugs in openings that would not normally be sealed such as hose connection fittings. In the case where a fuel cap directly mounted to the fuel tank, the production fuel cap (including gaskets) would have to be used during a permeation test. The inside surface area of the fuel cap would be included in the calculation of total tank surface area. However, if there is a vent hole in the fuel cap, the vent hole could be sealed using a nonpermeable plug.

We are proposing to modify §1051.515(a)(5) to read: "Seal the fuel tank using fuel caps and other fittings that would be used to seal openings in a production fuel tank. In the case where openings are not normally sealed on the fuel tank (such as hose connection fittings and vents in fuel caps), these openings may be sealed using nonpermeable fittings such as metal or fluoropolymer plugs."

In addition, we are proposing to include a clarification in the definition of fuel system that states: "In the case where the fuel tank cap or other components (excluding fuel lines) are directly mounted on the fuel tank, they are considered to be a part of the fuel tank."

3. Definition of fuel lines

The fuel system hose permeation regulations refer to "fuel lines" without providing a definition of what fuel lines are. The intent of the permeation standards is to prevent hydrocarbons from permeating through the walls of the fuel system. This permeation occurs at the same rate for materials exposed to saturated fuel vapor as it does for materials exposed to fuel.[8,9,10,11] Therefore the intent of the permeation standards was to include all hose and tubing in the fuel system that carries fuel or fuel vapor. To clarify this point we are proposing to add a definition of fuel lines that reads as follows: "fuel line means all hoses or tubing containing either liquid fuel or fuel vapor including fuel delivery hose to the engine, fuel lines on the engine, fill neck hose, hose connecting dual fuel tanks, and hose connecting a fuel tank to a carbon canister."

4. Timing of the permeation test run

The fuel tank permeation test currently includes a soak period on gasoline blended with 10% ethanol (E10). The purpose of this soak is to stabilize the permeation rate of the fuel through the fuel tank. E10 is used because it generally represents the worst case for fuel that is commonly

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[8]Tuckner, P., Baker, J., "Fuel Permeation Testing using Gravimetric Methods," SAE Paper 2000-01-1096, 2000, Docket A-2000-01, Document IV-A-96.

[9]Nulman, M., Olejnik, A., Samus, M., Fead, E., Rossi, G., "Fuel Permeation Performance of Polymeric Materials," SAE Paper 2001-01-1999, 2001, Docket A-2000-01, Document IV-A-23.

[10]Stevens, M., Demorest, R., "Fuel Permeation Analysis Method Correction," SAE Paper 1999-01-0376, 1999, Docket A-2000-02, Document IV-A-03.

[11]Lockhart, M., Nulman, M., Rossi, G., "Estimating Real Time Diurnal Permeation from Constant Temperature Measurements," SAE Paper 2001-01-0730, Docket A-2000-01, Document IV-A-21.

used by in-use vehicles. After the soak, the fuel tank is drained and refilled with fresh fuel prior to the permeation weight loss test. The intent is to begin the test as soon as the fuel in the tank reaches the test temperature. However, the current regulations to not specify the allowable period between the fuel soak and the permeation test run. We are proposing to require the permeation test run to begin within eight hours of fueling the tank. This should provide ample time for the fuel to stabilize within the test temperature range.

The length of the test run as described in the preamble is two weeks. This was determined to be ample time for the weight loss to be large enough for an accurate measurement to be made on a fuel tank meeting the permeation standards. In the regulations, we specify a range of 2 to 4 weeks using good engineering judgement based on the permeation rate. The intent of this is to allow more time for tests on very low permeating fuel tanks to gain a large enough weight loss to make an accurate measurement. To provide clarification on the appropriate test length, we propose to update the regulations to more clearly define when a 4 week test may be used.

The concern with the above timing issues is two-fold. First, if the fuel in the tank would sit long enough before the first measurement (or even during an overly long weight loss test), “weathering” of the fuel could reduce the measured permeation rate. Weathering refers to the evaporation of lighter hydrocarbons in the fuel resulting in a less volatile fuel. In this case, the fuel during the test could end up having a significantly lower Reid vapor pressure (RVP) than is specified in the regulations.

The second concern with the timing of the permeation testing is related to the effects on ethanol on a fuel system. When the fuel tank is soaked using E10, the ethanol in the fuel can temporarily change the structure of the polymers used to construct the fuel tank. This change in structure increases the permeation rate through most materials. The fuel permeation test run itself can be performed using either gasoline or E10. We anticipated that either fuel would produce the same permeation results because, even if gasoline were used, the effects of the ethanol fuel soak would not be reversed in the short time needed to perform the weight loss test. Clearly, if the fuel tank were allowed to soak too long with gasoline during the permeation test, the effects of the ethanol soak would be reversed and the measured emissions could be underestimated.

To provide further assurance that the effects of the ethanol soak are included in the permeation test, we are proposing another requirement for fuel tanks tested for permeation on gasoline. Weight measurements of the fuel tank would be made daily. In this case, daily means five days per week to allow for weekends. The daily weight loss would be plotted versus time to determine if a linear relationship was observed. We would expect that if the ethanol effects were to begin to reverse, that the slope of the weight loss line would flatten. If a linear relationship (minimum R-squared of 0.8) was not seen through the entire permeation test run, the test would be void. To avoid the issue of fuel effects on the permeation rate, EPA would likely perform any confirmatory tests using E10 fuel.

5. Phase-In for Youth ATV and Off-Highway Motorcycle Models

It was our intention in the recreational vehicle regulations to include youth ATV and off-highway motorcycle models to be counted in the phase-in percentage requirements for ATVs and off-highway motorcycles. Therefore, we are proposing language to clarify that ATVs with a total displacement of 100 cc or less and off-highway motorcycles with a total displacement of 70 cc or less will count in the phase-in (percentage) requirements of §1051.105.

6. CO Maximum FEL for ATVs

For standards that allow averaging, EPA has traditionally set a maximum allowable family emission limit (FEL) to ensure that manufacturers won't establish FELs that unneccesarily exceed the standard. Table 1 of §1051.107, which lists the exhaust emission standards for ATVs, lists a maximum allowable family emission limit of 50 g/km for the CO standard. However, since there is not an option for CO averaging for ATVs, there is no need for a maximum allowable family emission limit. We are therefore proposing to remove the FEL cap of 50 g/km from Table 1.

7. Emissions-Related Warranty Period

The language in §1051.120(b) states "the emission-related warranty period must be valid for at least 50 percent of the vehicles minimum useful life in kilometers.." However, many recreational vehicles are equipped with hourmeters instead of odometers. Therefore it makes sense to add "hours of engine operation" to §1051.120(b).

8. NER Equations

The recreational vehicle rule requires manufacturers to label all of their certified vehicles with a removable hang-tag showing its emission characteristics relative to other models. In lieu of providing certification emission levels on the tag, manufacturers are required to calculate and provide a normalized emission rate (NER). §1051.135(g) requires manufacturers to round the NER to the nearest whole number. However, we believe that it would be more appropriate and equitable to round to one decimal place instead. We are therefore proposing to modify §1051.135(g) to allow rounding to one decimal place rather than to the nearest whole number.

We are also proposing two additional equations for engines under 225 cc that are certified to g/kW-hr standards. The first equation is an interim provision for engines under 225 cc that are certified under §1051.145(b). The proposed equation is similar to the existing equation that will continue to apply to larger engines certified under §1051.145(b), but accounts for the higher standards that apply to engines under 225 cc. The second equations would apply to ATV engines under 100 cc that are certified under §1051.615. This equation was previously described in the

Regulatory Support Document for the recreational vehicle final rule.[12]

9. Useful Life for Youth ATV and Off-Highway Motorcycle Models

§1051.105(c) and §1051.107(c) state that "..ATVs and off-highway motorcycles must meet a minimum useful life of 10,000 kilometers, 1000 hours of operation, or five years, whichever comes first." The Motorcycle Industry Council (MIC) provided us with survey data that indicates that for off-highway motorcycles with a displacement less than 70 cc and ATVs with a displacement less than 100 cc, the minimum useful life should be half of that for the larger displacement models. We are therefore proposing to change the minimum useful life for these youth models to 5,000 kilometers and 500 hours.

10. Raw Gas Sampling Provisions

In the preamble of the final rule adopting standards for recreational vehicles, we described our intent to allow all ATVs certifying to the J1088 cycle to use raw gas sampling. However, through oversight, this provision did not appear in the regulations. We are therefore proposing to adopt the intended provision allowing all ATVs certifying to J1088 to use the raw gas sampling provisions of Part 91 for engine testing through the 2008 model year. ATVs under 100 cc and off-highway motorcycles under 70 cc certifying using J1088 may continue to use raw gas sampling through the 2010 model year after which time they must provide data and an analysis which demonstrates emissions equivalence between the raw gas and dilute sampling methods.

11. Engine Test Speed

The International Snowmobile Manufacturers Association (ISMA) and the Motorcycle Industry Council (MIC) have both stated that due to the nature of how snowmobiles and ATVs operate, §1065.515(d) which describes how to determine "maximum test speed," is inappropriate and overly burdensome. They have suggested language that significantly reduces the number of steps involved in determining maximum test speed. ISMA has suggested the following language: "Maximum test speed for snowmobile testing is the maximum steady speed of the installed engine during normal in-use operation at wide-open throttle." MIC suggested the following language: "For constant-speed engines, maximum test speed is the same as the engine's maximum operating speed in use. For variable-speed engines, maximum test speed is the vehicle's rated speed, where rated speed is the point at which the engine's peak power occurs." Rather than the specific wording recommended, we are proposing a more general approach that allows manufacturers to test engines from recreational vehicles based on an engine's maximum power if that better represents in-use operation. We request comment on the appropriateness of this proposed provision.

[12] Final Regulatory Support Document: Control of Emissions from Unregulated Nonroad Engines, EPA420-R-02-022, September 2002.

12. Low-speed ATVs

There are two types of vehicles that meet the definition of all-terrain vehicle. First, traditional ATV models have four wheels, a single seat straddled by the rider and handlebars. We also define other vehicles to be all-terrain vehicles if they are designed for operation over rough terrain. However, we exclude rough-terrain vehicles if they meet certain criteria as utility vehicles. Manufacturers have raised the concern that they produce low-speed models that would meet the second meaning of the definition for all-terrain vehicle. The engine technology and vehicle operation, however, are much more like that for Small SI engines covered under 40 CFR part 90. To address this, we are proposing to set a threshold to qualify as an all-terrain vehicle under this second meaning of the definition. Any such vehicles with maximum speed below 25 miles per hour would not be considered an all-terrain vehicle and would therefore be subject to emission standards under 40 CFR part 90. We request comment on this approach to revising the definition for all-terrain vehicles.

13. Ramped-modal Testing

As described in Chapter 1, we have developed a testing method that simplifies steady-state emission measurements. Ramped-modal procedures combine the several discrete modes into a defined sequence of operation with a fixed amount of time in each mode to capture the appropriate weighting factor for individual modes. Emissions are measured continuously during engine operation, so there is a single measurement to quantify, rather than separately measuring emissions from each mode and mathematically determining the overall brake-specific emission level. We have proposed this testing method either as a required method or an alternative method for several other engine types. This approach may also be appropriate for the steady-state testing cycles specified for snowmobiles and youth-model ATVs and off-highway motorcycles. We are requesting comment on allowing manufacturers to choose between ramped-modal testing and the conventional approach with discrete-mode testing.

The following tables show how we would convert the existing steady-state duty cycles in part 1051 to ramped-modal cycles.

Ramped-modal Cycle for Testing Snowmobiles (§1051.505)

RMC Mode	Time in Mode	Speed (percent)	Torque (percent)
1a Steady-state	27	Warm Idle	0
1b Transition	20	Linear Transition	Linear Transition
2a Steady-state	121	100	100
2b Transition	20	Linear Transition	Linear Transition
3a Steady-state	347	65	19
3b Transition	20	Linear Transition	Linear Transition
4a Steady-state	305	85	51
4b Transition	20	Linear Transition	Linear Transition
5a Steady-state	272	75	33
5b Transition	20	Linear Transition	Linear Transition
6 Steady-state	28	Warm Idle	0

[1] Percent speed is percent of maximum test speed.
[2] Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the torque setting of the current mode to the torque setting of the next mode.
[3] Percent torque is percent of maximum test torque at maximum test speed.

Ramped-modal Cycle for Testing Recreational Engines (§1051.615)

RMC Mode	Time	Speed (percent) [1,2]	Torque (percent) [2,3]
1a Steady-state	41	Warm Idle	0
1b Transition	20	Linear Transition	Linear Transition
2a Steady-state	135	85	100
2b Transition	20	85	Linear Transition
3a Steady-state	112	85	10
3b Transition	20	85	Linear Transition
4a Steady-state	337	85	75
4b Transition	20	85	Linear Transition
5a Steady-state	518	85	25
5b Transition	20	85	Linear Transition
6a Steady-state	494	85	50
6b Transition	20	Linear Transition	Linear Transition
7 Steady-state	43	Warm Idle	0

[1] Percent speed is percent of maximum test speed.
[2] Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the torque setting of the current mode to the torque setting of the next mode.
[3] Percent torque is percent of maximum test torque at the commanded test speed.

14. Other Changes

We adopted emission standards for recreational vehicles in November 2002 (67 FR 68242). The regulations in 40 CFR part 1051 were our first attempt to draft emission-control regulations in plain-language format. In the recent final rule for nonroad diesel engines, we went through a similar process, including extensive interaction with a different set of manufacturers. This process led us to adopt regulatory provisions in 40 CFR part 1039 that differ from those in part 1051. Since the process of meeting standards, applying for certificates, and complying with other emission-related requirements has a lot of commonality across programs, we have a strong interest in adopting consistent provisions and uniform terminology as much as possible. As a result, we are proposing extensive changes in part 1051 to align with the regulations in part 1039.

Many of the changes we are proposing for part 1051 involve relatively minor wording differences. Several other changes involve new or revised language to express a regulatory provision more clearly without changing the underlying policy. There are also some minor organizational changes to move certain provisions to a different location that better reflects their relationship to the overall process of certifying engines. We believe it is important to make these changes to avoid a situation where we unintentionally apply slightly different provisions to different categories of engines. These changes that are intended to involve no change in policy are not listed here.[13]

The following tables highlight many of the specific changes we are proposing to part 1051.

I. Subpart A—Overview and Applicability

Reference	Proposed Change
1051.1	We now state that the part 1051 requirements apply to recreational vehicles, rather than to the manufacturers of recreational vehicles.

II. Subpart B—Emission Standards and Related Requirements

Reference	Proposed Change
1051.120(a)	The scope of the warranty now explicitly includes secondary purchasers to make clear that the emission-related warranty is fully transferrable throughout the specified warranty period. Also, the scope of the warranty includes the engine and all its emission-related components.
1051.120(b)	Warranty periods are clarified: (1) If mechanical warranties are offered without charge, the emission-related warranty for the corresponding components (or the whole engine, as applicable) may not be shorter than the mechanical warranty. (2) If manufacturers offer an extended warranty for an extra charge, the emission-related warranty may not be shorter than that, but only for those particular engines. (3) We clarify that the warranty period starts when the engine is first placed into service.
1051.120(c)	We clarify that the warranty includes components such as catalysts that are manufactured by another company, even if the component is shipped separately and the certifying manufacturer never takes possession of those components.
1051.120(e)	We add a requirement for manufacturers to describe the emission-related warranty provisions that apply to their engines in the owners manual.
1051.125(c)	The rule originally allowed for extra maintenance for special situations. We are clarifying this to point out that manufacturers must make clear to the operator that this additional maintenance is tied to some special situation.
1051.125(g)	This provision was originally adopted as §1051.120(d). We have modified this to more carefully track provisions in the Clean Air Act. In particular, this provision now clarifies that owners must generally pay for scheduled maintenance, with an exception for relatively expensive parts that have been added to meet emission standards and that are not needed for proper engine performance.
1051.125(h)	Consistent with §1051.125(g), we now require manufacturers to communicate the owner's obligations to properly maintain their engines.

[13] See "Redline Version of 40 CFR Part 1051 Showing Proposed Changes," EPA memo from Alan Stout to Docket OAR-2004-0017, July 5, 2004.

1051.130(d)	We have added a provision allowing manufacturers to communicate installation instructions to engine installers other than sending a copy of the instructions along with each engine. Manufacturers would describe in their application for certification that they would, for example, post their installation instructions on a publicly available web site.
1051.135(c)	We have modified the requirements for the emission control information label: (1) We now allow manufacturers to apply the corporate name and trademark from another company, (2) The manufacturing date need not be on the label, as long as the manufacturer keeps records that allow us to find out the manufacturing date, or stamp the date on the engine and print it in the owners manual, (3) Only the exhaust emissions must be printed on the label.
1051.135(d)	We are adding a provision to specifically allow manufacturers to include additional label information related to meeting other emission standards, or properly maintaining engines.
1051.135(g)	We are adding a requirement for engine manufacturers to supply duplicate labels to equipment manufacturers that need them and to keep basic records to document the transactions. We have already adopted corresponding limits on what equipment manufacturers must do to properly apply these duplicate labels and prevent abuse, such as proliferation of counterfeit labels.
1051.145(c)	We are correcting the provision related to waived production-line testing for engines that do not generate or use ABT credits; the corrected language refers to all the different emission standards to which this applies.

III. Subpart C—Certifying Engine Families

Reference	Proposed Change
1051.201(g)	We are including a clearer statement that we may require manufacturers to deliver test engines to a particular facility for our testing.
1051.205(a)	We are clarifying the direction to describe emission-control systems to require that manufacturers identify each unique configuration.
1051.205(b)	We are adding a clarifying note to include part numbers for emission-related components. This information, which is already commonly included in applications, helps us to manage the information related to the certified configuration, especially as it relates to running changes in an engine family.
1051.205(b)(11)	The instructions for completing the certification application now include detailed items related to auxiliary emission-control devices. This clarifies the manufacturers' existing responsibility to describe their emission-control systems.
1051.205(k)	Add a requirement to include the hang-tag label with normalized emission rates in the application for certification.
1051.205(t)	In addition to the existing requirement to describe adjustable parameters, we are including a requirement to describe how the adjustment limits are effective in preventing operators from making inappropriate adjustments.
1051.250(b)	We are adding a requirement to keep records related to production figures by separate assembly plants and lists of engine identification numbers in each engine family.

IV. Subpart D—Testing Production-Line Engines

Reference	Proposed Change
1051.310(g)	Clarify that the maximum testing rate of 1 percent for production-line testing applies only after testing the minimum number of engines specified.
1051.345	Change reporting requirements based on calendar quarters to refer instead to the test period. This addresses small-volume families for which the test period is the full model year.

V. Subpart F—Test Procedures

Reference	Proposed Change
1051.501(a)	We no longer specify that testing must include measurement of CO_2 emissions. However, if manufacturers use equipment and procedures that require measurement of CO_2 emissions, then this information must be included in the application for certification (see §1051.205).
1051.520	The provisions that were adopted under this section are now included under §1051.243.

VI. Subpart G—Compliance Provisions

Reference	Proposed Change
1051.605	We have made changes to this section to clarify the responsibilities of the original manufacturer of the engine and that of the "engine dressing" company. We also clarify the ABT responsibilities relative to engines or vehicles that are certified under the motor-vehicle program and used in recreational vehicles.
1051.610	This section includes the same changes made in 1051.605 and adds a criterion such that adding 500 pounds to the weight of the vehicle is considered to be a substantial change to the engine. This is consistent with the approach we have taken in guidance documents under current regulations. The requirement to avoid changing the emission-control system now includes the refueling controls, since the vehicle is being used in nonroad service in its certified configuration; no engine installation is required.
1051.635	We are adding provisions that will allow manufacturers to place another company's brand name on the emission control information label. This is consistent with provisions we have adopted for nonroad diesel engines.

VI. Subpart H—ABT Provisions

Reference	Proposed Change
1051.701	We clarify the limits on using emission credits across families and model years, especially as it relates to noncompliant engines.
1051.705	We clarify the process for reconciling the balance of emission credits at the end of the model year.
1051.710	We clarify the process for banking emission credits and using banked emission credits.
1051.715	We clarify the process for trading emission credits.

1051.725 - 735	We clarify the requirements for sending us ABT-related information in the application for certification and the end-of-year report, and for keeping such records.
1051.745	We clarify the legal liabilities associated with using ABT provisions to comply with emission standards.

VII. Subpart I—Definitions and Other Reference Information

Reference	Proposed Change
1051.801	Brake power: We are revising the definition to focus on power required to fuel, lubricate, heat, and cool the engine, rather than on the components that do these things. This is necessary to address the ambiguity that would result from a single component such as a heat exchanger that cools the engine in addition to providing cooling for other purposes.
1051.801	Round: We are changing our rounding specification from ASTM E29 to NIST Special Publication 811. Our understanding is that these two publications have equivalent specifications.
1051.820	We are revising these provisions to clarify that we handle confidential information that we gather from manufacturers during inspections the same way that we handle what manufacturers send us.
1051.825	We are adding details to better define the process for requesting hearings under part 1051. For example, manufacturers would need to send a written request within 30 days of an EPA judgment. Also, we would limit hearings to substantial factual issues. These are consistent with longstanding regulatory provisions from other programs.

Chapter 8: Test Procedures (40 CFR part 1065)

The following tables describe the changes we are proposing for 40 CFR part 1065. The table entries generally describe the background and rationale for provisions we are adopting. We also cite the source of many of these provisions, including other parts of the Code of Federal Regulations and the standards adopted by the International Organization for Standardization (ISO).

Subpart A– Applicability and General Provisions

§1065.1 Applicability

Reference	Description	Source
(a) and (b)	We broadened applicability of Part 1065 to include Model year 2008 and later heavy-duty highway engines we regulate under 40 CFR Part 86. For model years 2006 and 2007, manufacturers may use the test procedures in this part or those specified in 40 CFR Part 86, Subpart N.	

§1065.2 Statements in applications and approvals

Reference	Description	Source
	We reiterated anyone's obligation to report truthful information to us and to reiterate our treatment of confidential business information.	§1068.101 §1068.10

§1065.5 Overview and relationship to standard setting parts

Reference	Description	Source
(a)	We revised the list of information needed from standard setting parts to conduct emissions testing according to this part. We revised the list to reflect a broader set of field testing requirements among the standard setting parts.	

§1065.10 Other procedures

Reference	Description	Source
(c)(3)	We provided guidance on how to gradually update your test procedures to eventually comply with Part 1065 based on §86.1306-07(c)(3).	§86.1306-07(c)

§1065.12 Approval of alternate procedures

Reference	Description	Source
	We incorporated and revised text from §86.1306-07(d). We revised §86.1306-07(d) text to provide additional guidance on how to use statistical tests and how to use the statistics for field testing.(3)	§86.1306-07(d)

§1065.15 Overview of procedures for lab and field testing

Reference	Description	Source
	We described lab testing and field testing in a similar context.	
(c)(1)	We described engine operation during lab and field testing.	
(c)(2)	We allowed both continuous and batch (e.g. bag, PM filter) sampling of emissions. In Part 1065 we incorporate specifications in Part 86, Part 89, and ISO 8178.	40 CFR Part 86 40 CFR Part 89 ISO 8178
(c)(3)	We allowed work determination via chemical balances of fuel and exhaust. This enables field testing without a direct torque measurement and without a flow measurement that is accurate to flow, but only linearly proportional to flow.	

§1065.20 Units of measure and overview of calculations.

Reference	Description	Source
(a)	We adopted the international system of units (SI) for all calculations. We revised Part 1065 to comply with a federal agency requirement to adopt SI.	15 CFR 1170
(a)	We adopted a molar basis for calculating ideal gas flows, which includes intake air, dilution air and raw and diluted exhaust. We deleted the volume and mass bases to eliminate the associated confusion from different datums of standard pressure and standard temperature.	
(f)	We revised equipment and measurement instrument specifications in Part 1065 to scale with our emissions standards and with the power of your engine. We revised these specifications to enable Part 1065 to be applicable across a wide range of emissions standards and engine sizes.	

§1065.25 Recordkeeping

Reference	Description	Source
	We added a minimum 1-year requirement to keep records, which may be superceded by requirements in the standard-setting part.	

Subpart B– Equipment Specifications

§1065.101 Overview

Reference	Description	Source
	We revised this subpart to only describe equipment specifications. We described measurement instrument specifications in their own subpart: Subpart C.	

§1065.110 Dynamometers and operator demand.

Reference	Description	Source
(a)	We revised dynamometer specifications for different applications, including duty cycles with motoring commands. We broadened specifications for standard setting parts that have motoring in their duty cycles.	§86.1308 §89.306 ISO 8178-1 §7.2
(b)	We described of how to control engine operator demand (e.g. throttle) to help ensure representative testing in the lab.	

§1065.120 Fuels and fuel temperature and pressure

Reference	Description	Source
(b)	We allowed manufacturers to specify the fuel temperature and pressure to the engine to help ensure representative testing in the lab.	ISO 8178-1 §6

§1065.122 Engine fluids, heat rejection, and engine accessories

Reference	Description	Source
(c)	We described how to use engine accessories and how to account for power to those accessories.	§86.1327-98 8178-11 §5.3

§1065.125 Engine intake air

Reference	Description	Source
	We allowed emissions testing with a production intake air system to help ensure representative testing in the lab.	
(b)	We allowed use of a central barometer within 1 % of pressure at engine, instead of 0.1 % in §86.1344(e)(4), which is overly stringent considering exhaust conditions are only held within 1 % of barometric (e.g. within 4 inches of water column).	§86.1344(e)(4)
(c)	We allowed engine manufacturers to specify a range of intake restriction, noting manufacturers' liability up to the maximum allowable restriction.	
(d)	We allowed the use of coolant as cool as 25 °C. We required the use of a cooler with a typical charge air volume to help ensure representative testing in the lab.	8178-11 §5.2

§1065.130 Engine exhaust

Reference	Description	Source
(a) through (d)	We scaled the exhaust system material, design, and component specifications in Part 86 Subpart N to enable Part 1065 to be applicable across a wide range of engine powers.	CFR 86 Subpart N
(e)	We allowed forced aftertreatment cool-down based on guidance we issued in the past [(1)], [(2)].	§86.1335-90
(f)	We allowed engine manufacturers to specify a range of exhaust restriction, noting manufacturers' liability up to the maximum allowable restriction.	
(g)	We added specifications on how to route open crankcase emissions to accommodate standard setting parts that require open crankcase emissions measurements.	

§1065.140 Dilution for gases and PM.

Reference	Description	Source
(a)	We adopted a minimum dilution air temperature of 15 C from §86.1310-2007.[(3)]	§86.1310-2007
(b)(1)	We recommended HEPA filtration, and we limited PM background if HEPA filtration is not used to improve PM measurement repeatability.	§86.1310-2007
(c)	We revised the CVS specifications, which we based on §86.1310-2007, to scale across a broad range of engine powers to enable Part 1065 to be applicable across a broad range of engine powers.	§86.1310-2007
(d)	We allowed constant-dilution ratio partial flow dilution samplers such as CVS secondary dilution systems. Previously we allowed this according to §86.1310-2007. We also allowed varying dilution ratio samplers for gaseous emissions, such as bag mini-diluters. We only allowed varying dilution ratio PFD systems for PM measurement as an alternate procedure, where we required prior approval from us according to §1065.10 and §1065.12.	§86.1310-2007
(e)	We specified temperature control during PM sampling the same as we specified in 86.1310-2007.[(3)]	§86.1310-2007

§1065.145 Gaseous and PM probes, transfer lines, and sample conditioning components

Reference	Description	Source
(b)	We defined a probe as only that section of a sampling system inside the raw or dilute exhaust duct. Note that this is a change from some of our other regulations where we allowed up to 1 meter of transfer line to be considered part of the probe.	

(b)	We allowed single port or multiport probes oriented in any direction for gaseous emissions sampling. Note that this is a change from some of our other regulations where we required certain probes and orientations for gas sampling. We allowed a wider variety of probes. because gas sampling is insensitive to the previous specifications.	
(b)	We required a more prescriptive design and orientation of for PM probes to ensure proper PM sampling.	
(c)	We recommended how to install transfer lines, and we specified materials and temperatures of transfer lines based on §86.1310-2007, which were for diesel emissions sampling. We extended these specifications to include some spark-ignition engines.(3)	§86.1310-2007
(d)	We allowed sample conditioning components in-line with transfer lines based on §86.1310-2007.(3)	§86.1310-2007

§1065.170 Batch sampling for gaseous and PM constituents

Reference	Description	Source
(a) and (b)	We allowed gaseous batch sampling (e.g. bag sampling) based on Part 86 subpart B, and we revised batch sampling to include high temperature batch sampling (i.e. 191 C) based on 86.1310-2007.(3)	40 CFR Part 86 Subpart B §86.1310-2007
(c)	We required the same PM sample media (i.e filters) that we required in 86.1310-2007. In addition we required a more prescriptive filter specification for standards below 0.05 g/kW-hr. We required this to prevent gas-phase hydrocarbon adsorption onto the PM sample media, which would cause an incorrect result.(3)	§86.1310-2007
(c)	We added PM sample media and PM batch sampling specifications based on 86.1310-2007.(3)	§86.1310-2007

§1065.190 PM stabilization and weighing environments for gravimetric analysis

Reference	Description	Source
	We added PM stabilization and weighing environmental specifications based on §86.1312-2007.(3)	§86.1312-2007
(b)	We revised our recommended clean room specification from an obsolete federal standard to an ISO standard. We reduced the stringency of this recommendation by an order of magnitude to reflect best practices. We recommend deviating from the ISO standard to control air velocities near a balance.	§86.1312-2007
(c)	We adopted §86.1312-2007 specifications for temperature and humidity, and we added guidance on humidity control as a function of sulfuric acid in PM.(3)	§86.1312-2007
(d)	We adopted §86.1312-2007 specifications for temperature and humidity monitoring, but we are less prescriptive on the averaging of these parameters to allow for other acceptable system designs.(3)	§86.1312-2007

(e) and (f)	We adopted §86.1312-2007 specifications for balance installation and balance accessories and tools. We added recommendations based on previous guidance we issued to engine manufacturers. [1], [2]	§86.1312-2007

§1065.195 PM stabilization environment for in-situ analyzers

Reference	Description	Source
	We described the stabilization environment for in-situ PM analyzers, based on §86.1312 for gravimetric balances.[3] We expected that these instruments are likely to be used for field-testing PM measurement.	§86.1312-2007
(b)	We required HEPA filtration of equilibration air based on §86.1310.[3]	§86.1310-2007
(c)	We adopted a (42 to 52) °C equilibration temperature range to align in-situ PM measurement temperature with the PM sampling temperature in §86.1310-2007.[3] We adopted this temperature range to ensure fast equilibration and measurement in-situ. We added guidance on humidity control as a function of sulfuric acid in PM to align in-situ PM measurement guidance with gravimetric PM measurement guidance.	§86.1310-2007

Subpart C– Measurement Instruments

§1065.201Overview and general provisions

Reference	Description	Source
(d)	We allowed combining results of redundant measurements a single test based on §86.1310-2007.[3]	§86.1310-2007
(e)	We allowed using an instrument's response if it is greater than 100 % of the instrument's range, but we required additional testing, which is similar to §86.1338-2007.	§86.1338-2007
(f)	We required continuous analyzer signals to be matched to other continuous signals to improve repeatability and correlation between continuous sampling and batch sampling systems. We defined this matching as "dispersion".	

§1065.202 Data recording and control

Reference	Description	Source
(a)	We required minimum recording frequencies of data. We took into account recent research that indicated that significant changes in raw exhaust flow can occur over a period as short as 200 milliseconds.[4] Combined with the signal dispersion and time alignment that we required in §1065.201, we improved repeatability and correlation between continuous sampling and batch sampling.	

§1065.205 Performance specifications.

Reference	Description	Source
(a)	We recommended performance specifications for individual instruments, and we relied on the calibrations and performance checks in Subpart D to ensure that complete measurement systems perform adequately. We recommended performance specifications based on calibration requirements in 40 CFR 86 Subpart N, 40 CFR 89 Subpart D Appendix A, and ISO 8178-1. We defined accuracy, repeatability, and noise in Part 1065 Subpart D. We defined these values relative to emissions levels at a standard; not a lower value such as at 2 % of the standard, which is how some of our regulations previously specified accuracy. Essentially we allowed instruments to be matched to their application without forcing the use of higher performing instruments than required.	40 CFR 86 Subpart N 40 CFR 89 Subpart D Appendix A ISO 8178-1

§1065.210 Speed and torque transducers

Reference	Description	Source
	We required the same speed and torque transducer as §86.1308-84.	§86.1308-84

§1065.215 Pressure, temperature, and dewpoint transducers

Reference	Description	Source
	We recommended specific transducers as guidance for future procurement of such transducers.	

§1065.220 Fuel flow

Reference	Description	Source
	We allowed fuel flow to be directly measured or calculated by chemical balances of fuel, intake air, and exhaust, plus either an intake air flow or exhaust flow measurement. We allowed both options to help facilitate field testing and redundant measurements for lab testing.	§89.415 §89.416

§1065.225 Intake air flow

Reference	Description	Source
	We allowed intake air flow to be directly measured or calculated by chemical balances of fuel, intake air, and exhaust, plus either a fuel or exhaust flow measurement. We allowed both options to help facilitate field testing and redundant measurements for lab testing.	§89.414

§1065.230 Raw exhaust flow

Reference	Description	Source

	We allowed exhaust flow to be directly measured or calculated by chemical balances of fuel, intake air, and exhaust, plus either a fuel or intake air flow measurement. We allowed both options to help facilitate field testing and redundant measurements for lab testing. We created this section because new exhaust flow measurement technology has matured since we last revised our regulations. Combined with a new way to calculate brake-specific emissions that we allowed in §1065.650, a signal that is not absolutely calibrated--but just linearly proportional to exhaust flow--may be used to determine brake-specific emissions.	

§1065.240 Dilution air and diluted exhaust flow

Reference	Description	Source
	We required the same flow meters as in §86.1310-2007 for CVS systems, and we added a new CVS flow meter, an ultrasonic air flow meter, because this technology has matured since we last updated our regulations.[3]	§86.1310-2007

§1065.245 Sample flow

Reference	Description	Source
	We required the same flow meter performance as specified in §86.1320-90, and we provided additional guidance on flow meter selection.	§86.1320-90

§1065.248 Gas divider

Reference	Description	Source
	We required the same flow meter performance as specified in §86.1314-94 for gas dividers. We also required a periodic gas divider linearity check.	§86.1314-94

§1065.250 Nondispersive infra-red CO analyzer

Reference	Description	Source
	We required the same CO measurement technology as Part 86 and Part 89.	§86.1322-84 §89.309

§1065.255 Nondispersive infra-red CO_2 analyzer

Reference	Description	Source
	We required the same CO_2 measurement technology as Part 86 and Part 89.	§86.1324-84 §89.309

§1065.260 Flame ionization detector analyzer for THC, NMHC, CH_4

Reference	Description	Source

	We required the same THC, NMHC measurement technology as Part 86 and Part 89 and we allowed a flame ionization detector to be coupled with a nonmethane cutter to facilitate CH_4 measurement according to ISO 8178-1 §16.4.	§86.1321-84 §89.309 ISO 8178-1 §16.4

§1065.265 Nonmethane cutter for CH_4

Reference	Description	Source
	We adopted the same nonmethane cutter performance specification as ISO 8178-1 to provide an alternative to the gas chromatograph we specified in §1065.267. We allowed this to facilitate continuous sampling of NMHC because the gas chromatograph is only applicable to batch (e.g. bag) measurements.	ISO 8178-1 §16.4

§1065.267 Gas Chromatograph for CH_4

Reference	Description	Source
	We adopted a gas chromatograph performance specification based on the methane analyzer descriptions in §86.1325-94 and §89.324.	§86.1325-94 §89.324

§1065.270 Chemiluminescent detector analyzer for NO_x

Reference	Description	Source
	We adopted the chemiluminescent detector analyzer specification in §86.1323-2007 §89.321.	§86.1323-2007 §89.321

§1065.272 Nondispersive ultraviolet analyzer for NO_x (NO and NO_2)

Reference	Description	Source
	We allowed the nondispersive ultraviolet detector NO_x analyzer because it has matured since we last updated our regulations. We allowed this technology to provide more measurement options, especially for field testing.	

§1065.274 Zirconia sensor for NO_x

Reference	Description	Source
	We allowed the zirconia sensor NO_x analyzer because it has matured since we last updated our regulations. We allowed this technology to provide more measurement options, especially for field testing.	

§1065.280 Paramagnetic detector analyzer for oxygen

Reference	Description	Source
	We adopted the paramagnetic detector analyzer specification for oxygen measurement from ISO 8178-1.	ISO 8178-1 §8.9.4

§1065.284 Zirconia sensor for oxygen

Reference	Description	Source
	We allowed the zirconia sensor O_2 analyzer because it has matured since we last updated our regulations. We allowed this technology to provide more measurement options, especially for field testing.	

§1065.290 Gravimetric balance for PM

Reference	Description	Source
	We adopted the gravimetric balance for PM specification from §86.1312-2007.[(3)] We provided additional recommendations for features to consider when procuring a PM balance.	§86.1312-2007

§1065.295 Inertial balance for PM

Reference	Description	Source
	We allowed the inertial balance for PM because it has matured since we last updated our regulations. We allowed this technology to provide more measurement options, especially for field testing.	

Subpart D– Calibrations and performance checks for complete measurement systems

§1065.301 Overview

Reference	Description	Source
(a) through (c)	We required calibrations and performance checks on complete laboratory and field testing measurement systems, which include the probes, transfer lines, sample conditioning equipment, analyzers, and any analog to digital conversion and data acquisition devices. We replaced some calibrations in 40 CFR Part 86 and 40 CFR Part 89 with performance checks.	
(d)	We required the use of NIST traceable standards, but we noted that you may ask to use other standards.	

§1065.305 Accuracy, repeatability, and noise performance check.

Reference	Description	Source
	We defined accuracy, repeatability, and noise by the procedure that we specify for determining these values. We defined these values procedurally to prevent sellers and buyers of measurement systems from misinterpreting our specifications. We defined noise is a limit value, below which you may set recorded values to zero.	

§1065.306 Summary of periodic calibration and performance checks

Reference	Description	Source

	We summarized how frequently each check in this subpart must be performed. We provided this summary so that laboratories and field test operators might use it as a template for part of a preventive maintenance plan.	

§1065.307 Linearity check.

Reference	Description	Source
	We replaced many calibrations that we required according to 40 CFR Part 86 and 40 CFR Part 89. We revised our approach toward instrument calibration because it did not apply to modern instruments that use other signals to correct for interferences.	

§1065.308 Response check for gas analyzers

Reference	Description	Source
	We added a performance check to determine the response of analyzers and the alignment of any compensation signals. We added this check to verify that analyzer response and recording rate were matched and that other signals used to compensate for interferences were aligned with the primary emissions signal.	

§1065.310 Torque calibration

Reference	Description	Source
	We adopted the calibration specifications in §86.1308-84, §89.306, and §89.307, but we scaled them to the maximum torque of an engine to make Part 1065 applicable across a wide range of maximum engine torques.	§86.1308-84 §89.306 §89.307

§1065.315 Pressure, temperature, and dewpoint calibration.

Reference	Description	Source
	We provided guidance on pressure, temperature, and dewpoint calibration. We allowed laboratories to develop their own calibration procedures because of the diversity of measurement technologies. We relied on performance checks such as the linearity check to ensure measurement system performance.	

§1065.320 Fuel flow calibration.

Reference	Description	Source
	We provided guidance on fuel flow calibration. We allowed laboratories to develop their own calibration procedures because of the diversity of measurement technologies. We relied on performance checks such as the linearity check to ensure measurement system performance.	

§1065.325 Intake air flow calibration

Reference	Description	Source
	We provided guidance on intake air flow calibration. We allowed laboratories to develop their own calibration procedures because of the diversity of measurement technologies. We relied on performance checks such as the linearity check to ensure measurement system performance.	

§1065.330 Exhaust flow check.

Reference	Description	Source
	We provided guidance on exhaust flow calibration. We allowed laboratories to develop their own calibration procedures because of the diversity of measurement technologies. We relied on performance checks such as the linearity check to ensure measurement system performance.	

§1065.340 CVS calibration

Reference	Description	Source
	We adopted CVS calibration specifications from §86.1319-90 and especially §86.1319-90(e)[3], which specified calculations that assume isentropic compressible flow. We adopted molar flow reference signals for calibration to eliminate the use of standard pressure and temperature values, which have been a frequent source of confusion–especially across different regulations. We recognized that 40 CFR Part 86, 40 CFR Part 89, and ISO 8178-1 all have different standard conditions specified in different sections.	§86.1319-90
(e)	We adopted PDP calibration specifications from §86.1319-90, but we reformulated the equations to make them easier to understand.	§86.1319-90
(f)	We adopted CFV calibration specifications from §86.1319-90 CFV, but we reformulated the calibration to take into account isentropic compressible flow. We specified the new calibration formulation to extend use of the calibration data to a wider range of molar masses of an exhaust mixture. We allowed assumptions to be made in order to reduce the new formulation to the formulation in §86.1319-90, but we restricted use of the §86.1319-90 formulation to a range of molar masses of flow. We provided similar guidance to this effect in the past.[1],[2]	§86.1319-90
(g)	We adopted the SSV calibration in §86.1319-90, but we used a molar reference signal.	§86.1319-90

§1065.341 Propane check

Reference	Description	Source

	We adopted the propane check of §1319-90(f), but we extended its use to check secondary dilution systems, and we added an option to use a flow-based reference instead of the gravimetric reference in §1319-90(f) . We recognized that the flow-based reference has been used successfully in light-duty CVS applications, and we allowed this reference to provide more options to engine dynamometer CVS laboratories.	§1319-90(f)

§1065.345 Vacuum side leak check

Reference	Description	Source
	We adopted the leak checks from §86.1337-90 and 89.316, but we revised this check to include two step-by-step procedures to perform the check. We allowed either form of the check to provide more options to engine dynamometer laboratory operators and field test system operators.	§86.1337-90 §89.316

§1065.350 CO_2 NDIR analyzer H_2O interference check.

Reference	Description	Source
	We adopted the performance specification in §89.318, and we described a step-by-step procedure for this check.	§89.318

§1065.355 CO NDIR analyzer CO_2 and H_2O interference check.

Reference	Description	Source
	We adopted the performance specification in §89.318, and we described a step-by-step procedure for this check.	§89.318

§1065.362 FID calibration, response optimization, CH_4 response factor determination and FID flow check

Reference	Description	Source
	We adopted the performance specification in §89.318, and we described a step-by-step procedure for this check. We allowed a simplified check that when completed successfully, significantly reduced the burden of the complete check. We currently use this simplified check successfully at our EPA labs; therefore, we allowed others to use it.	§89.318

§1065.362 FID O_2 interference check

Reference	Description	Source
	We incorporated by reference ISO 8178-1 §8.8.3, which is the oxygen interference check for raw exhaust flame ionization detector analyzers, which is the same check specified in §89.318.	§89.318 ISO 8178-1 §8.8.3

§1065.365 Nonmethane cutter penetration determination.

Reference	Description	Source
	We adopted a revised version of the nonmethane cutter efficiency determination, which is specified in ISO 8178-1 §8.8.4. We revised this section to include a more prescriptive step-by-step procedure, and a simplified calculation to detemine nonmethane cutter penetration.	ISO 8178-1 §8.8.4

§1065.370 CLD H_2O and CO_2 interference check

Reference	Description	Source
	We adopted the CLD H_2O and CO_2 interference check from §86.1323-2007.(3)	§86.1323-2007

§1065.372 NDUV NO_x analyzer performance check

Reference	Description	Source
	We required a performance check specifically for nondispersive ultraviolet detector NO_x analyzers. We required this check because of its limitations. We required this check to ensure that these instruments are designed and operated appropriately.	

§1065.374 Zirconia analyzer performance check

Reference	Description	Source
	We required a performance check specifically for zirconia detector NO_x analyzers. We required this check because of its limitations. We required this check to ensure that these instruments are designed and operated appropriately.	

§1065.376 Thermal chiller NO_2 penetration check

Reference	Description	Source
	We required this performance check if a thermal chiller is used upstream of an NO_2 detector or NO_2 to NO converter. We required this check because of its limitations. We required this check to ensure that these instruments are designed and operated appropriately.	

§1065.378 NO_2 to NO converter check

Reference	Description	Source
	We adopted the NO_2 to NO converter efficiency specifications in §86.1323-84 and ISO 8178-1 §8.7, however we scaled performance to the level of NO_2 expected during testing. We scaled this check to make it less stringent for emissions tests that are not affected by its performance and more stringent for emissions tests that are significantly affected by its performance.	§86.1323-84 ISO 8178-1 §8.7

§1065.390 PM weighing process performance check

Reference	Description	Source
	We adopted the PM weighing process performance check from §86.1312-2007.[(3)], however we scaled this check to the PM emissions expected at the standard. This prevents an unnecessarily stringent requirement for PM weighing.	§86.1312-2007

Subpart E– Engine selection, preparation, and maintenance.

§1065.405 Test engine preparation and maintenance.

Reference	Description	Source
	We required specifications for engine selection, preparation, and maintenance; however we stated that any requirements in any standard- setting part take precedence over the specifications in this subpart.	
	We allowed a default value 125 hours of engine service accumulation for compression-ignition engines without emissions measurement.	

Subpart F– Running an emissions test in a laboratory

§1065.501 Overview

Reference	Description	Source
	We summarized all of the step-by-step procedures for running an emissions test in a laboratory, and we reiterated that standard setting parts specify other information required to run an emissions test. We required variable speed and constant speed engines subject to steady-state, ramped modal, and transient testing to be tested according to this subpart, including any cold-start testing, hot-start testing, and warmed-up running engine testing. We adopted procedures in §86.1327 through §86.1337 [(3)], §89.404 through §89.408 and ISO 8178-1 §11. We added requirements and options to the specifications in §86.1327 through §86.1337 [(3)], §89.404 through §89.408 and ISO 8178-1 §11.	§86.1327-§86.1337 §86.1341 §89.404-§89.408 §89.410 ISO 8178-1 §11

§1065.510 Engine mapping

Reference	Description	Source
	We adopted §86.1332-90 for variable speed engines. We added new requirements for constant-speed engines, which rely on the engine's governor or simulated governor to select the engine speed during an emissions test. We required this to ensure that constant speed engines are tested in a representative way.	§86.1332-90

§1065.512 Duty cycle generation.

Reference	Description	Source
	We adopted §86.1333-90, §89.410, ISO 8178-1 §11.5, and ISO 8178-1 §11.7 to combine the requirements for steady-state, ramped modal, and transient test cycle generation. We allowed constant speed engines to operate at the speed selected by the engine's governor or simulated governor.	§86.1333-90, §89.410, ISO 8178-1 §11.5, ISO 8178-1 §11.7

§1065.514 Cycle validation criteria

Reference	Description	Source
	We adopted the cycle validation criteria of §86.1341-90, but we revised the point omission criteria easier to understand. We revised some of the statistics to reflect the dependence of power on speed and torque. We revised the statistics to reflect the capabilities of modern dynamometer and operator demand control systems. We required only torque validation criteria for constant speed engines because we allow constant speed engines to be governed by their governor or simulated governor during emissions testing.	§86.1341-90

§1065.520 Pre-test verification procedures and pre-test data collection

Reference	Description	Source
	We adopted §86.1330-90, §86.1334-84 and §89.406, including the preconditioning cycle we added to §86.1330-90 in January of 2001.[3] We replaced the hydrocarbon overflow zero and span procedure with a hydrocarbon sampling system contamination check. Up to a certain amount of contamination, we allowed emissions results correction by subtracting the contamination determined with an overflow zero check performed after an analyzer port zero and span. We required this to prevent excessive hydrocarbon contamination from biasing results. We allowed some contamination to be appropriately subtracted from emissions results, which is how the original overflow procedure worked, except that it had no limits on contamination. We required this procedure to improve test repeatability.	§86.1330-90 §86.1334-84 §89.406

§1065.525 Engine starting, restarting and shutdown

Reference	Description	Source
	We adopted §86.1334-84, but we have simplified the requirements because §86.1334-84 described some starting procedures with obsolete engine components. We revised §86.1334-84 to achieve the same intent.	§86.1334-84

§1065.530 Emission test sequence.

Reference	Description	Source

	We adopted §86.1337-90, §89.407, and ISO 8178-1 §11.7.1 and combined them to include PM sampling, continuous and batch sampling, and raw and dilute sampling. We required procedures to check for analyzer drift. We allowed collecting and correcting for background emissions in dilution air. We required procedures for cold-starts, hot-starts, soak periods, and hot running tests.	§86.1337-90, §89.407, ISO 8178-1 §11.7.1.

§1065.545 Validation of proportional flow control for batch sampling

Reference	Description	Source
	We adopted the performance specification of §86.1310-2007 for PM sampling systems.(3) We incorporated additional options for validating proportional sampling based on the principles of CVS sampling.	§86.1310-2007

§1065.550 Emissions analyzer range and drift validation.

Reference	Description	Source
	We adopted the performance specifications in §86.1340-90, §89.406, and ISO 8178-1 §11.8. We allowed for correction of a limited amount of analyzer drift. We developed this procedure jointly with measurement instrument manufacturers and engine manufactures.	§86.1340-90, §89.406, ISO 8178-1 §11.8.

§1065.590 PM sample preconditioning and tare weighing

Reference	Description	Source
	We adopted §86.1312-2007.(3) We added an option to perform substitution weighing, which has been used in ambient PM sampling successfully–especially when PM concentrations are very low.	§86.1312-2007

§1065.595 PM sample post-conditioning and total weighing.

Reference	Description	Source
	We adopted §86.1312-2007.(3) We added an option to perform substitution weighing, which has been used in ambient PM sampling successfully–especially when PM concentrations are very low.	§86.1312-2007

Subpart G– Calculations and data requirements

§1065.601 Applicability.

Reference	Description	Source
	We consolidated calculations that were specified multiple times in this part (i.e. Part 1065). For example we consolidated statistical calculations for instrument performance, alternate system approval, and duty cycle validation in §1065.602.	
	We adopted SI units for all calculations, except for one set of example calculations in §1065.640 where we showed how to convert different reference flow meter signals to molar reference signals.	

	We provided completely worked-out examples for every calculation, including conversion factors for various engineering units.	

§1065.602 Statistics

Reference	Description	Source
	We consolidated statistics calculations that were specified multiple times in this part (i.e. Part 1065). For example we consolidated statistical calculations for instrument performance, alternate system approval, and duty cycle validation. We added examples on how to calculate flow-weighted average concentrations at a given standard for various engines. We provided these examples because we scale many measurement instrument specifications to this value tto ensure that Part 1065 is applicable across a wide range of emissions standards and sampling techniques (e.g. raw, dilute, continuous, and batch sampling)	

§1065.605 Field test system overall performance check

Reference	Description	Source
	We required that field test systems pass an overall check versus laboratory measurements. We provided a complete example of the specialized data reduction techniques to perform this check.	

§1065.610 Test cycle generation

Reference	Description	Source
	We consolidated all of the calculations for steady-state, ramped modal, and transient test cycle generation from §86.1333-90, §89.410, ISO 8178-1 §11.5, and ISO 8178-1 §11.7. We allowed constant speed engines to operate at the speed(s) selected by the engine's governor or simulated governor.	§86.1333-90, §89.410, ISO 8178-1 §11.5, ISO 8178-1 §11.7

§1065.630 1980 International gravity formula

Reference	Description	Source
	We adopted this formula to prescribe what we meant in previous regulations when we required that you account for local effects on gravity at your location, such as in § 86.1308-84(e)(1)(i). We recommended to use this formula when conducting dynamometer torque calibration and torque linearity checks according to §1065.308 and §1065.310.	§86.1308-84(e)(1)(i)

§1065.340 CVS calibration equations

Reference	Description	Source

	We adopted CVS calibration calculations from §86.1319-90 and especially §86.1319-90(e)[3], which specified calculations that assume isentropic compressible flow. We adopted molar flow reference signals for calibration to eliminate the use of standard pressure and temperature values, which have been a frequent source of confusion–especially across different regulations. We recognized that 40 CFR Part 86, 40 CFR Part 89, and ISO 8178-1 all have different standard conditions specified in different sections.	§86.1319-90
(b)	We adopted PDP calibration calculations from §86.1319-90, but we reformulated the equations to make them easier to understand.	§86.1319-90
(c)	We adopted CFV calibration calculations from §86.1319-90 CFV, but we reformulated the equations to take into account isentropic compressible flow. We specified the new calibration equation to extend use of the calibration data to a wider range of molar masses of an exhaust mixture. We allowed assumptions to be made in order to reduce the new equation to the equation in §86.1319-90, but we restricted use of the §86.1319-90 equation to a range of molar masses of flow. We provided similar guidance to this effect in the past.[1],[2]	§86.1319-90
(d)	We adopted the SSV equation in §86.1319-90, but we rearranged it to use a molar reference signal.	§86.1319-90

§1065.340 CVS flow rate equations

Reference	Description	Source
	We adopted CVS flow rate calculations from §86.1319-90 and especially §86.1319-90(e)[3], which specified calculations that assume isentropic compressible flow. We adopted molar flow rates to eliminate the use of standard pressure and temperature values, which have been a frequent source of confusion–especially across different regulations. We recognized that 40 CFR Part 86, 40 CFR Part 89, and ISO 8178-1 all have different standard conditions specified in different sections.	§86.1319-90
(a)	We adopted PDP flow rate calculations from §86.1319-90, but we reformulated the equations to make them easier to understand.	§86.1319-90
(b)	We adopted CFV flow rate calculations from §86.1319-90 CFV, but we reformulated the equations to take into account isentropic compressible flow. We specified the new flow rate equation to extend use of the flow meter to a wider range of molar masses of an exhaust mixture. We allowed assumptions to be made in order to reduce the new flow rate equation to the equation in §86.1319-90, but we restricted use of the §86.1319-90 flow rate equation to a range of molar masses of flow. We provided similar guidance to this effect in the past.[1],[2]	§86.1319-90
(c)	We adopted the SSV flow rate equation in §86.1319-90, but we rearranged it to calculate a molar flow rate.	§86.1319-90

§1065.645 Amount of water in an ideal gas.

Reference	Description	Source
	We consolidated several other sections' requirements to calculate this value, such as those sections that required an amount of water removed correction, a buoyancy correction, a background emissions correction, chemical balances of fuel, exhaust, and intake air, and flowmeter calibrations and performance checks. We specified this calculation only once in Part 1065 to ensure that this value is calculated in only one way. We adopted an internationally accepted formulation for this value from the World Meteorological Organization.	

§1065.650 Emissions calculations

Reference	Description	Source
	We adopted emissions calculations from §86.1342-94, §89.418, §89.419, and ISO 8178-1 §12 though §16 to combine steady-state, ramped modal, and transient testing calculations. We included raw, dilute, continuous, and batch sampling. We added a new way to calculate brake-specific emissions based on the ratio of a value proportional to an emissions mass and another value similarly proportional to work.	§86.1342-94, §89.418, §89.419, ISO 8178-1 §12 though §16.

§1065.655 Chemical balances

Reference	Description	Source
	We adopted the chemical balances from §89.418 and ISO 8178-1 Annexe A. We specified how to use chemical balances to determine the amount of water in exhaust, the amount of carbon-containing emissions in exhaust, and the dilution fraction of dilution air in diluted raw exhaust.	§89.418 ISO 8178-1 Annexe A

§1065.657 Drift validation and correction.

Reference	Description	Source
	We adopted the drift performance specification from §86.1340-90, §89.406, and ISO 8178-1 §11.8. We added a drift correction to account for a limited amount of analyzer drift. We developed this procedure with instrument manufacturers and engine manufactures. We added this correction to improve repeatability.	§86.1340-90, §89.406, ISO 8178-1 §11.8.

§1065.658 Noise correction.

Reference	Description	Source

	We allowed values lower than a critical noise limit to be set to zero. We specified that this noise limit is the lower of two values: the instrument noise specification that we recommend in Subpart C for lab instruments (Subpart J for field testing instruments) and the actual noise of an instrument as determined according to Subpart D. We allowed this correction for all instruments with the expectation that it will be most beneficial for field test instruments because they are subject to more external sources of instrument noise.	

§1065.659 Removed water correction.

Reference	Description	Source
	We adopted the corection in §86.1342-90, §89.418, , ISO 8178-1 A.2.4, but we have revised it to take into account any condensation that occurs upstream of a flow meter.	§86.1342-90, §89.418, ISO 8178-1 A.2.4

§1065.660 THC and NMHC determination

Reference	Description	Source
	We adopted the THC and NMHC determination from §86.1342-94, ISO 8178 §15.4. We allowed multiplying THC by 0.98 as an approximation for NMHC. We replaced the hydrocarbon overflow zero and span procedure with a hydrocarbon sampling system contamination check. Up to a certain amount of contamination, we allowed emissions results correction by subtracting the contamination determined with an overflow zero check performed after an analyzer port zero and span. We required this to prevent excessive hydrocarbon contamination from biasing results. We allowed some contamination to be appropriately subtracted from emissions results, which is how the original overflow procedure worked, except that it had no limits on contamination. We required this procedure to improve test repeatability.	§86.1342-94, ISO 8178 §15.4

§1065.665 NMHCE determination

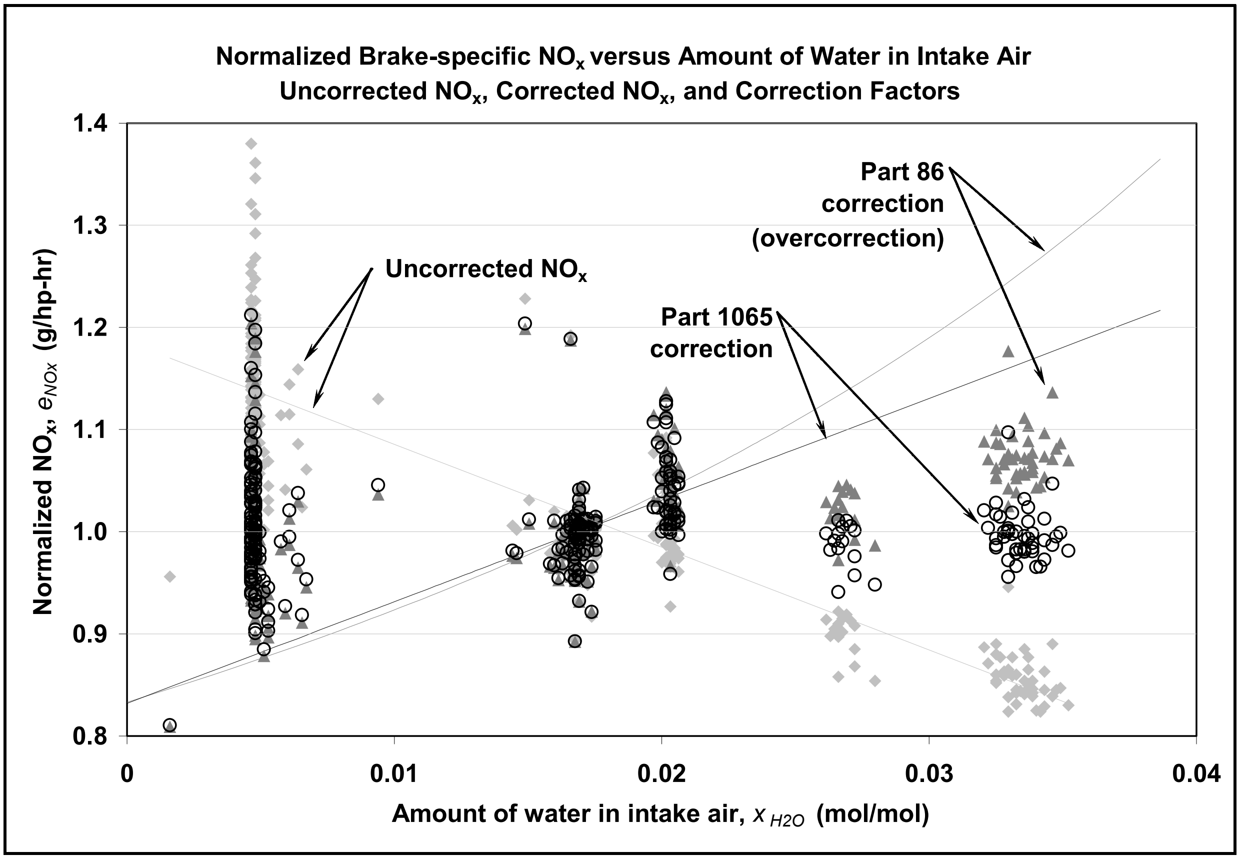
Reference	Description	Source
	We adopted the THCE and NMHCE determination from §86.1342-94 and ISO 8178-1 §15.5 and §15.6. We allowed multiplying THC by 0.98 as an approximation for NMHC. We replaced the hydrocarbon overflow zero and span procedure with a hydrocarbon sampling system contamination check. Up to a certain amount of contamination, we allowed emissions results correction by subtracting the contamination determined with an overflow zero check performed after an analyzer port zero and span. We required this to prevent excessive hydrocarbon contamination from biasing results. We allowed some contamination to be appropriately subtracted from emissions results, which is how the original overflow procedure worked, except that it had no limits on contamination. We required this procedure to improve test repeatability.	§86.1342-94, ISO 8178-1 §15.5 and §15.6

§1065.667 Dilution air background correction

Reference	Description	Source
	We adopted the dilution air background correction from §86.1342-94, §89.420, and ISO 8178-1 §13.5. We recommend when to remove background emissions from dilution air.	§86.1342-94, §89.420 ISO 8178-1 §13.5

§1065.670 NO_x intake air humidity correction

Reference	Description	Source
	We adopted the NO_x intake air humidity correction from §86.1342-94, §89.418, and ISO 8178-1 §13.4, but we revised the equation. We used a linear fit to a recent set of comprehensive data collected for the purpose of determining a NO_x humidity correction factor.(5) We generated the equation with a least squares linear regression line of more than 300 data points generated with six different engines over a broad range of humidity conditions. We forced the correction to pass through a value of one (1) at 75 grains of water per pound of dry air (10.71 g/kg dry air) to align it with the correction from §86.1342-94, §89.418, and ISO 8178-1 §13.4. This correction is significantly more consistent with computer NO_x models versus the previous correction. For example, from the range of (0 to 95) % relative humidity at 30 °C ambient temperature, the NO_x correction from §86.1342-94, §89.418, and ISO 8178-1 §13.4 was 1.70 while the linear correction we adopted was 1.48. A computer NO_x model, ALAMO,(6) predicted a correction of 1.42 for an engine at rated conditions across the same humidity. For this example the linear correction is 4 % higher than the model, but the correction from §86.1342-94, §89.418, and ISO 8178-1 §13.4 is 20 % high. We based this revised equation on data and verified it with a computer model to improve test repeatability. Below is an illustration of the uncorrected data(5), the data corrected according to §86.1342-94, §89.418, and ISO 8178-1 §13.4,(5) the data corrected to the equation we adopted in Part 1065, and lines depicting the corresponding correction factors.	§86.1342-94, §89.418, ISO 8178-1 §13.4.



§1065.672 CLD quench check calculations.

Reference	Description	Source
	We adopted the chemiluminescent detector Nox analyzer quench check performance specification from §86.1323-2007.[3]	§86.1323-2007

§1065.690 PM sample media buoyancy correction.

Reference	Description	Source
	We adopted the bu §86.1312-2007,[3] but we eliminated the temperature and humidity portions of the correction because we specified tight humidity and temperature control in the PM weighing environment. We determined that making corrections based on small changes in temperature and humidity might induce error due to the measurement error associated with them. We revised the correction so that it only accounts for changes in barometric pressure, which is the dominant parameter that causes a change in PM sample media buoyancy.	§86.1312-2007.

§1065.695 Required data.

Reference	Description	Source
	We adopted the data requirements from §86.1344-94, and we combied these with required data from various standard setting parts and our most recent application formats for certification.	§86.1344-94 EPA's most recent application formats for certification.

Subpart H– Engine fluids, test fuels, analytical gases, and other calibration standards

§1065.701 General requirements for test fuels

Reference	Description	Source
	We adopted the general requirements for test fuels that was originally in Part 1065.	

§1065.703 Distillate diesel fuel

Reference	Description	Source
	We deleted specific ranges of fuel parameters for diesel service accumulation fuel, which is different from §86.1313-2007. We adopted a 10 mg/kg minimum limit for aromatics, which is the same as the nonroad diesel engine Tier IV rule,(7) instead of 25 mg/kg, which was in §86.1313-2007. We eliminated the specification for Cetane Index because it is obsolete and because we require Cetane Number, which is a more accurate determination of Cetane.	§86.1313-2007

§1065.705 Residual fuel [reserved]

Reference	Description	Source
	We reserved this section for a future marine residual fuel specification.	

§1065.710 Gasoline.

Reference	Description	Source
	We adopted the test fuels that were originally in Part 1065.	Current Part 1065

§1065.715 Natural gas.

Reference	Description	Source
	We adopted the test fuels that were originally in Part 1065.	Current Part 1065

§1065.720 Liquefied propane gas

Reference	Description	Source
	We adopted the test fuels that were originally in Part 1065.	Current Part 1065

§1065.740 Lubricants.

Reference	Description	Source
	We adopted the lubricant specification in §89.330.	§89.330

§1065.745 Coolants.

Reference	Description	Source
	We adopted the coolant specification in §86.1327-98	§86.1327-98

§1065.750 Analytical gases.

Reference	Description	Source
	We adopted the analytical gas specifications in §86.1314-94 and §89.312, however, we allowed zero gas contamination to scale with the concentration expected at the standard. In some cases this will be a decrease in stringency, however, we significantly increased the stringency on the level of contaminants when very low levels of emissions are expected at the standard. We adopted these changes to improve test repeatability.	§86.1314-94, §89.312

§1065.790 Mass standards

Reference	Description	Source
	We adopted the dynamometer calibration weight specifications in §86.1308-84 and §89.305. We specified new requirements for calibration weights for PM balances.	§86.1308-84 §89.305

Subpart I– Testing with oxygenated fuels.

§1065.801 Applicability.

Reference	Description	Source
	We applied this subpart to engines tested with a fuel that has a 25 % or greater concentration of oxygenate.	

§1065.805 Sampling systems.

Reference	Description	Source
	We allowed a photo-acoustic analyzer to be used to measure methanol and ethanol in exhaust. We provided similar guidance in the past,[8] which is consistent with regulations published by the California Air Resources Board.[9]	

§1065.660 Calculations.

Reference	Description	Source
	We relocated the calculations to §1065.665.	

Subpart J– Field Testing

§1065.901 Applicability

Reference	Description	Source
	We applied this subpart to engines with field testing requirements, including manufacturer-run on-vehicle testing requirements. Refer to the standard setting part for applicability.	
	We superceded the current field testing subpart in Part 1065 with a new subpart.	

§1065.905 General provisions.

Reference	Description	Source
	We provided a list of information needed from standard setting parts to conduct field testing according to this part. We indicated that much of this subpart relies on specifications in other subparts of Part 1065.	

§1065.910 Field testing equipment

Reference	Description	Source
	We specified the equipment we require for field testing. We included equipment for routing exhaust for sampling and flow measurement, mounting hardware, and power supplies.	

§1065.915 Measurement instruments.

Reference	Description	Source
	We specified the measurement instruments we require for field testing by referring to Subpart C. We explained how to use signals from an engine's electronic control module. We specified how to use redundant measurements. We specified how to address the effects of ambient conditions on field test measurement systems. We specified how to estimate torque in the field.	

§1065.920 Calibrations and performance checks

Reference	Description	Source
	We referred to Subpart D for performance checks. We specified an overall field test system performance check against a laboratory that meets Part 1065.	

§1065.925 Measurement instrument and equipment preparation

Reference	Description	Source
	We specified a step-by-step set of instructions for preparing a field test measurement system for use. We based the instructions on a generic field test system by drawing on our own field testing experience and reports outlining similar instructions.[(10), (11)]	

§1065.930 Engine starting, restarting, and shutdown

Reference	Description	Source
	We specified a step-by-step set of instructions for engine starting, restarting and shutdown based on lab testing, except that an engine may be shut down and restarted any number of times during a field test.	

§1065.935 Emission test sequence.

Reference	Description	Source
	We specified a step-by-step set of instructions for running a field test. We based the instructions on a generic field test system by drawing on our own field testing experience and reports outlining similar instructions.[(10), (11)]	

§1065.940 Emission calculations.

Reference	Description	Source
	We specified the same emissions calculations as used in a laboratory according to §1065.650. We noted that information from the standard setting parts are required to define individual test intervals within a field test.	

Subpart K– Definitions and other reference information

§1065.1001 Definitions.

Reference	Description	Source
	We defined terms that we use in Part 1065. We revised definitions from 40 CFR Part 86 and 40 CFR Part 89. We revised definitions to reflect the use of Part 1065 test procedures and the application of modern emissions control technology such as aftertreatment systems.	

§1065.1005 Symbols, abbreviations, acronyms, and units of measure.

Reference	Description	Source

	We defined the symbols, abbreviations, acronyms, and units of measure that we use in Part 1065. We minimized repeating symbols for different quantities. We used symbols consistent with ISO 31. We revised symbols, abbreviations, acronyms, and units of measure to reflect the use of Part 1065 test procedures and the application of SI units, and molar flow rates.	

§1065.1010 Reference materials.

Reference	Description	Source
	We revised Part 1065 reference materials to include new ISO and NIST publications.	

References for Chapter 8

(1) Letter from EPA to EMA, "Guidance Regarding Test Procedures for Heavy-Duty On-Highway and Non-Road Engines", Gregory Green, Division Director, Certification and Compliance Division, Office of Transportation and Air Quality, United States Environmental Protection Agency, December 3, 2002.

(2) "Supporting Document for Letter to EMA Regarding Acceptable Interpretations and Alternatives to the Rules and Regulations published in the Federal Register, Vol. 66, No. 12, Thursday, January 18, 2001", Matthew Spears, Assessment and Standards Division, Office of Transportation and Air Quality, United States Environmental Protection Agency, December 3, 2002.

(3) "Description of Changes to the Test Procedures Specified in 40 CFR Part 86 for Model Year 2007 and Later Heavy-Duty Engines", Air Docket A-99-06, IV-B-11, Matthew Spears, Assessment and Standards Division, Office of Transportation and Air Quality, United States Environmental Protection Agency, December 6, 2000.

(4) "Performance of Partial Flow Sampling Systems Relative to Full Flow Cvs for Determination of Particulate Emissions Under Steady-State and Transient Diesel Engine Operation", Khalek Imad A., et al., Southwest Research Institute, Society of Automotive Engineers Technical Paper 2002-01-1718, May 2002.

(5) "Heavy-Duty Diesel Engine NO_x and PM Correction Factors", Project 08-2597, Southwest Research Institute, San Antonio, TX, July 27, 1999.

(6) "A PC-Based Model for Predicting Nox Reductions in Diesel Engines", Dodge, Lee G., Leone, Douglas M., Naegeli, David W., Dickey Daniel, W., Swenson, Kendall R., Southwest Research Institute Society of Automotive Engineers Technical paper 962060, 1996.

(7) Nonroad Diesel Tier IV Rule, EPA420-F-04-037, May 2004.

(8)"Approval of the Request to Use the Innova 1312 Photoacoustic Multi-gas Monitor in the Measurement of Ethanol in Exhaust and Evaporative Emissions", Gregory Green, Division Director, Certification and Compliance Division, Office of Transportation and Air Quality, United States Environmental Protection Agency, January 25, 2002.

(9) Use of Innova Photoacoustic Multi-gas Monitor to Measure Ethanol Exhaust and Evaporative Vehicle Emissions", Mail-Out #MSO 2000-08, Summerfield, R.B, Mobile Source Operations Division, California Air Resources Board, June 29,2000.

(10) "On-vehicle, In-use, Heavy Duty Diesel Engine (HDDE) Protocol", Czachura Barry S. J., Analytical Engineering Incorporated, September 2, 2003.

(11) "Protocol for Measurement of Air Pollutant Emissions from Ferry Boats", Culnane Mary, San Francisco Water Transit Authority, August 19, 2002.