Test Plan

Testing to Establish Up-to-Date Exhaust Emission and Deterioration Factors for Small Off-Road Engines Using E10 Fuel

Project Number #:

Initial Release:

Emissions Compliance, Automotive Regulations and Science Division
Monitoring and Laboratory Division

Project Engineers (Monitoring and Laboratory Division)
Christopher Dilbeck
Scott Monday

Test Engineers (Emissions Compliance, Automotive Regulations and Science Division)
John Massetti
Travis Wong

Lead Chemists (Emissions Compliance, Automotive Regulations and Science Division)
Noriko Nishino
Hyun Ji (Julie) Lee

_____ _____

Mark Fuentes
Assistant Division Chief
Emissions Compliance, Automotive
Regulations and Science Division

Date

I. OBJECTIVES

The primary objective of this project is to develop exhaust emission factors in grams per kilowatt-hour (g/(kW·hr)) for small off-road engines (SORE) currently available for sale in California, using LEV III certification fuel containing ten percent ethanol (E10 fuel). A second objective is to determine exhaust emission and deterioration factors in grams per kilowatt-hour per hour (g/(kW·hr^2)) for SORE retrofitted with emission controls in addition to those already installed by the manufacturer, to evaluate the emissions reductions achievable using currently available technologies. The emissions testing will aid in developing lower exhaust emission standards for SORE, which will be presented to the Board in 2020 along with other proposed amendments to the SORE regulations. A third objective is to test the ability of currently available zero-emission equipment (ZEE) to meet the performance requirements of California Code of Regulations, title 13, section 2408.1 for professional level equipment, which are used to earn ZEE emission reduction credits. A project flow chart is provided in Attachment I.

II. BACKGROUND

Monitoring and Laboratory Division (MLD) staff will present proposed amendments to the SORE evaporative and exhaust emission regulations to the Board in 2020. The proposed amendments will include tightened exhaust and evaporative emission standards. The Mobile Source Strategy includes a measure to reduce both oxides of nitrogen (NO_x) and reactive organic gas (ROG) emissions from SORE significantly by 2031. In order to achieve maximum emission reductions, the ability of currently-available SORE to meet tightened emission standards when retrofitted with additional emission control technology must be demonstrated.

III. TESTING FACILITY

SORE exhaust emissions testing will be conducted in Test Cell 5 of CARB's Haagen-Smit Laboratory in El Monte, California.

A. Dynamometer

Test Cell 5 is equipped with three Dyne Systems engine dynamometers: 5-horsepower, 30-horsepower, and 50-horsepower, which can provide steady-state discrete mode test cycles in compliance with 40 CFR 1054/1065.

B. Dilution Tunnel Sampling System

Test Cell 5 is equipped with a Horiba 10-inch full-flow dilution tunnel constant volume sampler (CVS) with nominal flow between 150 and 1000 standard cubic feet per minute.

C. Particulate Matter Filter-based Sampler

Test Cell 5 is equipped with an AVL SPC-472 Sampler with three filter holders. Particulate matter (PM) mass can be collected on one filter per test mode (individual mode) or on one filter for the entire test cycle (composite mode).

D. Analytical System

Test Cell 5 is equipped with an analytical bench for THC, CO, CO_2, NO/NO_x, and CH_4 measurements for each test phase (batch measurement). If Test Cell 5 acquires the ability to collect samples in Tedlar bags, nitrous oxide (N_2O) and speciated non-methane hydrocarbon (NMHC) samples may be collected. In addition, Organic Analysis Section (OAS) will analyze alcohols and carbonyl samples.

IV. TEST ENGINES

All exhaust emissions testing performed as part of this program will follow the *California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines (Part 1065)*, which is included as Attachment II.

A total of 22 spark-ignited engines will be tested. Thirteen of these are four-stroke engines. MLD has completed evaporative emissions testing with E10 fuel for all 13 engines, which will be transported to El Monte upon approval of this test plan. Once in El Monte, the engines will be equipped with hour meters and tested three times each to determine their beginning-of-life (after break-in) emission rates. At the conclusion of beginning-of-life testing, one engine from each of the following displacement categories: ≤ 80 cc, 81-224 cc, and ≥ 225 cc, will be retrofitted with additional emissions controls before continuing testing. The retrofitted engines will be retested for beginning-of-life emissions, and three times each after running for a number of hours equivalent to the mid-point and end-point of their certified durability periods. A matrix of the four-stroke engines selected for testing is included as Attachment III.

Nine two-stroke engines with displacements of ≤ 80 cc have been procured by MLD for exhaust emissions testing. The two-stroke engines are in new condition, and will also be tested three times each to determine their beginning-of-life emission rates. At the conclusion of beginning-of-life testing, one two-stroke engine from each of the following equipment types: backpack blower, chain saw, and string trimmer, will be retrofitted with additional emissions controls before continuing testing. If special fixtures or couplings are needed for testing engines from equipment such as blowers or chainsaws, the Project Engineers will work with the manufacturers and the Test Engineers to obtain or fabricate those pieces. The retrofitted engines will be retested for beginning-of-life emissions, and three times each after running for a

number of hours equivalent to the mid-point and end-point of their certified durability periods. A matrix of the two-stroke test engines selected for testing is included as Attachment IV.

Ten pieces of ZEE will be tested by MLD and/or an independent laboratory contracted by MLD using a dynamometer only, since no emissions need to be measured. A yet to be completed matrix of ZEE is included as Attachment V.

V. ENGINE SERVICE ACCUMULATION

Service accumulation will be conducted, using the applicable duty cycles, at MLD's Depot Park facility and/or an independent laboratory contracted by MLD. Transportation of engines for service accumulation will be coordinated by the MLD Project Engineers.

VI. TEST FUEL

California certification gasoline fuel for LEV III Light-Duty Vehicles and Medium-Duty Vehicles as specified in part II., section A.100.3.1.2. of the *California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles* (E10 fuel) will be used for the project.

Two-stroke engine oil meeting the recommendations of the engine manufacturer must be mixed with the test fuel at the ratio specified by the manufacturer and listed in Attachment IV.

VII. ENGINE DELIVERY, CHECK-IN AND TRACKING

Engines will be shipped from MLD, Sacramento, to HSL, El Monte. Upon the engine delivery to HSL, the Testing Operations Support Section (TOSS) will:

- Notify the Project Engineer and Test Engineer;
- Record and provide the following data to the Test Engineer:
  1. Small Engine Description Form (included as Attachment VI)
  2. Engine Manual

The activity of each engine as it progresses through testing will be recorded on the Chain of Custody (Attachment VII) dedicated to that engine.

VIII. ENGINE PREPARATION, PRECONDITIONING AND MAINTENANCE

Service accumulation of the engines up to the end of the rated durability period will be required. Therefore, TOSS will need to perform regularly-scheduled

maintenance on them as recommended by the manufacturers. The four-stroke engines have been tested for evaporative emissions, so engine preparation and fuel tank preconditioning will be complete. Two-stroke engines have also been prepared and preconditioned in Sacramento.

IX. TEST CYCLES

Engines with displacement ≤ 80 cc will be tested using the two-mode duty cycle as specified in the Final Regulation Order Test Procedures (Part 1054) for Small Off-Road Engines, which is included as Attachment VIII. Engines with displacement > 80 cc can be tested by either the six-mode duty cycle or the ramped-modal duty cycle as specified in the Final Regulation Order Test Procedures (Part 1054) for Small Off-Road Engines. Zero-emission walk-behind lawn mowers and riding mowers will be tested by a one-hour five-mode duty cycle (similar to the six-mode duty cycle used for engines with displacement > 80 cc but with no idle mode). The durability test power load for each type of equipment is specified in Table 1 of Cal. Code Regs., Title 13, section 2408.1(b)(1)(D)1.

X. TEST PARAMETERS

The operating parameters to be monitored for spark-ignited SORE during baseline and durability emissions testing are identified in Table X-1. These parameters have been requested with the understanding that Test Cell 5 may not have the capability to provide these data. Some of these parameters may be omitted and additional parameters included as necessary to provide more comprehensive data, or to accommodate the capabilities of the test cell.

Table X-1
SORE Operating Parameters for Baseline and Durability Emissions Testing

Engine Speed (RPM)
Engine Exhaust Gas Temperature
Engine Exhaust Gas Pressure (outlet)
Engine Exhaust Gas Oxygen Concentration (Calculated)
Muffler Surface Temperature
Catalyst Surface Temperature
Catalyst Mid-Bed Temperature
Cylinder Head Temperature
Oil Temperature

Each spark-ignited SORE will be tested three times using the test cycles described in section IX when new to establish its beginning-of-life emission rate. Three four-stroke engines and three two-stroke engines will be tested with additional emissions controls installed by the Test Engineers and Project Engineers, possibly in coordination with manufacturers and/or the Manufacturers of Emission Controls Association (MECA), in order to develop deterioration factors for these engines.

Catalyst temperature measurement will also be coordinated with manufacturers and/or MECA. Coordination with manufacturers and MECA will be the responsibility of the Project Engineers. The Project Engineers will also ensure the emissions controls do not interfere with installation of the engines on the dynamometers. The types of emissions controls may include (but are not limited to): catalysts, secondary air flow injection, and fuel injection. The six engines undergoing deterioration factor testing will be selected based upon mutual agreement between ECARS and MLD staff at the completion of beginning-of-life testing, with the following conditions: a single four-stroke engine will be selected from each of the ≤ 80 cc, 81-224 cc and ≥ 225 cc displacement categories; and one two-stroke engine will be selected from each of the backpack blower, chainsaw, and string trimmer equipment categories. Each of these six engines will be tested three times after installing the additional emissions controls, and three times when it has accumulated use equivalent to the mid-point and end-point of its certified durability period. Cold start and hot start emissions will also be measured during testing. The additional emissions controls will remain on the engines through service accumulation and deterioration factor testing.

Each ZEE will be tested three times using the test cycles described in section IX when new. At the conclusion of beginning-of-life testing, a determination will be made whether service accumulation and end-of-durability-period testing will be performed on any of the ZEE, based on available resources and the results of beginning-of-life testing. For example, engines that cannot meet the performance requirements when new would not be expected to meet the performance requirements at the end of their useful life.

XI. ANALYTICAL COMPOUNDS OF INTEREST

The target compounds selected for analysis include particulate matter, gaseous compounds, volatile organic compounds, and semi-volatile organic compounds. The analytical compounds of interest and their respective CARB test procedures or analytical methodologies are summarized in Table XI-1 below. All samples will be collected in Test Cell 5 in accordance with the capabilities of the test equipment, by the Testing Staff, with the exception of PTR-MS, and will be analyzed by OAS and Aerosol Analysis and Methods Evaluation Section (AAMES) staff. Sample collection is limited to the three tests performed per engine. Therefore, the full complement of compound analysis as requested in this test plan is not expected. Some samples may not be collected if there are an insufficient number of samplers or there is insufficient space in the test cell.

Table XI-1 SORE Exhaust Analytical Compounds of Interest	
Test Procedure or Methodology	**Target Compounds**
MLD 102/103	C_2 through C_{12} Hydrocarbons
MLD 101	Alcohol (Methanol and Ethanol)
MLD 104	Carbonyls
Analytical Bench	NO/NO_x, CO, CO_2, CH_4, THC
Cavity Enhanced Absorption Technique (MV-GHG-159)	N_2O
PTR-MS (if available & capable)	Real-time VOCs analyzer
MV-AEROSOL-139	Particulate Organic Carbon and Elemental Carbon (OC/EC)
MV-AEROSOL-142	Particulate Anions and Cations (IC)
MV-AEROSOL-144	PM Polynuclear Aromatic Hydrocarbons
MV-AEROSOL-145	Particulate Matter Mass (Filterable)
MV-AEROSOL-152	PM Trace Elements (ICP-MS)
MV-AEROSOL-156	PM Elements (XRF)
Solid Particle Counter	Refractory Ultrafine Particulate Matter
Micro Soot Sensor	Black Carbon

The following are brief descriptions of the methods, except for measurements with the analytical bench, which are discussed in the *California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines (Part 1065)*:

MLD 102/103: Speciated Non-Methane Hydrocarbon (NMHC) /VOCs in Tedlar bag (NOTE: Tedlar bag sampling is not currently available in Test Cell 5)

During the test cycle, the engine exhaust may be collected in a Tedlar bag for each mode. A background sample may be collected in a Tedlar bag for each test cycle. Based on these sampling procedures, the total sample count for each engine has been estimated in Attachment IX. Unless a Tedlar bag is subject to question, all bags will be recycled promptly after analysis. In order to avoid contamination of OAS instruments, samples with total hydrocarbon content greater than 200 ppmC, as measured by the analytical bench, will not be subjected to the speciated NMHC analysis.

Cavity Enhanced Absorption Technique (MV-GHG-159): Nitrous Oxide (N_2O) in Tedlar bag (NOTE: Tedlar bag sampling is not currently available in Test Cell 5)

During the test cycle, the engine exhaust may be collected in a Tedlar bag for each mode. A background sample may be collected in a Tedlar bag for each test cycle. Based on these sampling procedures, the total sample count for each engine has

been estimated in Attachment IX. Unless a Tedlar bag is subject to question, all bags will be recycled promptly after analysis.

MLD 101: Alcohol (Methanol and Ethanol)

During the test cycle, alcohol from the engine exhaust will be collected by flowing the exhaust though a glass impinger that contains deionized water. While collecting, the glass impinger will be temperature controlled with a water bath. For each mode, two impingers will be collected in series. For each test, a background sample will be collected using two impingers in series. Based on these sampling procedures, the total sample count for each engine has been estimated in Attachment IX. Once OAS staff transfers the liquid sample out, the glass impingers will be washed and reused promptly.

MLD 104: Carbonyls

During the test cycle, carbonyls from the engine exhaust will be collected by flowing the exhaust through two 2,4-dinitrophenylhydrazine (DNPH) cartridges, mounted in series, for each mode. Similarly, a background sample will be collected on a DNPH cartridge for each mode. Along with these samples, a blank DNPH cartridge with the same lot number will be provided. All DNPH cartridges will be provided by the Test Cell 5. Based on these sampling procedures, the total sample count for each engine has been estimated in Attachment IX.

Proton transfer reaction-mass spectrometer (PTR-MS): Real-time VOCs analyzer

During the test cycle, PTR-MS may be used to conduct real-time VOC measurements for the exhaust being emitted from the engine. OAS will provide and operate the instrument, if the instrument is available and if Test Cell 5 can host the instrument.

MV-AEROSOL-139: Particulate organic carbon and elemental carbon

This method is for organic carbon (OC) and elemental carbon (EC) analysis of engine exhaust PM on quartz fiber filters using a Desert Research Institute (DRI) Thermal/Optical Carbon Analyzer.

MV-AEROSOL-142: Particulate Anions and Cations

This method uses ion chromatography (IC) to determine water soluble anions (chloride, nitrate and sulfate) and cations (sodium, ammonium, potassium, magnesium and calcium) collected on filters from engine exhaust. The ions are extracted from the filter by sonication in deionized (DI) water with ~1% isopropyl

alcohol. The resulting extracts are stored in a refrigerator in order to settle particles. The extract is analyzed by IC with a conductivity detector.

MV-AEROSOL-144: PM Polynuclear Aromatic Hydrocarbons

This method is for the identification and quantification of polynuclear aromatic hydrocarbons (PAHs) in engine exhaust. The PAHs are extracted from engine exhaust PM collected on filters or with XAD/polyurethane foam (PUF) and are analyzed using gas chromatography/mass spectrometry (GC/MS).

MV-AEROSOL-145: Particulate Matter Mass (Filterable)

This method is used to determine the mass of PM collected on filters from engine exhaust emissions. This method meets requirements specified in the 40 CFR Part 1065 and Part 1066 for the weighing of PM sample filters from engines and vehicles. The weighing procedure is carried out in a temperature and humidity controlled clean room automatically and/or manually on a microbalance capable of measuring 0.1 microgram. The sampling filters are weighed before (e.g. pre-test) and after (e.g. post-test) the engine emission testing. It is required to stabilize the pre-test and post-test filters in a temperature and humidity controlled environment prior to weighing. Both pre-test and post-test PM weights are buoyancy corrected. The difference of the buoyancy corrected pre-test and post-test filter weights is reported as PM mass.

MV-AEROSOL-152: PM Trace Elements

This method involves identification and quantification of trace elements in PM using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS). This method is suitable for the determination of trace elements in particulate matter collected on Teflon filters.

MV-AEROSOL-156: PM Elements

This method uses Energy Dispersive X-Ray Fluorescence (EDXRF) spectroscopy to determine the composition of elements in particulate matter collected on Polytetrafluoroethylene (PTFE) membrane filters. When samples are irradiated by X-rays within the instrument sampling chamber, they emit X-ray fluorescence that is characteristic for each element. The intensity of emitted fluorescence energy is proportional to the surface concentration of each element (in units of $\mu g/cm^2$) and is used for their quantification.

The background X-ray spectrum of a blank filter is subtracted from that of the sample spectrum. The net intensity is proportional to the concentration of the corresponding element collected on the sample filter.

XII. SAMPLING MEDIA REQUIREMENTS

Filterable PM mass emissions may be collected per mode for each engine test (i.e., 6 PM filters for each six-mode duty cycle test, and 2 PM filters for each two-mode duty cycle test). It is estimated that a maximum total of 420 Teflon filters may be needed for PM mass analysis for all engine tests, and a maximum total of 80 Teflon filters for tunnel blanks and trip blanks may be needed (based on the assumption of one tunnel and one trip blank per testing week). Therefore, a maximum total of 500 Teflon filters may be needed for PM mass analysis.

Other PM samples may be collected in an integrated (or composite) manner, meaning a single sample may be collected over the duration of a duty cycle. For PAH and OC/EC analyses, 80 Teflon-coated glass fiber (TX60) filters and 80 quartz fiber filters may be needed for all engine tests, respectively. An additional 34 filters for tunnel and trip blanks may be needed for each analysis (See Section XIII). Therefore, a maximum total of 114 TX60 and 114 quartz filters may be needed for PAH and OC/EC analyses, respectively. PAH analysis may also need XAD/PUFs in addition to TX60 filters to analyze semi-volatile PAHs. A maximum total of 114 XAD/PUFs may be needed for PAH analysis. For IC and ICP-MS/XRF analyses, 80 Teflon filters may be needed for engine tests for each analysis. With an additional 34 filters for tunnel and trip blanks, a total of 114 Teflon filters may be needed for each analysis. IC and ICP-MS/XRF Teflon filters may be used for gravimetric analysis before they are processed for metal analysis. An additional 40 Teflon filter samples may also be collected for mass analysis and then archived. The details of this estimation are provided in Attachment IX.

XIII. PM TUNNEL & TRIP BLANK

For PM mass samples collected in individual mode, one PM tunnel blank will be collected at the beginning of the testing series per testing cycle per week. If both testing cycles (i.e. six-mode and two-mode duty cycles) occur within the same week, then two PM tunnel blanks will be collected. PM tunnel blanks will be collected using the same settings as the PM emission samples collected in the first mode of a test cycle with the engine off and the exhaust entrance to the tunnel capped. One trip blank will be collected per week no matter how many testing cycles will be used. The trip blank filter should remain inside the Petri-dish at all times until it is returned to the weighing room.

For samples collected in composite mode, one PM tunnel blank will be collected for each test engine. One trip blank will be collected monthly for each analysis.

XIV. DATA MANAGEMENT

The Test Engineer, using standard protocols in order to ensure a valid test, will review the test data, the emission results, and presence of violations. In case of test

aborts or invalidation of data, the test will be repeated and the reasons for test aborts/invalidation will be documented. The Test Engineer will communicate testing status to the Project Engineer.

The Lead Chemists will coordinate the delivery and the return of sampling media between Test Cell 5 and the analytical laboratory. The Lead Chemists will also communicate the status of analyses to the Project Engineer.

Management from MLD & Evaporative and Motorcycle Testing Section (EMTS) will evaluate the need for additional testing. Test data will be verified by the Project Engineer.

XV. QUALITY CONTROL

All applicable Standard Operating Procedures (SOPs) should be followed and weekly quality assurance (QA) should be performed, verified, and documented prior to conducting emission testing. Only tests meeting all weekly quality control criteria will be used for data analysis. This includes but is not limited to dynamometer performance, CVS propane recovery tests, analyzer responses to gas standards, and tests of the accuracy of environmental measurements (barometric pressure, dew point, and temperature).

XVI. REPORTING OF TEST DATA

The Test Engineer will review all test results for completeness and verify that all tests meet Code of Federal Regulations and CARB requirements and that all documentation is complete. After reviewing and approving the data, the Test Engineer will notify the Project Engineer of the status of the test data. Once the test data is deemed valid by the Test Engineer, a signed and dated copy of the official test report shall be forwarded to the project engineer. All data will be reviewed by the Project Engineer for completeness and accuracy. Then the Project Engineer must verify and finalize the data in the Test Control System, STARS, within two weeks of testing before it can be distributed to the Vehicle Emissions Data System (VEDS). If the STARS to VEDS transfer procedure has not been developed by the Laboratory Data Support Branch (LDSB), then the Project Engineer shall provide a single spreadsheet summarizing all test results. Under no circumstances shall CARB staff other than the Project Engineer deliver any documentation regarding this test project to manufacturer representative(s). The Project Engineer will have access to all test data and documentation of the test vehicle during this project. The Project Engineers will provide a brief write-up summarizing the data results within four weeks after completion of the project.

XVII. PROJECTED TEST PERIOD AND STAFF TIME ALLOTMENT

Testing will be divided into three independent phases: Phase I will consist of four-stroke engine testing, Phase II will consist of two-stroke engine testing, and Phase III will consist of ZEE testing. Phase I and Phase II testing will be performed at HSL. Phase III testing and engine service accumulation time for all three test phases will be performed by MLD, and/or Intertek (contracted by MLD).

The projected HSL and MLD staff time allotments for this project are summarized in Table XVII-1, below, and presented in detail in Attachment X. Assuming it requires 8 hours to install and another 8 hours to uninstall an engine on the engine dyno, the estimated time commitment from HSL for this activity for Phase I and Phase II combined will be 640 hours. Assuming the maximum break-in time of 12 hours per engine, HSL's total time commitment for engine break-in is 264 hours. Assuming 4 hours per six-mode test, and 2 hours per five-mode or two-mode test, HSL's total time commitment to complete all Phase I and Phase II testing is estimated at 330 hours. The minimum time commitment for HSL staff to complete this project is estimated at 1,234 hours or 155 eight-hour working days (approximately 0.6 PY). To account for scheduled and unscheduled test cell down time and invalid tests, it is assumed that 50 percent additional time will be needed for testing at HSL. Therefore, the total time commitment for HSL staff to complete this project is estimated at 1,851 hours or 231 eight-hour working days (0.9 PY). The total MLD/independent laboratory time commitment to install and uninstall engines on dynos is estimated at 352 hours, and total MLD/independent laboratory service accumulation time for the 6 retrofitted spark-ignited engines, and beginning-of-life test time for 10 ZEE, is estimated at 2,848 hours. Additional service accumulation time for ZEE will be determined after the completion of beginning-of-life testing. Therefore, the minimum estimated time for MLD/independent laboratory staff to complete this project is 2,848 hours. Concurrent use of several dynamometers will enable service accumulation to be completed in 3 to 6 months.

Table XVII-1 Estimated Staff Time Allotments				
Task	**Phase I**	**Phase II**	**Phase III**	**Totals**
No. of Engines	13	9	10	32
6-Mode Tests	45	--	--	45
5-Mode Tests	--	--	9	9
2-Mode Tests	21	54	21	96
HSL Test Time Allotments (hours)				
Dyno Install/Uninstall	352	288	---	640
Break-in Time	156	108	---	264
6-Mode Time	180	---	---	180
5-Mode Time	---	---	---	---
2-Mode Time	42	108	---	150
HSL Totals	730	504	---	1234
HSL Totals (Buffer)	1095	756		1851
MLD/Contract Laboratory Accumulation and ZEE Test Time Allotments (hours)				
Dyno Install/Uninstall	96	96	160	352
6-Mode Time	1380	---	---	1380
5-Mode Time	---	---	60	60
2-Mode Time	264	792	---	1056
MLD Totals	1740	888	220	2848

XVIII. STAKEHOLDER OUTREACH

The Project engineers will coordinate communication with MECA, manufacturers, and other stakeholders throughout the test program. This may involve, e.g., arranging for fixtures or special tools to be used during testing, discussions related to additional emission controls, notifications of test scheduling, or invitations to observe testing.

XIX. SURVEY OR DISPOSAL OF TEST ENGINES

Within six months of completing this test program, MLD will either dispose, survey, or transport test engines from the El Monte facilities.

XX. CONTACTS

ECARS:

Test Engineer: John Massetti, EMTS, at (626) 350-6510 or john.massetti@arb.ca.gov

Back-up Test Engineer: Travis Wong, EMTS, at (626) 350-6517 or travis.wong@arb.ca.gov

Lead Chemist: Noriko Nishino, AAMES, at (626) 575-6825 or noriko.nishino@arb.ca.gov

Back-up Lead Chemist: Hyun Ji (Julie) Lee, OAS, at (626) 350-6522 or hyunji.lee@arb.ca.gov

MLD:

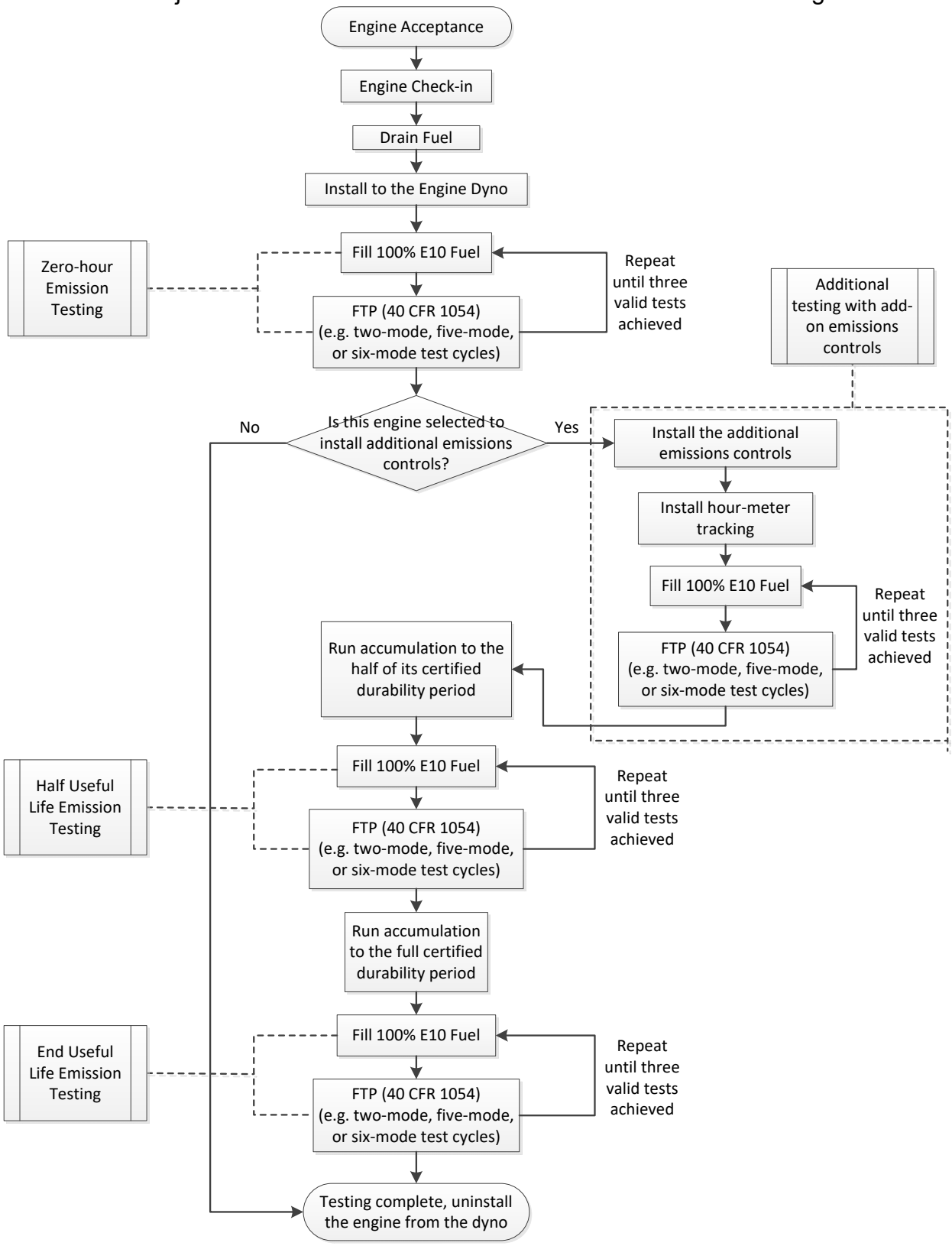
Project Engineer: Christopher Dilbeck, Testing and Certification Section (TCS), at (916) 319-0106 or christopher.dilbeck@arb.ca.gov

Back-up Project Engineer: Scott Monday, Engineering and Regulation Development Section (ERDS), at (916) 445-9319 or scott.monday@arb.ca.gov

XXI. ATTACHMENTS

I. Project Flow Chart
II. California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines (Part 1065)
III. Matrix of Four-Stroke Test Engines
IV. Matrix of Two-Stroke Test Engines (TBD)
V. Matrix of Zero-Emission Test Equipment (TBD)
VI. Small Engine Description Form
VII. Chain of Custody
VIII. Final Regulation Order Test Procedures for Small Off-Road Engines (Part 1054)
IX. Sampling Media Requirements
X. Test Periods and Staff Time Allotments

Attachment I
Project Flow Chart: Phase 1 and 2 – Exhaust Emission Testing



Attachment I (cont.)

Project Flow Chart: Phase 3 – Zero-Emission Equipment Durability Testing

Attachment II

California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines (Part 1065)

PART 4

FINAL REGULATION ORDER TEST PROCEDURES
(Part 1065)

Small Off-Road Engines

This Page Left Intentionally Blank

FINAL REGULATION ORDER TEST PROCEDURES

Note: This appendix shows the entirety of regulatory amendments to the test procedures titled below, which were approved by the Air Resources Board on December 16, 2011, and refined via subsequent conforming modifications authorized under Resolution 11-41. Incorporated by reference into these test procedures are portions of Title 40 of the Code of Federal Regulations (CFR) Part 1065 – Engine-Testing Procedures, Subparts A through K inclusive, as amended June 28, 2011; and, the internally referenced sections of Title 40 CFR, Parts 60, 80, 86, 90, 1054, and 1068. Sections that have been included in their entirety are set forth with the section number and title. California provisions that replace specific federal language provisions are denoted by the words “DELETE” for the federal language and “REPLACE WITH” or “ADD” for the California language. The notation [* * * * *] or [...] means that the remainder of the CFR text for a specific section is not shown in these procedures but has been incorporated by reference, with only the printed text changed. CFR sections that are not listed are not part of California’s test procedures. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations (CCR), the Health and Safety Code and Title 13 apply.

This document is all newly adopted text.

This Page Left Intentionally Blank

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR NEW 2013 AND LATER SMALL OFF-ROAD ENGINES

ENGINE-TESTING PROCEDURES (PART 1065)

Adopted: October 25, 2012

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR NEW 2013 AND LATER SMALL OFF-ROAD ENGINES

The following provisions of Part 1065, Title 40, Code of Federal Regulations, as promulgated by the United States Environmental Protection Agency on the date listed, are adopted and incorporated herein by this reference for 2013 model year and later small off-road engines as the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines, except as altered or replaced by the provisions set forth below.

PART 1065 – ENGINE-TESTING PROCEDURES

SOURCE: 76 FR 37977, June 28, 2011, unless otherwise noted.

Subpart A – Applicability and General Provisions

§ 1065.1 Applicability.

* * * * *

(a) DELETE,
REPLACE WITH:
(a) (1) This part applies to 2013 and later model year small off-road engines regulated under Title 13, California Code of Regulations, Chapter 9, Article 1, and subject to the emission standards in § 2403(b)(1) of that Article. These provisions do not apply to engines and equipment that fall within the scope of the preemption of Section 209(e)(1)(A) of the Federal Clean Air Act, as amended, and as defined by regulation of the Environmental Protection Agency.

(2) Every new small off-road engine that is manufactured for sale, sold, offered for sale, introduced or delivered or imported into California for introduction into commerce and that is subject to any of the standards prescribed herein is required to be covered by an Executive Order issued pursuant to Article 1, Chapter 9, Title 13, California Code of Regulations, including these Test Procedures.

* * * * *

(d) DELETE,
REPLACE WITH:
Paragraph (a) of this section identifies the parts of the CFR that define emission standards and other requirements for particular types of engines. In this part, we refer

to each section of the Article 1, Chapter 9, Title 13, California Code of Regulations, and the incorporated CFR part 1054, generically as the ”standard-setting part.”

* * * * *

(g) DELETE,
REPLACE WITH:
For additional information regarding these test procedures, visit our Web site at http://www.arb.ca.gov/msprog/offroad/sore/sore.htm

§ 1065.2 Submitting information to ARB under this part.

* * * * *

§ 1065.5 Overview of this part 1065 and its relationship to the standard-setting part.

* * * * *

§ 1065.10 Other procedures.

* * * * *

§ 1065.12 Approval of alternate procedures.

* * * * *

§ 1065.15 Overview of procedures for laboratory and field testing.`

* * * * *

§ 1065.20 Units of measure and overview of calculations.

* * * * *

§ 1065.25 Recordkeeping.

* * * * *

Subpart B – Equipment Specifications

§ 1065.101 Overview.

* * * * *

§ 1065.110 Work inputs and outputs, accessory work, and operator demand.

* * * * *

§ 1065.120 Fuel properties and fuel temperature and pressure.

* * * * *

§ 1065.122 Engine cooling and lubrication.

(a) DELETE,
REPLACE WITH:
The use of auxiliary fans for engine cooling must be indicated in the application for certification. The manufacturer must detail the use of such fans and demonstrate that the supplemental cooling resulting from the use of the fans is representative of in-use engine operation. The records must be maintained by the manufacturer and must be made available to the Executive Officer upon request.

(b) DELETE

* * * * *

§ 1065.125 Engine intake air.

* * * * *

§ 1065.127 Exhaust gas recirculation.

* * * * *

§ 1065.130 Engine exhaust.

* * * * *

(g) DELETE

* * * * *

§ 1065.140 Dilution for gaseous and PM constituents.

* * * * *

§ 1065.145 Gaseous and PM probes, transfer lines, and sampling system components.

* * * * *

§ 1065.150 Continuous sampling.

* * * * *

§ 1065.170 Batch sampling for gaseous and PM constituents.

* * * * *

§ 1065.190 PM-stabilization and weighing environments for gravimetric analysis.

* * * * *

§ 1065.195 PM-stabilization environment for in-situ analyzers.

* * * * *

Subpart C – Measurement Instruments

§ 1065.201 Overview and general provisions.

* * * * *

§ 1065.202 Data updating, recording, and control.

* * * * *

§ 1065.205 Performance specifications for measurement instruments.

* * * * *

Measurement of Engine Parameters and Ambient Conditions

§ 1065.210 Work input and output sensors.

* * * * *

§ 1065.215 Pressure transducers, temperature sensors, and dewpoint sensors.

* * * * *

Flow-Related Measurements

§ 1065.220 Fuel flow meter.

* * * * *

§ 1065.225 Intake-air flow meter.

* * * * *

§ 1065.230 Raw exhaust flow meter.

* * * * *

§ 1065.240 Dilution air and diluted exhaust flow meters.

* * * * *

§ 1065.245 Sample flow meter for batch sampling.

* * * * *

§ 1065.248 Gas divider.

* * * * *

CO and CO_2 Measurements

§ 1065.250 Nondispersive infra-red analyzer.

* * * * *

Hydrocarbon Measurements

§ 1065.260 Flame-ionization detector.

* * * * *

§ 1065.265 Nonmethane cutter.

* * * * *

§ 1065.267 Gas chromatograph.

* * * * *

NO_x and N_2O Measurements

§ 1065.270 Chemiluminescent detector.

* * * * *

§ 1065.272 Nondispersive ultraviolet analyzer.

* * * * *

§ 1065.275 N_2O measurement devices.

* * * * *

O_2 Measurements

§ 1065.280 Paramagnetic and magnetopneumatic O_2 detection analyzers.

* * * * *

Air-to-Fuel Ratio Measurements

§ 1065.284 Zirconia (ZrO_2) analyzer.

* * * * *

PM Measurements

§ 1065.290 PM gravimetric balance.

* * * * *

§ 1065.295 PM inertial balance for field testing analysis.

* * * * *

Subpart D –Calibrations and Verifications

§ 1065.301 Overview and general provisions.

* * * * *

§ 1065.303 Summary of required calibration and verifications.

* * * * *

§ 1065.305 Verifications for accuracy, repeatability, and noise.

* * * * *

§ 1065.307 Linearity verification.

* * * * *

§ 1065.308 Continuous gas analyzer system-response and updating-recording verification – for gas analyzers not continuously compensated for other gas species.

* * * * *

§ 1065.309 Continuous gas analyzer system-response and updating-recording verification – for gas analyzers continuously compensated for other gas species.

* * * * *

Measurement of Engine Parameters and Ambient Conditions

§ 1065.310 Torque calibration.

* * * * *

§ 1065.315 Pressure, temperature, and dewpoint calibration.

* * * * *

Flow-Related Measurements

§ 1065.320 Fuel-flow calibration.

* * * * *

§ 1065.325 Intake-flow calibration.

* * * * *

§ 1065.330 Exhaust-flow calibration.

* * * * *

§ 1065.340 Diluted exhaust flow (CVS) calibration.

* * * * *

§ 1065.341 CVS and batch sampler verification (propane check).

* * * * *

§ 1065.342 Sample dryer verification.

* * * * *

§ 1065.345 Vacuum-side leak verification.

* * * * *

CO and CO_2 Measurements

§ 1065.350 H_2O interference verification for CO_2 NDIR analyzers.

* * * * *

§ 1065.355 H_2O and CO_2 interference verification for CO NDIR analyzers.

* * * * *

Hydrocarbon Measurements

§ 1065.360 FID optimization and verification.

* * * * *

§ 1065.362 Non-stoichiometric raw exhaust FID O_2 interference verification.

* * * * *

§ 1065.365 Nonmethane cutter penetration fractions.

* * * * *

NO_x and N_2O Measurements

§ 1065.370 CLD CO_2 and H_2O quench verification.

* * * * *

§ 1065.372 NDUV analyzer HC and H_2O interference verification.

* * * * *

§ 1065.375 Interference verification for N_2O analyzers.

* * * * *

§ 1065.376 Chiller NO_2 penetration.

* * * * *

§ 1065.378 NO_2-to-NO converter conversion verification.

* * * * *

PM Measurements

§ 1065.390 PM balance verifications and weighing process verification.

* * * * *

§ 1065.395 Inertial PM balance verifications.

* * * * *

Subpart E – Engine Selection, Preparation, and Maintenance

§ 1065.401 Test engine selection.

* * * * *

§ 1065.405 Test engine preparation and maintenance.

* * * * *

§ 1065.410 Maintenance limits for stabilized test engines.

* * * * *

§ 1065.415 Durability demonstration.

* * * * *

Subpart F –Performing an Emission Test in the Laboratory

§ 1065.501 Overview.

* * * * *

§ 1065.510 Engine mapping.

* * * * *

§ 1065.512 Duty cycle generation.

* * * * *

§ 1065.514 Cycle-validation criteria for operation over specified duty cycles.

* * * * *

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

* * * * *

§ 1065.525 Engine starting, restarting, and shutdown, and optional repeating of void discrete modes.

* * * * *

§ 1065.526 Repeating void modes or test intervals.

* * * * *

§ 1065.530 Emission test sequence.

* * * * *

§ 1065.545 Validation of proportional flow control for batch sampling.

* * * * *

§ 1065.546 Validation of minimum dilution ration for PM batch sampling.

* * * * *

§ 1065.550 Gas analyzer range validation, drift validation, and drift correction.

* * * * *

§ 1065.590 PM sampling media (e.g., filters) preconditioning and tare weighing.

* * * * *

§ 1065.595 PM sample post-conditioning and total weighing.

* * * * *

Subpart G –Calculations and Data Requirements

§ 1065.601 Overview.

* * * * *

§ 1065.602 Statistics.

* * * * *

§ 1065.610 Duty cycle generation.

* * * * *

§ 1065.630 1980 international gravity formula.

* * * * *

§ 1065.640 Flow meter calibration calculations.

* * * * *

§ 1065.642 SSV, CFV, and PDP molar flow rate calculations.

* * * * *

§ 1065.644 Vacuum-decay leak rate.

* * * * *

§ 1065.645 Amount of water in an ideal gas.

* * * * *

§ 1065.650 Emission calculations.

* * * * *

ADD:
(i) For PM testing, engine manufacturers must use the particulate sampling test procedure specified in this part 1065 or any similar procedure that has been approved by the Executive Officer. For two-stroke engines, engine manufacturers may, in lieu of testing, determine PM emissions through the following equation:

$$PM_{est} = \frac{HC}{\text{Fuel to oil ratio}}$$

Where HC = weighted hydrocarbons in g/kW-hr, and
Fuel to oil ratio = the fuel to oil ratio used in the test engine.

Engine manufacturers may report this estimate as PM_{est}, and indicate that the PM emissions were estimated as per this paragraph.

§ 1065.655 Chemical balances of fuel, intake air, and exhaust.

* * * * *

§ 1065.659 Removed water correction.

* * * * *

§ 1065.660 THC, NMHC, and CH_4 determination.

* * * * *

§ 1065.665 THCE and NMHCE determination.

* * * * *

§ 1065.667 Dilution air background emission correction.

* * * * *

§ 1065.670 NO_x intake-air humidity and temperature corrections.

* * * * *

§ 1065.672 Drift correction.

* * * * *

§ 1065.675 CLD quench verification calculations.

* * * * *

§ 1065.690 Buoyancy correction for PM sample media.

* * * * *

§ 1065.695 Data requirements.

* * * * *

Subpart H –Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

§ 1065.701 General requirements for test fuels.

(a) DELETE,
REPLACE WITH:

(a) Certification test fuel.

(1) The certification test fuel used for emission testing must be consistent with the fuel specifications as outlined in the California Code of Regulations, title 13, §1960.1, and the "California Exhaust Emission Standards and Test Procedures for 2001 – 2014 Model Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles", as last amended [insert latest amendment date], and as incorporated by reference herein. The test fuel specification should remain consistent from batch to batch. If a particular engine requires a different octane fuel, test records should indicate the fuel used.

(2) For 2020 and later gasoline-fueled engines: The certification test fuel for emission testing must be consistent with the fuel specifications as outlined in title 13, section 1961.2 and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," adopted [insert adoption date], and incorporated by reference herein. The test fuel specifications must remain consistent from batch to batch. Optionally, manufacturers may use other renewable fuel blends under this paragraph that have been certified by ARB as yielding test results equivalent, or more stringent than, those resulting from the fuel specified by 13 CCR 1961.2, and which are appropriate for the certification of small off-road engines.

(3) For 2013 – 2019 model-year gasoline-fueled engines, the manufacturer has the option to use the certification test fuel specified in §1065.701(a)(2).

(4) Alcohol-based fuels. Alcohol-based fuels must be allowed for emission test purposes when the appropriate emission standards with respect to such fuels are a part of these provisions. Such fuels must be as specified in either §1065.701(a)(1) or §1065.701(a)(2), as applicable.

(b) DELETE,
REPLACE WITH:
With Executive Officer approval, the certifying entity may use other test fuels so long as they do not affect the demonstration of compliance.

* * * * *

(f) DELETE,
REPLACE WITH:

(f) Test fuels – service accumulation and aging.

(1) Gasoline.

(i) Gasoline representative of commercial gasoline generally available through retail outlets must be used in service accumulation and aging for gasoline fueled, spark ignition engines. As an alternative, the certification test fuels specified under either §1054.501(b)(2)(ii)(A) or §1054.501(b)(2)(ii)(B), as applicable, may be used for engine service accumulation and aging.

(ii) The octane rating of the gasoline used for service accumulation and aging must be no higher than 4.0 Research Octane Numbers above the minimum recommended by the engine manufacturer when a certification fuel is not used for service accumulation, and must have a minimum sensitivity of 7.5 Octane Numbers. Sensitivity is the Research Octane Number minus the Motor Octane Number.

(iii) The Reid Vapor Pressure of a gasoline used for service accumulation and aging must be characteristic of the engine fuel during the season in which the service accumulation takes place in the outdoors, or must be characteristic of the engine fuel appropriately suited to the ambient conditions of an indoor test cell in which the entire service accumulation takes place.

(2) Alternative fuels.

(i) Liquefied petroleum gas meeting the ASTM D1835 (11/10/1997) or NGPA HD-5 (1970) specifications must be used for service accumulation.

(ii) Natural gas representative of commercial natural gas that is available locally to the manufacturer's test site may be used in service accumulation. The manufacturer must provide the Executive Officer with detail of how the commercial natural gas differs from the certification test fuel specifications.

* * * * *

§ 1065.703 Distillate diesel fuel.

DELETE

§ 1065.705 Residual and intermediate residual fuel.

DELETE

§ 1065.710 Gasoline.

DELETE

§ 1065.715 Natural gas.

DELETE

§ 1065.720 Liquefied petroleum gas.

DELETE

§ 1065.740 Lubricants.

* * * * *

ADD:
(c) During all engine tests, the engine shall employ a lubricating oil consistent with the engine manufacturer's specifications for that particular engine. These specifications shall be recorded and declared in the certification application.

§ 1065.745 Coolants.

* * * * *

§ 1065.750 Analytical gases.

* * * * *

§ 1065.790 Mass standards.

* * * * *

Subpart I – Testing with Oxygenated Fuels

§ 1065.801 Applicability.

* * * * *

§ 1065.805 Sampling system.

* * * * *

§ 1065.845 Response factor determination.

* * * * *

§ 1065.850 Calculations.

* * * * *

Subpart J – Field Testing and Portable Emission Measurement Systems

§ 1065.901 Applicability.

* * * * *

§ 1065.905 General provisions.

* * * * *

§ 1065.910 PEMS auxiliary equipment for field testing.

* * * * *

§ 1065.915 PEMS instruments.

* * * * *

§ 1065.920 PEMS calibrations and verifications.

* * * * *

§ 1065.925 PEMS preparation for field testing.

* * * * *

§ 1065.930 Engine starting, restarting, and shutdown.

* * * * *

§ 1065.935 Emission test sequence for field testing.

* * * * *

§ 1065.940 Emission calculations.

* * * * *

Subpart K – Definitions and Other Reference Information

§ 1065.1001 Definitions.

ADD:
The definitions in Section 2401, Chapter 9, Title 13 of the California Code of Regulations, 40 CFR 1054.801, and 1068.30 apply with the following additions:

* * * * *

Act DELETE.

Adjustable parameter DELETE,
REPLACE WITH:
Adjustable parameter means any device, system, or element of design that someone can adjust (including those which are difficult to access) and that, if adjusted, may affect emissions or engine performance during emission testing or normal in-use operation. This includes, but is not limited to, parameters related to injection timing and fueling rate. You may ask us to exclude a parameter that is difficult to access if it cannot be adjusted to affect emissions without significantly degrading engine performance, or if you otherwise show us that it will not be adjusted in a way that affects emissions during in-use operation.

* * * * *

Aftertreatment DELETE,
REPLACE WITH:
Aftertreatment means relating to a catalytic converter, particulate filter, thermal reactor, or any other system, component, or technology mounted downstream of the exhaust valve (or exhaust port) whose design function is to decrease emissions in the engine exhaust before it is exhausted to the environment. Exhaust-gas recirculation (EGR), turbochargers, and oxygen sensors are not aftertreatment.

* * * * *

Applicable standard DELETE,
REPLACE WITH:
Applicable emission standard or *applicable standard* means an emission standard to which an engine (or equipment) is subject. Additionally, if an engine (or equipment) has been or is being certified to another standard or FEL, *applicable emission standard* means the FEL or other standard to which the engine (or equipment) has been or is being certified.

* * * * *

Brake power DELETE,
REPLACE WITH:
Brake power means the usable power output of the engine, not including power required to fuel, lubricate, or heat the engine, circulate coolant to the engine, or to operate aftertreatment devices.

* * * * *

Calibration DELETE,
REPLACE WITH:
Calibration means the set of specifications and tolerances specific to a particular design, version, or application of a component or assembly capable of functionally describing its operation over its working range.

* * * * *

ADD:
Certificate of Conformity means an Executive Order issued in accordance with the California Health and Safety Code, Division 26, Part 5.

Certification DELETE,
REPLACE WITH:
Certification means, with respect to new small off-road engines, obtaining an executive order for an engine family complying with the small off-road engine emission standards and requirements specified in the California Code of Regulations, Title 13, Chapter 9, Sections 2400-2409.

* * * * *

Designated Compliance Officer DELETE,
REPLACE WITH:
Designated Compliance Officer means the Executive Officer of the Air Resources Board, or a designee of the Executive Officer.

* * * * *

Discrete-mode DELETE,
REPLACE WITH:
Discrete-mode means relating to the discrete-mode type of steady-state test described in §1054.505.

* * * * *

Engine DELETE,
REPLACE WITH:
Engine as used in this part, refers to small off-road engine.

* * * * *

ADD:
EPA means Air Resources Board.

ADD:
Executive Order means an order issued by the Executive Officer of the Air Resources Board or his or her delegate certifying engines for sale in California.

* * * * *

Fuel type DELETE,
REPLACE WITH:
Fuel type means a general category of fuels such as gasoline or natural gas. There can be multiple grades within a single fuel type, such as low-temperature or all-season gasoline.

Good engineering judgment DELETE.

* * * * *

Hydrocarbon DELETE,
REPLACE WITH:
Hydrocarbon (HC) means the hydrocarbon group on which the emission standards are based for each fuel type, as described in subpart B of 40 CFR 1054.

* * * * *

Manufacturer DELETE.

* * * * *

Nonroad engine DELETE,
REPLACE WITH:
Nonroad engine means a small off-road engine as defined in the California Code of Regulations, Title 13, Chapter 9, Section 2401.

* * * * *

Ramped-modal DELETE,
REPLACE WITH:
Ramped-modal means ramped-modal type of steady-state test, as described in 40 CFR 1054.

* * * * *

ADD:
Small volume engine manufacturer means any engine manufacturer whose total production of small off-road engines slated for sale in California are projected at the time of certification of a given model year to be no more than 500 engines.

* * * * *

Steady-state DELETE,
REPLACE WITH:
Steady-state means relating to emission tests in which engine speed and load are held at a finite set of essentially constant values. Steady-state tests are either discrete-mode tests or ramped-modal tests.

* * * * *

Test sample DELETE,
REPLACE WITH:
Test sample means the collection of engines selected from the population of an emission family for emission testing. This may include testing for certification, production-line testing, or in-use testing.

* * * * *

United States DELETE.

* * * * *

Useful life DELETE,
REPLACE WITH:
Useful life means the period during which the engine and equipment are designed to properly function in terms of power output and intended function, without being remanufactured, specified as a number of hours of operation or calendar years, whichever comes first. It is the period during which an off-road engine must comply with

all applicable emission standards. If an engine has no hour meter, the specified number of hours does not limit the period during which an in-use engine is required to comply with emission standards unless the degree of service accumulation can be verified separately.

* * * * *

We (us, our) DELETE,
REPLACE WITH:
We (us, our) means the Executive Officer of the Air Resources Board or a designee of the Executive Officer.

* * * * *

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

* * * * *

§ 1065.1010 Reference materials.

* * * * *

Attachment III: List of Four-Stroke Test Engines

NUMBER	Exhaust EO #	TYPE	BRAND	MODEL	MODEL YEAR	Engine Model #	Exh EO Holder	Durability Period	Equipped w/ Governor (Y/N)	Power	DISP (CC)	ENG FAMILY
E10-2/13D10	U-U-125-0077	GENERATOR	GENERAC	GP3250	2013	UP170	United Power Equipment Co., Ltd.	125	N	4.1 kW	208	DUPMS.2081CB
E10-3	U-U-001-0600	TRIMMER	HONDA	HHT35SUKAT	2013	GX35	Honda Motor Co., Ltd.	300	N	1.0 kW/1.3 hp	36	DHNXS.0364AA
E10-4	U-U-002-0678-1	WB MOWER	SNAPPER	7800841-01	2012	128M	Briggs & Stratton Corporation	125	Y	3.2 kW	190	CBSXS.1901VP
E10-7	U-U-020-0217	BP BLOWER	CRAFTSMAN	316.794011	2013	CRAFTSMAN	MTD Southwest Inc.	50	N	1.59 hp @ 8000 RPM, 1.186 kW	32	DMTDS.0324PB
E10-11	U-U-002-0737-1	RIDE MOWER	SNAPPER	7800932-00	2013	2198	Briggs & Stratton Corporation	250	Y	8.0 kW	344	DBSXS.3442VA
E10-12	U-U-004-0588	RIDE MOWER	HUSQVARNA	960430190 00	2014	FR600V	Kawasaki Heavy Industries, Ltd.	250	Y	17.0 hp	603	EKAXS.6032CC
E10-14	U-U-019-0101	TRIMMER	HUSQVARNA	965 96 67-01	2011	224L	Husqvarna AB	300	N	0.7 kW	25	BHVXS.0254FD
E10-16	U-U-002-0813	TILLER	HUSQVARNA	960830009 00	2014	130G	Briggs & Stratton Corporation	250	Y	4.8 kW	208	EBSXS.2081HB
E10-19	U-U-001-0650	WB MOWER	HONDA	HRR2169VKA	2014	GCV160	Honda Motor Co., Ltd.	250	Y	3.3 kW/4.4 hp	161	EHNSX.1871AA
E10-21	U-U-004-0492	WB MOWER	TORO	22297	2011	FJ180	Kawasaki Heavy Industries, Ltd.	500	Y	3.4 kW (4.56 hp)	179	KAXS.179N3CB BKAXS.1791CC
E10-24	U-U-145-0063-1	WB MOWER	TORO	20372	2012	LC1P65FC	Loncin Motor Co., Ltd.	250	Y	2.7 kW/3600	159	CCGPS.1591PC
E10-26	U-U-240-0003	BLOWER	DOLMAR	PB-251.4	2014	EH025A2 or 5	Makita Corporation	300	N	0.69 kW	25.4	DFNXS.0254GA
E10-30			TBD					1000			≥ 225	

Attachment III Legend
Performance-Based
Design-Based
Less than 80 cc

Attachment IV: List of Two-Stroke Test Engines (TBD)

NUMBER	Exhaust EO #	TYPE	BRAND	MODEL	MODEL YEAR	Engine Model #	Exhaust EO Holder	Durability Period	Governor (Y/N)	Fuel/ Oil Ratio	Power	DISP CC	ENGINE FAMILY
E10-31	U-U-015-0673	LINE TRIMMER	Stihl					300			< 5 hp	≤ 80	
E10-32	U-U-010-0759	CHAINSAW	ECHO					300			< 5 hp	≤ 80	
E10-33	U-U-015-0701	CHAINSAW	Stihl					300			< 5 hp	≤ 80	
E10-34	U-U-006-0498	CHAINSAW	Poulan					300			< 5 hp	≤ 80	
E10-35		GENERATOR SET	Tail Gator					300			< 5 hp	≤ 80	
E10-36	U-U-019-0146	HEDGE TRIMMER	Husq.					300			< 5 hp	≤ 80	
E10-37	U-U-176-0187	LEAF BLOWER	Hitachi					300			< 5 hp	≤ 80	
E10-38	U-U-016-0416	LEAF BLOWER	Husq.					300			< 5 hp	≤ 80	
E10-39	U-U-015-0660	LEAF BLOWER	Stihl					300			< 5 hp	≤ 80	

Attachment IV Legend
Less than 80 cc

Attachment V: List of Zero Emission Test Equipment (TBD)

NUMBER	TYPE	BRAND	MODEL	MODEL YEAR	SERIAL #	Engine Model #	ENG MFR	Required Durability Period	Governor (Y/N)	Power	Equivalent DISP (CC)	CARB PROP #	SPECIAL FEATURES
ZEE-1	BRUSHCUTTER							300		< 5 hp	≤ 80		
ZEE-2	CHAINSAW							300		< 5 hp	≤ 80		
ZEE-3	EDGER							300		< 5 hp	≤ 80		
ZEE-4	BLOWER (HANDHELD)							300		< 5 hp	≤ 80		
ZEE-5	BLOWER (BACKPACK)							300		< 5 hp	≤ 80		
ZEE-6	HEDGE CLIPPER							300		< 5 hp	≤ 80		
ZEE-7	SPLIT BOOM SYSTEM							300		< 5 hp	≤ 80		
ZEE-8	WALK-BEHIND LAWNMOWER							500		< 5 hp	81-224		
ZEE-9	WALK-BEHIND LAWNMOWER							500		< 5 hp	81-224		
ZEE-10	RIDING LAWNMOWER							1000		<25 hp	≥ 225		

Attachment VI

Small Engine Description Form

CARB DRAFT

Small Engine Description

(Transaction 2A)

Project: | | | | | | | | | **Engine #:** | | | | **Engine ID:** | | | | | | |

Model Year: | | | | | **Engine Family:** | | | | | | | | | | | | | | |

Manufacture: __________________ **Standard:** ___________

Manufacture ID: _________________

Model : _________________________

Engine Code: ___________________

Engine Class : _______

1. < 50 cc
2. 50 - 80 cc
3. > 80 cc - < 225 cc
4. ≥ 225 cc

Fuel Tanks

Size (liters)**:** ____________ ☐ Aux. Tank

Source Project : _________________

History

Received date : ____/_____/_______

Emission Control System: __________

1. Engine modification
2. Oxidation catalytic converter 2
3. Oxidation catalyst
4. Dual three way catalytic converter
5. Oxygen sensor
6. Heated O_2 sensor
7. Air fuel sensor
8. Carburetor
9. Throttle body fuel injection
10. Sequential mult-port fuel injection
11. Direct gasoline injection
12. Gaseous fuel mixer
13. Exhaust gas re-circulation
14. Naturally aspirated engine
15. Turbocharged engine

EO Rated Torque (lb-ft) **:** _____________________

EO Rated Horsepower (hp)**:** _____________

EO Rated Speed (rpm)**:** ___________

Equip Application: _____

1. Riding mower
2. Tractor
3. Walk-behind lawnmower
4. Compressor
5. Pump
6. Chainsaw
7. Pressure washer
8. Stump beater
9. Generator set
10. Snowblower
11. Non-backpack blower
12. Backpack blower
13. Line trimmer
14. Leaf blower/vacuum
15. Tiller
16. Ice auger
17. Commercial Turf
18. Floor buffer/polishing
19. Floor scrubber
20. Turf and ground maintenance vehicle
21. Lo-loader
22. Go-kart
23. Dune buggy
24. Edger
25. Brushcutter
26. Utility Equipment
27. Sweeper
28. Aerial lift
29. Welder
30. Goft cart
31. Scooter
32. Off-road vehicle
33. Other

Project Engineer: _______________________ **Test Engineer:** ______________________________

Codes

Combustion Cycle: _________

B = Spark Ignited, 4 Stroke
C = Spark Ignited, 2 Stroke
D = Comp Ignited, 4 Stroke
E = Comp. Ignited, 2 Stroke
F = Sterling.
G = Spark ignited, 5 Stroke
H = Other

Valve Location/Porting Config.: ___________

A = Side B = Overhead C = Piston ported D = Reed valve

Governor: _______

A = Equipped w/ governor B = Not equipped

Crankshaft orientation: _____

A = Vertical B = Horizontal C = Not applicable

Fuel System: _____

A = Carburetor B = Fuel injection C = Unknown

Cooling Medium: ________

A = Air cooled B = Water cooled

Ignition Timing: _______

A = Before TDC B = TDC C = After TDC D = N/A

Degrees:_______ @ **RPM**: _________

Engine Configuration : _____

L = In Line H = Horizontally opposed R = Rotary
V = V Type S = Stratified Charge T = Transverse

Emission Test Standard: _____

A = California B = Federal

Specifications

Num. Cylinders : ☐☐

Num. Caburetors : ☐

Barrels/Carb. : ☐

Eng. Disp. Vol. (cc) **:** ☐ . ☐☐☐

Comments

____

____

____

____

____

____

____

Extra parts? Yes No

OE Fuel

Fuel Type: ___________

EO Fuel/Oil Ratio: ______/___________

EO Lubricant Type: ______________________

ARB Signature: Check-in ____________________ **ARB Signature:** Check-Out ____________________

Driver Signature: Check-in ____________________ **Driver Signature:** Check-Out ____________________

10/04/2017

Attachment VII

Chain of Custody

Project Number _____

EO Holder _____

As each task is completed, the person performing the task will sign, date, and fill in the time and hour meter reading in the space provided.

	Signature	Date	Time (Hrs:Min)	Hours (XXX.x)
Engine Receipt/Check-in				
Delivery Driver:				
Engine Check-In: Verify/Record Engine ID & engine family name				
Acceptance Checks:				
Verify Closed Crankcase system:				
Verify ECS Part #s:				
Engine Pre-Check				
Check for adjustable parameters:				
Test Prep				
Verify Engine Test Setup:				
Test Sequence				
Test Cycle _____:				
Test Cycle _____:				
Test Cycle _____:				
Test Cycle _____:				
Test Cycle _____:				
Exhaust Data Review:				

Attachment VIII

Final Regulation Order Test Procedures for Small Off-Road Engines (Part 1054)

PART 3

FINAL REGULATION ORDER TEST PROCEDURES
(Part 1054)

Small Off-Road Engines

This Page Left Intentionally Blank

FINAL REGULATION ORDER TEST PROCEDURES

Note: This appendix shows the entirety of regulatory amendments to the test procedures titled below, which were approved by the Air Resources Board on December 16, 2011, and refined via subsequent conforming modifications authorized under Resolution 11-41. Incorporated by reference into these test procedures are portions of Title 40 of the Code of Federal Regulations (CFR) Part 1054 – Control of Emissions from New, Small Nonroad Spark-Ignition Engines and Equipment, including Subparts A, B, C, D, E, F, G, H and I, as amended November 8, 2010; and, the internally referenced sections of Title 40 CFR, Parts 60, 80, 86, 90, and 1065. Sections that have been included in their entirety are set forth with the section number and title. California provisions that replace specific federal language provisions are denoted by the words “DELETE” for the federal language and “REPLACE WITH” or “ADD” for the California language. The notation [* * * * *] or [...] means that the remainder of the CFR text for a specific section is not shown in these procedures but has been incorporated by reference, with only the printed text changed. CFR sections that are not listed are not part of the test procedures. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations (CCR), the Health and Safety Code and Title 13 apply.

This document is all newly adopted text.

This Page Left Intentionally Blank

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR NEW 2013 AND LATER SMALL OFF-ROAD ENGINES

ENGINE-TESTING PROCEDURES (PART 1054)

Adopted: October 25, 2012

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR NEW 2013 AND LATER SMALL OFF-ROAD ENGINES

The following provisions of Part 1054, Title 40, Code of Federal Regulations, as proposed by the United States Environmental Protection Agency on the date listed, are adopted and incorporated herein by this reference for 2013 model year and later small off-road engines as the California Exhaust Emission Standards and Test Procedures for New 2013 and Later Small Off-Road Engines, except as altered or replaced by the provisions set forth below.

PART 1054 – CONTROL OF EMISSION FROM NEW, SMALL NONROAD SPARK-IGNITION ENGINES AND EQUIPMENT

SOURCE: 75 FR 59259, November 8, 2010, unless otherwise noted.

Subpart A – Overview and Applicability

§ 1054.1 Does this part apply for my engines and equipment?

* * * * *

(a) (2) DELETE,
REPLACE WITH:
The requirements of this part related to evaporative emissions apply as specified in Title 13, California Code of Regulations, Chapter 15, Article 1 to fuel systems used with engines subject to exhaust emission standards in this part if the engines use a volatile liquid fuel (such as gasoline).

(a) (3) DELETE,
REPLACE WITH:
This part 1054 applies starting with the 2013 model year for all small spark-ignition off-road engines and equipment.

(a) (4) DELETE,
REPLACE WITH:
The provisions of CCR 2403(f) currently apply for new engines used in emergency rescue equipment.

(a) (5) DELETE.

(b) DELETE.

(c) DELETE,
REPLACE WITH:
See California Exhaust Emission Standards and Test Procedures for 2005 – 2012 Small Off-Road Engines for requirements that apply to engines not yet subject to the requirements of this part 1054.

(d) DELETE.

(e) DELETE.

§ 1054.2 Who is responsible for compliance?

DELETE,
REPLACE WITH:
The requirements and prohibitions of this part apply to manufacturers of engines and equipment, as described in §1054.1. The requirements of this part are generally addressed to manufacturers subject to this part's requirements. The term “you” generally means the certifying manufacturer. For provisions related to exhaust emissions, this generally means the engine manufacturer, especially for issues related to certification (including production-line testing, reporting, etc.).

For provisions related to certification with respect to evaporative emissions, this generally means the equipment manufacturer. Equipment manufacturers must meet applicable requirements as described in Title 13, California Code of Regulations, Chapter 15, Article 1. Engine manufacturers that assemble an engine's complete fuel system are considered to be the equipment manufacturer with respect to evaporative emissions.

§ 1054.5 Which nonroad engines are excluded from this part's requirements?

DELETE,
REPLACE WITH:
This part does not apply to the engines that are excluded in the “small off-road engine” definition found in Title 13, section 2401.

§ 1054.10 How is this part organized?

* * * * *

§ 1054.15 Do any other CFR parts apply to me?

(a) DELETE.

* * * * *

(c) DELETE.

* * * * *

§ 1054.20 What requirements apply to my equipment?

* * * * *

(b) DELETE,
REPLACE WITH:
All equipment subject to the exhaust standards of Title 13, California Code of Regulations, Chapter 9, Article 1, must also meet the evaporative emission standards of Title 13, California Code of Regulations, Chapter 15, Article 1.

(c) DELETE,
REPLACE WITH:
You must identify and label equipment you produce under 40 CFR part 1054 consistent with the requirements of Title 13, California Code of Regulations, Chapter 9, Article 1, Section 2404 and Chapter 15, Article 1, Section 2759.

(d) DELETE,
REPLACE WITH:
You must certify your equipment or fuel systems as described in Title 13, California Code of Regulations, Chapter 15, Article 1.

(e) DELETE,
REPLACE WITH:
You must follow all emission-related installation instructions from the certifying manufacturers as described in §1054.130, and Title 13, California Code of Regulations, Chapters 9 and 15. Failure to follow these instructions may subject you to civil penalties.

(f) DELETE.

§ 1054.30 Submission of information.

(a) DELETE,
REPLACE WITH:
This part includes various requirements to record data or other information. Refer to §1054.825 and Title 13, California Code of Regulations, Chapters 9 and 15 regarding recordkeeping requirements. If recordkeeping requirements are not specified, store these records in any format and on any media and keep them readily available for one model year after you send an associated application for certification, or one year after you generate the data if they do not support an application for certification. You must promptly send us organized, written records in English if we ask for them. We may review them at any time.

(b) DELETE,

REPLACE WITH:
The regulations in §1054.255 describe your obligation to report truthful and complete information and the consequences of failing to meet this obligation. This includes information not related to certification.

* * * * *

Subpart B—Emission Standards and Related Requirements

§ 1054.101 What emission standards and requirements must my engines meet?

(a) DELETE,
REPLACE WITH:
(a)(1) *Exhaust emissions.* All engines must meet the requirements in §1054.115. Exhaust emissions from small off-road spark-ignition engines manufactured for sale, sold, offered for sale in California, or that are introduced, delivered or imported into California for introduction into commerce, must not exceed:

Exhaust Emission Standards for Spark-Ignition Engines
(grams per kilowatt-hour)

Model Year	Displacement Category	Durability Periods (hours)	Hydrocarbon plus Oxides of Nitrogen[(1)(3)]	Carbon Monoxide	Particulate
2005 and subsequent	<50 cc	50/125/300	50	536	2.0[(2)]
	50-80 cc, inclusive	50/125/300	72	536	2.0[(2)]
2008 and subsequent	>80 cc - <225 cc	125/250/500	10.0	549	
	≥ 225 cc	125/250/500/1000	8.0	549	

(1) The Executive Officer may allow gaseous-fueled (i.e., propane, natural gas) engine families, that satisfy the requirements of the regulations, to certify to either the hydrocarbon plus oxides of nitrogen or hydrocarbon emission standard, as applicable, on the basis of the non-methane hydrocarbon (NMHC) portion of the total hydrocarbon emissions.
(2) Applicable to all two-stroke engines.
(3) Engines used exclusively to power products which are used exclusively in wintertime, at the option of the engine manufacturer, may comply with the provisions in Part 1054.101(a)(2)(ii).

(2) (i) Two-stroke engines used to power snowthrowers may meet the emission standards for engines at or less than 80 cc in displacement.
(ii) Engines used exclusively to power products which are used exclusively in wintertime, such as snowthrowers and ice augers, at the option of the engine manufacturer, need not certify to or comply with standards regulating emissions of $HC+NO_x$ or $NMHC+NO_x$, as applicable. If the manufacturer exercises the option to certify to standards regulating such emissions, such engines must meet such standards. If the engine is to be used in any equipment or vehicle other than an exclusively wintertime product such as a snowthrower or ice auger, it must be certified to the applicable standard regulating emissions of $HC+NO_x$ or $NMHC+NO_x$ as applicable.
(3) Low-emitting Blue Sky Series engine requirements.
Voluntary standards. Engines may be designated “Blue Sky Series” engines by meeting:
(i) All applicable requirements of this Article, and

(ii) The following voluntary exhaust emission standards, which apply to all certification and compliance testing. Blue Sky Series engines shall not be included in the averaging, banking, and trading program. Zero-emission small off-road equipment may certify to the Blue Sky Series emission standards. Manufacturers of zero-emission small off-road equipment are not required to perform emissions testing, but must file an application of certification and comply with the administrative requirements outlined in these procedures.

Voluntary Emission Standards
(grams per kilowatt-hour)

Model Year	Displacement Category	Hydrocarbon plus Oxides of Nitrogen	Carbon Monoxide	Particulate*
2005 and subsequent	<50 cc	25	536	2.0
	50 - 80 cc, inclusive	36	536	2.0
2007 and subsequent	>80 cc - <225 cc	5.0	549	
2008 and subsequent	≥225 cc	4.0	549	

* Applicable to all two-stroke engines

(b) DELETE,
REPLACE WITH:
Evaporative emissions. Except as specified in §1054.20, new equipment using engines that run on a volatile liquid fuel (such as gasoline) must meet the evaporative emission requirements as specified in Title 13, California Code of Regulations, Chapter 15, Article 1.

* * * * *

(d) DELETE.

(e) DELETE.

* * * * *

§ 1054.103 What exhaust emission standards must my handheld engines meet?

(a) DELETE,
REPLACE WITH:
Emission standards. The exhaust emissions from your engines may not exceed the emission standards that are specified in §1054.101. Measure emissions

using the applicable steady-state test procedures described in subpart F of this part.

(b) DELETE,
REPLACE WITH:
Averaging, banking, and trading. You may generate or use emission credits under the averaging, banking, and trading (ABT) program for $HC+NO_X$ emissions and Particulate Matter emissions as described in Title 13, California Code of Regulations, Chapter 9, Article 1.

* * * * *

(e) DELETE,
REPLACE WITH:
Applicability for testing. The emission standards in Title 13, California Code of Regulations, Chapter 9, Article 1 apply to all testing, including certification, production-line, in-use, and new engine compliance testing.

§ 1054.105 What exhaust emission standards must my nonhandheld engines meet?

(a) DELETE,
REPLACE WITH:
Emission standards. Exhaust emissions from your engines may not exceed the emission standards that are specified in §1054.101. Measure emissions using the applicable steady-state test procedures described in subpart F of this part.

(b) DELETE,
REPLACE WITH:
Averaging, banking, and trading. You may generate or use emission credits under the averaging, banking, and trading (ABT) program for $HC+NO_X$ emissions and Particulate Matter emissions as described in Title 13, California Code of Regulations, Chapter 9, Article 1.

* * * * *

(e) DELETE,
REPLACE WITH:
Applicability for testing. The emission standards in Title 13, California Code of Regulations, Chapter 9, Article 1 apply to all testing, including certification, production-line, in-use, and new engine compliance testing.

§ 1054.107 What is the useful life period for meeting exhaust emission standards?

* * * * *

(a) (1) DELETE,
RELACE WITH:
The useful life period for exhaust requirements is the number of engine operating hours from Title 13, California Code of Regulations, Chapter 9, Article 1, Section 2404 that most closely matches the expected median in-use life of your engines. The median in-use life of your engine is the shorter of the following values:

(i) The median in-use life of equipment into which the engine is expected to be installed.

(ii) The median in-use life of the engine without being scrapped or rebuilt.

(2) DELETE.

(3) DELETE.

* * * * *

§ 1054.110 What evaporative emission standards must my handheld equipment meet?

DELETE,
REPLACE WITH:
All equipment must meet the evaporative emission requirements as specified in Title 13, California Code of Regulations, Chapter 15, Article 1. The evaporative emission requirements apply for handheld equipment over a useful life of five years.

§ 1054.112 What evaporative emission standards must my nonhandheld equipment meet?

DELETE,
REPLACE WITH:
All equipment must meet the evaporative emission requirements as specified in Title 13, California Code of Regulations, Chapter 15, Article 1. The evaporative emission requirements apply for nonhandheld equipment over a useful life of five years.

§ 1054.115 What other requirements apply?

* * * * *

(b) DELETE,
REPLACE WITH:
Adjustable parameters. Engines that have adjustable parameters must meet all the requirements of this part for any adjustment in the physically adjustable range. An operating parameter is not considered adjustable if you permanently

seal it or if it is not normally accessible using ordinary tools. We may require that you set adjustable parameters to any specification within the adjustable ranges during any testing including certification testing, production-line testing, in-use testing, or new engine compliance testing.

(c) DELETE,
REPLACE WITH:
Altitude adjustments. Engines must meet applicable emission standards for valid tests conducted under the ambient conditions specified in 40 CRF 1065.520. Engines must meet applicable emission standards at all specified atmospheric pressures except: (i) engines with displacements ≤80 cc for atmospheric pressures below 96.0 kPa; and, (ii) engines with displacements >80 cc may rely on an altitude kit for atmospheric pressures below 94.0 kPa if you meet the requirements specified in 1054.205(r). If you rely on an altitude kit for certification, you must identify in the owners manual the altitude range for which you expect proper engine performance and emission control with and without the altitude kit; you must also state in the owners manual that operating the engine with the wrong engine configuration at a given altitude may increase its emissions and decrease fuel efficiency and performance. In your application for certification, identify the altitude above which you rely on an altitude kit to meet emission standards and describe your plan for making information and parts available such that you would reasonably expect that altitude kits would be widely used at all such altitudes.

* * * * *

§ 1054.120 What emission-related warranty requirements apply to me?

DELETE,
REPLACE WITH:
The requirements of this section and Title 13, CCR, Chapter 9, Article 1 apply to the manufacturer certifying with respect to exhaust emissions. See Title 13, CCR, Chapter 15, Article 1 for the warranty requirements related to evaporative emissions.

* * * * *

(b) (1) DELETE,
REPLACE WITH:
The minimum warranty period is two years.

(b) (2) DELETE.

(b) (3) DELETE.

(c) DELETE,

REPLACE WITH:
Components covered. The emission-related warranty covers all components whose failure would increase an engine's emissions of any regulated pollutant, including components listed in Title 13, California Code of Regulations, Chapters 9 and 15, and components from any other system you develop to control emissions. The emission-related warranty covers these components even if another company produces the component. Your emission-related warranty does not cover components whose failure would not increase an engine's emissions of any regulated pollutant.

(d) DELETE.

* * * * *

(f) (3) (i) DELETE,
REPLACE WITH:
If you have authorized service centers in all California population centers with a population of 100,000 or more based on the 2010 census, you may limit warranty repairs to these service providers.

(f) (3) (ii) DELETE,
REPLACE WITH:
You may limit warranty repairs to authorized service centers for owners located within 100 miles of an authorized service center. For owners located more than 100 miles from an authorized service center, you must state in your warranty that you will either pay for shipping costs to and from an authorized service center, provide for a service technician to come to the owner to make the warranty repair, or pay for the repair to be made at a local non-authorized service center.

(f) (3) (iii) DELETE,
REPLACE WITH:
You must have at least one authorized service center in California.

(f) (4) DELETE.

§ 1054.125 What maintenance instructions must I give to buyers?

DELETE,
REPLACE WITH:
Give the ultimate purchaser of each new engine written instructions for properly maintaining and using the engine, including the emission control system as described in this section. The maintenance instructions also apply to service accumulation on your emission-data engines as described in §1054.245 and in 40 CFR part 1065. Note that for engines with a displacement of less than or equal to 80 cc you may perform maintenance on emission-data engines during

service accumulation provided that exhaust emission tests are performed before and after the maintenance is performed.

* * * * *

(d) DELETE,
REPLACE WITH:
Noncritical emission-related maintenance. Subject to the provisions of this paragraph (d), you may schedule any amount of emission-related inspection or maintenance that is not covered by paragraph (a) of this section (i.e., maintenance that is neither explicitly identified as critical emission-related maintenance, nor that we approve as critical emission-related maintenance). Noncritical emission-related maintenance generally includes re-seating valves, removing combustion chamber deposits, or any other emission-related maintenance on the components we specify in Title 13, California Code of Regulations, Chapters 9 and 15 that is not covered in paragraph (a) of this section. You must state in the owner's manual that these steps are not necessary to keep the emission-related warranty valid. If operators fail to do this maintenance, this does not allow you to disqualify those engines from in-use testing or deny a warranty claim. Do not take these inspection or maintenance steps during service accumulation on your emission-data engines.

* * * * *

§ 1054.130 What installation instructions must I give to equipment manufacturers?

* * * * *

(b) (2) DELETE,
REPLACE WITH:
State: "Failing to follow these instructions when installing a certified engine in off-road equipment violates California law, subject to penalties as described in Title 13, California Code of Regulations."

* * * * *

(b) (4) DELETE,
REPLACE WITH:
Describe the steps needed to control evaporative emissions in accordance with Executive Order that you hold. Include instructions for connecting fuel lines as needed to prevent running loss emissions, if applicable. Such instructions must include sufficient detail to ensure that running loss control will not cause the engine to exceed exhaust emission standards. For example, you may specify a maximum vapor flow rate under normal operating conditions. Also include

notification that the installer must meet the requirements of §1054.112 and Title 13, California Code of Regulations, Chapter 15, Article 1.

* * * * *

(b) (7) DELETE,
REPLACE WITH:
State: “If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in Title 13, California Code of Regulations, Chapter 9, Article 1, Section 2404.”

* * * * *

§ 1054.135 How must I label and identify the engines I produce?

DELETE,
REPLACE WITH:
The label shall meet the requirements specified in Section 2404, Title 13 of the California Code of Regulations.

§ 1054.140 What is my engine's maximum engine power and displacement?

* * * * *

(a) DELETE,
REPLACE WITH:
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 0.1 kilowatts for nonhandheld engines and to the nearest 0.01 kilowatts for handheld engines. 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. For handheld engines, we may allow manufacturers to base the nominal power curve on other mapping procedures. This information may also be expressed by a torque curve that relates maximum available engine torque with engine speed. Note that maximum engine power is based on engines and installed engine governors; equipment designs that further limit engine operation do not change maximum engine power.

* * * * *

§ 1054.145 Are there interim provisions that apply only for a limited time?

* * * * *

(a) DELETE.

(b) DELETE.

(c) DELETE.

(d) DELETE.

(e) DELETE.

(f) DELETE.

(g) DELETE.

(h) DELETE.

(i) DELETE.

(j) DELETE,
REPLACE WITH:
Continued use of California Exhaust Emission Standards and Test Procedures for 2005 through 2012 Small Off-Road Engines. You may use the test procedures for measuring exhaust emissions in the California Exhaust Emission Standards and Test Procedures for 2005 through 2012 Small Off-Road Engines instead of those in subpart F of this part for the 2013 through 2014 model years. This applies for certification, production-line, and in-use testing. You may continue to use data based on the test procedures in the California Exhaust Emission Standards and Test Procedures for 2005 through 2012 Small Off-Road Engines for engine families in 2014 and later model years, provided that we allow you to use carryover emission data under 40 CFR 1054.235(d) for your engine family. You may also use the test procedures for measuring exhaust emissions in the California Exhaust Emission Standards and Test Procedures for 2005 to 2012 Small Off-Road Engines for production-line testing with any engine family whose certification is based on testing with those procedures.

(k) DELETE.

* * * * *

(m) DELETE.

(n) DELETE.

(o) DELETE.

Subpart C—Certifying Emission Families

§ 1054.201 What are the general requirements for obtaining a certificate of conformity?

DELETE,
REPLACE WITH:
Engine manufacturers must certify their engines with respect to the exhaust emission standards in Title 13, CCR, Chapter 9, Article 1, Section 2403. Manufacturers of engines, equipment, or fuel-system components may need to certify their products with respect to evaporative emission standards as described in Title 13, CCR, Chapter 15, Article 1. The following general requirements apply for obtaining an Executive Order:

(a) DELETE,
REPLACE WITH:
You must send us a separate application for an Executive Order for each engine family. An Executive Order is not valid for any production after December 31 of the model year for which it is issued. If you certify with respect to both exhaust and evaporative emissions, you must submit separate applications.

* * * * *

(d) DELETE.

* * * * *

(h) DELETE.

ADD:
(i) The Executive Officer may request notification, prior to the initial model year submission of an engine manufacturer's certification application(s), of the engine manufacturer's intent to seek engine family certification (i.e., a letter of intent) so that the Executive Officer can adequately allocate resources required for reviewing such certification applications in a timely manner. Such letters of intent must provide the engine manufacturer's best estimate of general information for the applicable model-year certification, such as identification of each engine family, date of expected submission, etc.

§ 1054.205 What must I include in my application?

DELETE,
REPLACE WITH:

This section specifies the information that must be in your application, unless we ask you to include less information under §1054.201(c). We may require you to provide additional information to evaluate your application. The provisions of this section apply to the manufacturer that is to be granted an Executive Order.

(a) DELETE,
REPLACE WITH:
Describe the engine family's specifications and other basic parameters of the engine's design and emission controls (i.e., catalyst specifications). List the fuel type on which your engines are designed to operate (for example, all-season gasoline). List each distinguishable engine configuration in the engine family.

* * * * *

(i) DELETE,
REPLACE WITH:
Include the maintenance and warranty instructions you will give to the ultimate purchaser of each new engine (see §§1054.120 and 1054.125). Describe your basis for meeting the warranty-assurance provisions in §1054.120(f). Describe your recall repair network if it is different than your warranty repair network.

* * * * *

(l) DELETE,
REPLACE WITH:
Identify the emission standards or FELs for the engine family. Include a statement indicating whether the manufacturer intends to include the engine family in a corporate average, and, if so, an estimate of the overall corporate average emissions for that model year.

* * * * *

(p) (1) DELETE,
REPLACE WITH:
Report all test results involving measurement of pollutants for which emission standards apply. Include test results from invalid tests and from any other tests, whether or not they were conducted according to the test procedures of subpart F of this part. We may ask you to send other information to confirm that your tests were valid under the requirements of this part; Title 13, CCR, Chapters 9 and 15; and 40 CFR 1065.

(2) DELETE,
REPLACE WITH:
Report measured CO_2, N_2O, and CH_4 as described in §1054.235.

* * * * *

ADD:
(q) (5) Information including but not limited to part numbers, technical specifications, schematics, and photographs of physical samples.

(r) DELETE,
REPLACE WITH:
Describe how your engines with a displacement of greater than 80 cc comply with emission standards at varying atmospheric pressures. Include a description of altitude kits you designed to comply with the requirements of §1054.115(c). Identify the part number of each component you describe. Identify the altitude range for which you expect proper engine performance and emission control with and without the altitude kit. State that your engines will comply with applicable emission standards throughout the useful life with the altitude kit installed according to your instructions. Describe any relevant testing, engineering analysis, or other information in sufficient detail to support your statement. In addition, describe your plan for making information and parts available such that you would reasonably expect that altitude kits would be widely used in the high-altitude counties. For example, engine owners should have ready access to information describing when an altitude kit is needed and how to obtain this service. Similarly, parts and service information should be available to qualified service facilities in addition to authorized service centers if that is needed for owners to have such altitude kits installed locally.

(s) DELETE.

* * * * *

(u) DELETE,
REPLACE WITH:
Unconditionally certify that all the engines in the engine family comply with the requirements of this part, other referenced parts of the CFR as incorporated and modified herein, California's Health and Safety Code, and CCR 2400-2409.

(v) DELETE,
REPLACE WITH:
Include good-faith estimates of California-directed production volumes. Include a justification for the estimated production volumes if they are substantially different than actual production volumes in earlier years for similar models. Also indicate whether you expect the engine family to contain only off-road engines, only stationary engines, or both.

(w) DELETE.

(x) DELETE,
REPLACE WITH:
Include the information required by other subparts of this part.

(y) DELETE,
REPLACE WITH:
Include other applicable information, such as information specified in this part related to requests for exemptions.

* * * * *

§ 1054.210 May I get preliminary approval before I complete my application?

DELETE.

§ 1054.220 How do I amend the maintenance instructions in my application?

* * * * *

§ 1054.225 How do I amend my application for certification to include new or modified engines or fuel systems or change an FEL?

* * * * *

(a) (3) DELETE.

* * * * *

(f) DELETE.

§ 1054.230 How do I select emission families?

(a) DELETE,
REPLACE WITH:
For purposes of certification, divide your product line into families of engines that are expected to have similar emission characteristics throughout their useful life as described in this section. Your engine family is limited to a single model year. For evaporative emissions, group engines into emission families as described in the California Code of Regulations, Chapter 15, Article 1.

* * * * *

(d) (1) DELETE.

(d) (2) DELETE.

* * * * *

§ 1054.235 What exhaust emission testing must I perform for my application for a certificate of conformity?

* * * * *

(a) DELETE,
REPLACE WITH:
Select an emission-data engine from each engine family for testing as described in 40 CFR 1065.401. Select a configuration that is most likely to exceed the $HC+NO_X$ standard. Configurations must be tested as they will be produced, including installed governors, if applicable.

* * * * *

(c) (3) DELETE,
REPLACE WITH:
For engines with adjustable parameters, manufacturers must test the engines at both extremes of the adjustment, as applicable.

* * * * *

(g) DELETE,
REPLACE WITH:
Measure $CO_2$and $CH_4$with each low-hour certification test using the procedures specified in 40 CFR part 1065 starting in the 2013 model year. Also measure N_2O with each low-hour certification test using the procedures specified in 40 CFR part 1065 starting in the 2013 model year for any engine family that depends on NOx aftertreatment to meet emission standards. Use the same units and modal calculations as for your other results to report a single weighted value for each constituent. Round the final values as follows:

(1) Round $CO_2$to the nearest 1 g/kW-hr.

(2) Round N_2O to the nearest 0.001 g/kW-hr.

(3) Round $CH_4$to the nearest 0.001 g/kW-hr.

ADD:
(h) The use of auxiliary fans for engine cooling must be indicated in the application for certification. The manufacturer must justify to the satisfaction of the Executive Officer in the application for certification the need for and use of such fans. The manufacturer must also demonstrate that the supplemental cooling resulting from the use of the fans is representative of in-use engine operation.

§ 1054.240 How do I demonstrate that my emission family complies with exhaust emission standards?

(a) DELETE,
REPLACE WITH:
For purposes of certification, your engine family is considered in compliance with the emission standards in §1054.101(a) if all emission-data engines representing that family have test results showing deteriorated emission levels at or below these standards. This includes all test points over the course of the durability demonstration. Note that your FELs are considered to be the applicable emission standards with which you must comply if you participate in the ABT program.

* * * * *

(c) DELETE,
REPLACE WITH:
Determine a deterioration factor to compare emission levels from the emission-data engine with the applicable emission standards. Section 1054.245 specifies how to test engines to develop deterioration factors that represent the expected deterioration in emissions over your engines' full useful life. Calculate a multiplicative deterioration factor as described in §1054.245. If the deterioration factor is less than one, use one. Specify the deterioration factor to one more significant figure than the emission standard.

* * * * *

§ 1054.245 How do I determine deterioration factors from exhaust durability testing?

DELETE,
REPLACE WITH:
(a) Small-volume engine manufacturers may, at their option, use deterioration factors (DF) for $HC+NO_x$ ($NMHC+NO_x$) and CO from Table 1 or Table 2 of this paragraph (a) or they may calculate deterioration factors for $HC+NO_x$ ($NMHC+NO_x$) and CO according to the process described in paragraph (d) of this section. For technologies that are not addressed in Table 1 or Table 2 of this paragraph (a), the manufacturer may ask the Executive Officer to assign a deterioration factor prior to the time of certification.

(b) Table 1 follows:

TABLE 1: ENGINES GREATER THAN 80 CC $HC+NO_x$ ($NMHC+NO_x$) AND CO ASSIGNED DETERIORATION FACTORS FOR SMALL VOLUME ENGINE MANUFACTURERS

Displacement Category	Side valve engines		Overhead valve engines		Engines with aftertreatment
	$HC+NO_x$ ($NMHC+NO_x$)	CO	$HC+NO_x$ ($NMHC+NO_x$)	CO	
>80 cc-<225 cc	2.1	1.1	1.5	1.1	DFs must be calculated using the formula in Subsection (d) below
≥ 225 cc	1.6	1.1	1.4	1.1	

(c) Table 2 follows:

TABLE 2. ENGINES AT OR BELOW 80 CC HC+NOx (NMHC+NOx) AND CO ASSIGNED DETERIORATION FACTORS FOR SMALL VOLUME ENGINE MANUFACUTURERS

Displacement category	Two-stroke engines[1]		Four-stroke engines		Engines with aftertreatment
	$HC+NO_x$ ($NMHC+NO_x$)	CO	$HC+NO_x$ ($NMHC+NO_x$)	CO	
0-80 cc, inclusive	1.1	1.1	1.5	1.1	DFs must be calculated using the formula in Subsection (d) below

[1] Two-stroke technologies to which these assigned deterioration factors apply include conventional two-strokes, compression wave designs, and stratified scavenging designs.

(d) Formula for calculating deterioration factors for engines with aftertreatment:

$$DF = [(NE * EDF) – (CC * F)]/(NE – CC)$$

Where:

DF = deterioration factor.
NE = new engine emission levels prior to the catalyst (g/kW-hr).
EDF = deterioration factor for engines without catalyst as shown in Table 1 or Table 2 of this paragraph.
CC = amount converted at 0 hours in g/kW-hr.
F = 0.8 for HC (NMHC), 1.0 for NOx, and 0.8 for CO for all classes of engines.

(e)(1) Manufacturers shall obtain an assigned DF or calculate a DF, as appropriate, for each regulated pollutant for all engine families. Such DF shall be used for certification, production line testing, and Selective Enforcement Auditing.

(2) For engines not using assigned deterioration factors from Table 1 or Table 2 of paragraph (a) of this section, deterioration factors shall be determined as follows:

(i) The new prototype engine must be emissions tested at zero hour (break-in) with all emission control systems (e.g., EGR, catalysts, etc.) installed.

(ii) The engine must be aged on the emissions durability cycle to the first test point. The manufacturer must choose its test points that are equally divided (same number of hours $\pm$ 2 hours). An emissions test is conducted at half the emissions durability period $\pm$ 2 hours.

(iii) The prototype engine must be emissions tested at each test point. Following testing the durability cycle must be continued to the next point.

(iv) Only specified maintenance may be performed during durability cycle testing. In addition, an emission test must be performed before and after the maintenance is performed.

(v) When the prototype engine has been aged on the durability cycle to the full emissions durability cycle, a final emissions test must be conducted.

(vi) For each pollutant, a line must be fitted to the data points treating the initial test as occurring at hour=0, and using the method of least-squares. The deterioration factor is the calculated emissions at the end of the emissions durability period divided by the calculated emissions at zero hours.

(vii) If the engine manufacturer conducts more than one test at a test point, the number of tests at every test point must be the same. All tests must be used in a linear regression analysis as separate points to determine the deterioration factor.

(viii) Additional engines identical to the original test engine may be tested with prior approval from the Executive Officer. In such cases, data collection must remain consistent for all test engines. The testing of multiple engines requires the determination of separate deterioration factors for each test engine. The official deterioration factor shall be the average of the separate deterioration factors for each test engine.

(ix) The product of the zero-hour (break-in) results from the engine multiplied by the deterioration factor is the emissions certification value for that engine family and pollutant. In the case of multiple zero-hour tests on a single engine, the engine manufacturer must select the last zero-hour test as the official zero-hour test upon which the deterioration factor is applied. If multiple engines are tested, the manufacturer must select the highest zero-hour result among the last zero-hour test of each engine as the official zero-hour test upon which the deterioration factor is applied.

(3) ARB may reject a DF if it has evidence that the DF is not appropriate for that engine family within 30 days of receipt from the manufacturer. The manufacturer must retain actual emission test data to support its choice of DF and furnish that data to the Executive Officer upon request. Manufacturers may request approval by the Executive Officer of alternative procedures for determining deterioration. Any submitted DF not rejected by ARB within 30 days shall be deemed to have been approved.

(4) Calculated deterioration factors may cover families and model years in addition to the one upon which they were generated if the manufacturer submits a justification acceptable to the Executive Officer in advance of certification that the affected engine families can be reasonably expected to have similar emission deterioration characteristics.

(5) Engine families that undergo running changes need not generate a new DF, if the manufacturer submits a justification acceptable to the Executive Officer concurrent with the running change that the affected engine families can be reasonably expected to have similar emission deterioration characteristics.

§ 1054.250 What records must I keep and what reports must I send to EPA?

(a) DELETE,
REPLACE WITH:
Send to the Chief, Mobile Source Operations Division, 9528 Telstar Avenue, El Monte, CA, 91731, information related to your California-directed production volumes as described in §1054.345. In addition, within 45 days after the end of the model year, you must send ARB a report describing information about engines you produced during the model year as follows:

(a) (1) DELETE,
REPLACE WITH:
State the total California and Federal production volume for each engine family.

(a) (2) DELETE.

(a) (3) DELETE.

(a) (4) DELETE.

* * * * *

§ 1054.255 What decisions may EPA make regarding my certificate of conformity?

(a) DELETE,
REPLACE WITH:
If we determine your application is complete and shows that the engine family meets all the requirements of 40 CFR part 1054, the California Health and Safety Code, and Title 13, California Code of Regulations, Chapters 9 and 15, we will issue an Executive Order for your engine family for that model year. We may make the approval subject to additional conditions.

(b) DELETE,

REPLACE WITH:
We may deny your application for certification if we determine that your engine family fails to comply with emission standards or other requirements of 40 CFR part 1054 or the California Health and Safety Code or Title 13, California Code of Regulations, Chapters 9 and 15. We will base our decision on all available information. If we deny your application, we will explain why in writing.

* * * * *

(c) (4) DELETE,
REPLACE WITH:
Deny us from completing authorized activities (see subsections (i) through (vi) below). This includes a failure to provide reasonable assistance.

(i) We may inspect your testing, manufacturing processes, storage facilities (including port facilities for imported engines and equipment or other relevant facilities), or records, as authorized by California law, to enforce the provisions of 40 CFR part 1054. Inspectors will have authorizing credentials and will limit inspections to reasonable times—usually, normal operating hours.

(ii) If we come to inspect, we may or may not have a warrant or court order.

(A) If we do not have a warrant or court order, you may deny us entry.

(B) If we have a warrant or court order, you must allow us to enter the facility and carry out the activities it describes.

(iii) We may seek a warrant or court order authorizing an inspection described in this section whether or not we first tried to get your permission to inspect.

(iv) We may select any facility to do any of the following:

(A) Inspect and monitor any aspect of engine or equipment manufacturing, assembly, storage, or other procedures, and any facilities where you do them.

(B) Inspect and monitor any aspect of engine or equipment test procedures or test-related activities, including test engine/equipment selection, preparation, service accumulation, emission duty cycles, and maintenance and verification of your test equipment's calibration.

(C) Inspect and copy records or documents related to assembling, storing, selecting, and testing an engine or piece of equipment.

(D) Inspect and photograph any part or aspect of engines or equipment and components you use for assembly.

(v) You must give us reasonable help without charge during an inspection authorized by California law, including but not limited to the Health and Safety Code. For example, you may need to help us arrange an inspection with the facility's managers, including clerical support, copying, and translation. You may also need to show us how the facility operates and answer other questions. If we ask in writing to see a particular employee at the inspection, you must ensure that he or she is present (legal counsel may accompany the employee).

(vi) If you have facilities in other countries, we expect you to locate them in places where local law does not keep us from inspecting as described in this section. We will not try to inspect if we learn that local law prohibits it, but we may suspend your certificate if we are not allowed to inspect.

* * * * *

(c) (7) DELETE,
REPLACE WITH:
Take any action that otherwise circumvents the intent of the California Health and Safety Code, or 40 CFR part 1054 or Title 13, California Code of Regulations, Chapters 9 and 15.

(d) DELETE,
REPLACE WITH:
We may void your certificate if you do not keep the records we require or do not give us information as required under 40 CFR part 1054 or the California Health and Safety Code, or Title 13, California Code of Regulations, Chapters 9 and 15.

* * * * *

Subpart D—Production-Line Testing

§1054.300
DELETE,
REPLACE WITH:
§1054.300 General provisions.
Upon the Executive Officer's request, the manufacturer must supply a reasonable number of production engines for testing and evaluation. These engines must be representative of typical production and supplied for testing at such time and place and for such reasonable periods as the Executive Officer may require. Manufacturers must comply with the production-line testing provisions as specified in Title 13, California Code of Regulations, Section 2407.

Subpart E—In-use Testing

§ 1054.401 General provisions.

* * * * *

Subpart F—Test Procedures

§ 1054.501 How do I run a valid emission test?

* * * * *

(b) (2) (ii) DELETE,
REPLACE WITH:
For engines with a displacement of greater than eighty cubic centimeters, you may use the blended fuel for certifying engines under this part without our advance approval. If you use the blended fuel for certifying a given engine family, you must also use it for production-line testing or any other testing you perform for that engine family under this part. If the certification of all your engine families in a given model year is based on test data collected using the blended fuel, we will also use the blended fuel for testing your engines. If the certification of some but not all of your engine families in a given model year is based on test data collected using the blended fuel, we may use the blended fuel or the specified gasoline test fuel for testing any of your engines.

* * * * *

(b) (3) (ii) DELETE,
REPLACE WITH:
Intake air temperature. Measure engine intake air temperature as described in 40 CFR 1065.125, and control it if necessary. For example, since the purpose of this requirement is to ensure that the measured air temperature is consistent with the intake air temperature that would occur during in-use operation at the same ambient temperature, do not cool the intake air and do not measure air temperature at a point where engine heat affects the temperature measurement.

* * * * *

ADD:
(b) (8) Engine service accumulation and stabilization procedure. Use the service accumulation procedure determined by the manufacturer for exhaust emission stabilizing of an engine, consistent with good engineering practice.

(i) The manufacturer determines, for each engine family, the number of hours at which the engine exhaust emission control system combination is stabilized for emission testing. However, this stabilization procedure may not exceed 12 hours. The manufacturer must maintain, and provide to the Executive Officer upon request, a record of the rationale used in making this determination. If the manufacturer can document that at some time prior to the full 12 hour service accumulation period the engine emissions are decreasing for the remainder of the 12 hours, the service accumulation may be completed at that time. The

manufacturer may elect to accumulate 12 hours on each test engine within an engine family without making this determination.

(ii) During service accumulation, the fuel and lubricants specified in 40 CFR 1065 must be used.

(iii) Engine maintenance during service accumulation is allowed only in accordance with 40 CFR 1065.

(9) Engine pre-test preparation.

(i) Drain and charge the fuel tank(s) with the specified test fuel to 50 percent of the tank's nominal capacity. If an external fuel tank is used, the engine fuel inlet system pressure must be typical of what the engine will see in use.

(ii) If you are using the raw gas sampling method, operate the engine on the dynamometer measuring the fuel consumption and torque before and after the emission sampling equipment is installed, including the sample probe.

(10) Analyzer pre-test procedures.

(i) If necessary, warm up and stabilize the analyzer(s) before calibrations are performed.

(ii) Replace or clean the filter elements and then leak check the system as required by 40 CRF 1065. If necessary, allow the heated sample line, filters and pumps to reach operating temperature.

(iii) Perform the following system checks:

(A) If necessary, check the sample line temperature. Heated FID sample line temperature must be maintained between 110°C and 230°C; a heated NOx sample line temperature must be maintained between 60°C and 230°C.

(B) Check that the system response time has been accounted for prior to sample collection data recording.

(C) A HC hang-up check is permitted.

(iv) Check analyzer zero and span before and after each test at a minimum. Further, check analyzer zero and span any time a range change is made or at the maximum demonstrated time span for stability for each analyzer used.

(11) Check system flow rates and pressures and reset, if necessary.

* * * * *

(c) (2) DELETE,
REPLACE WITH:
Describe in your application for certification any specially designed fixtures or other hardware if they are needed for proper testing of your engines. (Note: You do not need to specify the size or performance characteristics of engine dynamometers.) You must send us these fixtures or other hardware if we ask for them. We may waive the requirement of §1054.205(aa) to identify a test facility in the United States for such engine families as long as the projected California-directed production volume of all your engine families using the provisions of this paragraph (c)(2) is less than 5 percent of your total production volume from all engine families certified under this part 1054.

(d) DELETE,
REPLACE WITH:
Wintertime engines. You may test wintertime engines at the ambient temperatures specified in 40 CFR 1065.520, even though this does not represent in-use operation for these engines (40 CFR 1065.10(c)(1)). In this case, you may modify the test engine as needed to achieve intake temperatures that are analogous to in-use conditions. You may also test wintertime engines at reduced ambient temperatures as specified in 40 CFR 1051.505. Use the gasoline specified for low-temperature testing only if you test your engines at ambient temperatures below 20 °C.

§ 1054.505 How do I test engines?

(a) DELETE,
REPLACE WITH:
This section describes how to test engines under steady-state conditions. For engines with a displacement of less than or equal to eighty cubic centimeters you must perform tests with discrete-mode sampling. For engines with a displacement of greater than eighty cubic centimeters we allow you to perform tests with either discrete-mode or ramped-modal testing methods. You must use the same modal testing method for certification and all other testing you perform for an engine family. If we test your engines to confirm that they meet emission standards, we will use the modal testing method you select for your own testing. If you submit certification test data collected with both discrete-mode and ramped-modal testing (either in your original application or in an amendment to your application), either method may be used for subsequent testing. We may also perform other testing as allowed by the California's Health and Safety Code. Conduct duty-cycle testing as follows:

* * * * *

(a) (2) DELETE,
REPLACE WITH:

For ramped-modal testing, start sampling at the beginning of the first mode and continue sampling until the end of the last mode. Calculate emissions and cycle statistics the same as for transient testing as specified in 40 CFR part 1065. Unless we specify otherwise, you may simulate the governor for ramped-modal testing.

* * * * *

§ 1054.520 What testing must I perform to establish deterioration factors?

* * * * *

Subpart G—Special Compliance Provisions

§ 1054.601 What compliance provisions apply?

(a) DELETE,
REPLACE WITH:
Engine and equipment manufacturers, as well as owners, operators, and rebuilders of engines subject to the requirements of this part, and all other persons, must observe the provisions of this part and the provisions of California's Health and Safety Code.

* * * * *

(c) (1) DELETE,
REPLACE WITH:
You must label the engine as specified in Title 13, Chapter 9, Article 1, Section 2404.

* * * * *

§ 1054.610 What is the exemption for delegated final assembly?

DELETE.

§ 1054.612 What special provisions apply for equipment manufacturers modifying certified nonhandheld engines?

DELETE.

§ 1054.615 What is the exemption for engines certified to standards for Large SI engines?

DELETE.

§ 1054.620 What are the provisions for exempting engines used solely for competition?

DELETE.

§ 1054.625 What requirements apply under the Transition Program for Equipment Manufacturers?

DELETE.

§ 1054.626 What special provisions apply to equipment imported under the Transition Program for Equipment Manufacturers?

DELETE.

§ 1054.630 What provisions apply for importation of individual items for personal use?

DELETE.

§ 1054.635 What special provisions apply for small-volume engine and equipment manufacturers?

DELETE,
REPLACE WITH:
This section describes how we apply the special provisions in this part for small-volume engine and equipment manufacturers. Small-volume engine and equipment manufacturers may use assigned deterioration factors. See §1054.245.

§ 1054.640 What special provisions apply to branded engines?

* * * * *

§ 1054.645 What special provisions apply for converting an engine to use an alternate fuel?
DELETE,
REPLACE WITH:
An Executive Order is no longer valid for an engine if the engine is modified such that it is not in a configuration covered by the Executive Order. Such engines may need to be recertified as specified in 40 CFR part 1054 if the Executive Order is no longer valid for that engine.

DELETE.

§ 1054.650 What special provisions apply for adding or changing governors?

* * * * *

(b) DELETE.

§ 1054.655 What special provisions apply for installing and removing altitude kits?
DELETE,
REPLACE WITH:

An action for the purpose of installing or modifying altitude kits and performing other changes to compensate for changing altitude is not considered a prohibited act as long as it is done consistent with the manufacturer's instructions.

§ 1054.660 What are the provisions for exempting emergency rescue equipment?
DELETE,
REPLACE WITH:
Fire and police departments and other entities that specialize in emergency response may purchase emergency equipment powered by a non-California certified engine under the provisions specified in Title 13, Chapter 9, Article 1, Section 2403(f).

§ 1054.690 What bond requirements apply for certified engines?
DELETE.

Subpart H—Averaging, Banking and Trading for Certification

§1054.701 General Provisions.

DELETE,
REPLACE WITH:
Each manufacturer must comply with all provisions of the averaging, banking, and trading program outlined in Title 13, California Code of Regulations, Sections 2408-2409, for each engine family participating in that program.

Subpart I—Definitions and Other Reference Information

§ 1054.801 What definitions apply to this part?
DELETE,
REPLACE WITH:
The following definitions apply to this part. The definitions apply to all subparts unless we note otherwise. All undefined terms have the meaning California's Health and Safety Code gives to them. The definitions follow:

Adjustable parameter DELETE,
REPLACE WITH:
Adjustable parameter means any device, system, or element of design that someone can adjust (including those which are difficult to access) and that, if adjusted, may affect emissions or engine performance during emission testing or normal in-use operation.

* * * * *

Alcohol-fueled engine DELETE.

Amphibious vehicle DELETE.

Applicable emission standard or *applicable standard* DELETE,
REPLACE WITH:
Applicable emission standard or *applicable standard* means an emission standard to which an engine (or equipment) is subject. Additionally, if an engine (or equipment) has been or is being certified to another standard or FEL, *applicable emission standard* means the FEL or other standard to which the engine (or equipment) has been or is being certified.

* * * * *

ADD:
Certificate of Conformity means an Executive Order issued in accordance with the California Health and Safety Code, Division 26, Part 5 chapters 1 and 2.

Certification DELETE,
REPLACE WITH:
Certification means, with respect to new small off-road engines, obtaining an executive order for an engine family complying with the small off-road engine emission standards and requirements specified in the California Code of Regulations, Title 13, chapter 9, Sections 2400-2409.

Certified emission level DELETE.

Class I DELETE.

Class II DELETE.

Class III DELETE.

Class IV DELETE.

Class V DELETE.

Clean Air Act DELETE.

Cold-weather equipment DELETE.

Crankcase emissions DELETE.

* * * * *

Date of manufacture DELETE.

Days DELETE,
REPLACE WITH:
Days means calendar days unless otherwise specified. For example, when we specify working days we mean calendar days, excluding weekends and California state holidays.

Designated Compliance Officer DELETE,
REPLACE WITH:
Designated Compliance Officer means the Executive Officer of the Air Resources Board or a designee of the Executive Officer.

Designated Enforcement Officer DELETE.

* * * * *

Deterioration factor DELETE,
REPLACE WITH:
Deterioration factor means the relationship between emissions at the end of useful life and emissions at the low-hour test point (see §§1054.240 and 1054.245), expressed as the ratio of emissions at the end of useful life to emissions at the low-hour test point.

* * * * *

Dry weight DELETE.

* * * * *

Emission control system DELETE.

* * * * *

Engine DELETE,
REPLACE WITH:
Engine as used in this part, refers to small off-road engine.

* * * * *

Engine manufacturer DELETE.

ADD:
EPA means Air Resources Board.

* * * * *

Equipment manufacturer DELETE,
REPLACE WITH:
Equipment manufacturer means a manufacturer of equipment with an engine . All such equipment manufacturing entities under the control of the same person are considered to be a single equipment manufacturer.

Evaporative DELETE,
REPLACE WITH:
Evaporative means relating to fuel emissions controlled by Title 13, California Code of Regulations, Chapter 15, Article 1. This generally includes emissions that result from permeation of fuel through the fuel-system materials or from ventilation of the fuel system.

Excluded DELETE.

ADD:
Executive Order means an order issued by the Executive Officer of the Air Resources Board or his or her delegate certifying engines for sale in California.

Exempted DELETE.

* * * * *

Family emission limit (FEL) DELETE,
REPLACE WITH:
Family emission limit (FEL) means an emission level declared by the manufacturer that will be used in the ABT program. The family emission level will take the place of an otherwise applicable emission standard. The family emission limit must be expressed to the same number of decimal places as the

emission standard it replaces. The family emission limit serves as the emission standard for the engine family (exhaust) or emission family (evaporative) with respect to all required testing.

* * * * *

Fuel line DELETE.

* * * * *

Good engineering judgment DELETE.

Handheld DELETE,
REPLACE WITH:
Handheld means equipment that contains an engine with a displacement of less than 80cc.

* * * * *

Integrated equipment manufacturer DELETE.

* * * * *

Manufacturer DELETE.

Marine engine DELETE.

Marine generator engine DELETE.

Marine vessel DELETE.

* * * * *

Maximum test torque DELETE.

Model year DELETE.

Motor vehicle DELETE.

New nonroad engine DELETE.

New nonroad equipment DELETE.

Noncompliant engine or noncompliant equipment DELETE.

Nonconforming engine or nonconforming equipment DELETE.

* * * * *

Nonintegrated equipment manufacturer DELETE.

Nonmethane hydrocarbon DELETE,
REPLACE WITH:
Nonmethane hydrocarbon (NMHC) means the sum of all hydrocarbon species except methane. Refer to §1065.660 for NMHC determination.

* * * * *

Nonroad DELETE.

Nonroad engine DELETE,
REPLACE WITH:
Nonroad engine means a small off-road engine as defined in the California Code of Regulations, Title 13, Chapter 9, Section 2401.

* * * * *

Permeation emissions DELETE.

Phase 1 DELETE.

Phase 2 DELETE.

Phase 3 DELETE.

* * * * *

Pressurized oil system DELETE.

* * * * *

Rated-speed equipment DELETE
REPLACE WITH:
Rated-speed equipment means equipment in which the installed engine is intended for operation at a rated speed that is nominally 3600 rpm or higher.

Recreational application DELETE.

* * * * *

Revoke DELETE.

* * * * *

Running loss emissions DELETE.

* * * * *

Small-volume emission family DELETE.

Small-volume engine manufacturer DELETE,
REPLACE WITH:
Small-volume engine manufacturer means any engine manufacturer whose total production of small off-road engines slated for sale in California are projected at the time of certification of a given model year to be nor more than 500 engines.

Small-volume equipment manufacturer DELETE.

* * * * *

Structurally integrated nylon fuel tank DELETE.

Subchapter U DELETE.

Suspend DELETE.

* * * * *

Tethered gas cap DELETE.

* * * * *

Total hydrocarbon DELETE,
REPLACE WITH:
Total hydrocarbon (THC) means the combined mass of organic compounds measured by the specified procedure for measuring total hydrocarbon, expressed as a hydrocarbon with a hydrogen-to-carbon mass ratio of 1.85:1.
Total hydrocarbon equivalent DELETE,
REPLACE WITH:
Total hydrocarbon equivalent (THCE) means the sum of the carbon mass contributions of non-oxygenated hydrocarbons, alcohols and aldehydes, or other organic compounds that are measured separately as contained in a gas sample, expressed as exhaust hydrocarbon from petroleum-fueled engines. The hydrogen-to-carbon ratio of the equivalent hydrocarbon is 1.85:1.

* * * * *

Ultimate purchaser DELETE,
REPLACE WITH:

Ultimate purchaser means, with respect to any new small off-road equipment or new small off-road engine, the first person who in good faith purchases such new off-road equipment or new off-road engine for purposes other than resale.

United States DELETE.

Upcoming model year DELETE.

U.S.-directed production volume DELETE.

Useful life DELETE,
REPLACE WITH:
Useful life means the period during which the engine and equipment are designed to properly function in terms of power output and intended function, without being remanufactured, specified as a number of hours of operation or calendar years, whichever comes first. It is the period during which an off-road engine must comply with all applicable emission standards. If an engine has no hour meter, the specified number of hours does not limit the period during which an in-use engine is required to comply with emission standards unless the degree of service accumulation can be verified separately.

* * * * *

Vessel DELETE.

Void DELETE.

* * * * *

We (us, our) DELETE:
REPLACE WITH:
We (us, our) means the Air Resources Board and any authorized representatives.

* * * * *

§ 1054.805 What symbols, acronyms, and abbreviations does this part use?

* * * * *

§ 1054.815 What provisions apply to confidential information?
DELETE,
REPLACE WITH:
(a) Clearly show what you consider confidential by marking, circling, bracketing, stamping, or some other method.

(b) We will handle your confidential information as described in Title 17, California Code of Regulations, Section 91000-91022.

(c) If you send us information without claiming it is confidential, we may make it available to the public without further notice to you.

§ 1054.820 How do I request a hearing?
DELETE,
REPLACE WITH:
The hearing procedure set forth in Subchapter 1.25, Title 17, California Code of Regulations, Section 60040, et seq. apply to this subpart.

ADD:
§ 1054.821 Right of entry and access.

(a) Any engine manufacturer affected by these regulations, upon receipt of prior notice must admit or cause to be admitted during operating hours any ARB Enforcement Officer that has presented proper credentials to any of the following:

(1) Any facility where tests or procedures or activities connected with such tests or procedures are or were performed.

(2) Any facility where any new small off-road engine is present and is being, has been, or will be tested.

(3) Any facility where a manufacturer constructs, assembles, modifies, or builds-up an engine into a certification engine that will be tested for certification.

(4) Any facility where any record or other document relating to any of the above is located.

(b) Upon admission to any facility referred to in paragraph (c)(1) of this Section, any ARB Enforcement Officer must be allowed:

(1) To inspect and monitor any part or aspect of such procedures, activities, and testing facilities, including, but not limited to, monitoring engine preconditioning, emissions tests and break-in, maintenance, and engine storage procedures.

(2) To verify correlation or calibration of test equipment; and,

(3) To inspect and make copies of any such records, designs, or other documents; and,

(4) To inspect and/or photograph any part or aspect of any such certification engine and any components to be used in the construction thereof.

(c) To permit an ARB determination whether production small off-road engines conform in all material respects to the design specifications that apply to those engines described in the Executive Order certifying such engines and to standards prescribed herein. Engine manufacturers must, upon receipt of prior notice, admit any ARB Enforcement Officer, upon presentation of credentials, to:

(1) Any facility where any document design, or procedure relating to the translation of the design and construction of engines and emission related components described in the application for certification or used for certification testing into production engines is located or carried on; and,

(2) Any facility where any small off-road engines to be introduced into commerce are manufactured or assembled.

(3) Any California retail outlet where any small off-road engine is sold.

(d) On admission to any such facility referred to in this Section, any ARB Enforcement Officer must be allowed:

(1) To inspect and monitor any aspects of such manufacture or assembly and other procedures;

(2) To inspect and make copies of any such records, documents or designs; and,

(3) To inspect and photograph any part or aspect of any such new small off-road engines and any component used in the assembly thereof that are reasonably related to the purpose of the Enforcement Officer's entry.

(e) Any ARB Enforcement Officer must be furnished by those in charge of a facility being inspected with such reasonable assistance as may be necessary to discharge any function listed in this paragraph. Each applicant for or recipient of certification is required to cause those in charge of a facility operated for its benefit to furnish such reasonable assistance without charge to the ARB irrespective of whether or not the applicant controls the facility.

(f) The duty to admit or cause to be admitted any ARB Enforcement Officer applies whether or not the applicant owns or controls the facility in question and applies both to domestic and foreign engine manufacturers and facilities. The ARB will not attempt to make any inspections that it has been informed that local law forbids. However, if local law makes it impossible to insure the accuracy of data generated at a facility, no informed judgment that an engine is certifiable or is covered by an Executive Order can properly be based on the data. It is the responsibility of the engine manufacturer to locate its testing and manufacturing facilities in jurisdictions where this situation will not arise.

(g) For purposes of this Section:

(1) “Presentation of credentials” means a display of a document designating a person to be an ARB Enforcement Officer.

(2) Where engine, component, or engine storage areas or facilities are concerned, “operating hours” means all times during which personnel are at work in the vicinity of the area or facility and have access to it.

(3) Where facilities or areas other than those covered by paragraph (g)(2) of this Section are concerned, “operating hours” means all times during which an assembly line is in operation or during which testing, maintenance, break-in procedure, production or compilation of records, or any other procedure or activity is being conducted related to certification testing, translation of designs from the test stage to the production stage, or engine manufacture or assembly.

(4) “Reasonable assistance” includes, but is not limited to, providing clerical, copying, interpretation and translation services; making personnel available upon request to inform the ARB Enforcement Officer of how the facility operates and to answer questions; and performing requested emissions tests on any engine that is being, has been, or will be used for certification testing. Such tests must be nondestructive, but may require appropriate break-in. The engine manufacturer must be compelled to cause the personal appearance of any employee at such a facility before an ARB Enforcement Officer, upon written request from the Executive Officer for the appearance of any employee of a facility, and service of such request upon the engine manufacturer. Any such employee who has been instructed by the engine manufacturer to appear will be entitled to be accompanied, represented, and advised by counsel.

§ 1054.825 What reporting and recordkeeping requirements apply under this part?
DELETE,
REPLACE WITH:
The following items illustrate the kind of reporting and recordkeeping we require for engines and equipment regulated under this part:

* * * * *

(a) (1) DELETE.

(a) (2) DELETE.

(a) (3) DELETE.

(a) (4) DELETE.

(a) (5) DELETE.

* * * * *

(a) (8) DELETE.

(b) DELETE.

* * * * *

(d) DELETE.

Appendix II to Part 1054—Duty Cycles for Laboratory Testing

* * * * *

Attachment IX

Sampling Media Requirements

Number	Test Cycle	Number of Tests	PM Teflon Filters (Mass, Individual Mode)	PM TX60 Filters (PAH, Composite Mode)	PM Teflon Filters (Mass, Composite Mode)	PM Teflon Filters (XRF/ ICP-MS, Composite Mode)	PM Teflon Filters (IC, Composite Mode)	PM Quartz Filters (OC/EC, Composite Mode)	PM PUF (PAH, Composite Mode)	Tedlar Bags (VOC, Optional)	Tedlar Bags (N_2O, Optional)	DNPH Cartridges (Carbonyls)	Impingers (Alcohols)
E10-2/ 13D10	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-3	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-4	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-7	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-11	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-12	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-14	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-16	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-19	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-21	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-24	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10-26	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-30	6-mode	3	18	2	5	(2)	(2)	2	2	21	21	54	42
E10ECS-1[df]	**2-mode**	**9**	**18**	6	15	(6)	(6)	6	6	**27**	**27**	**54**	**54**
E10ECS-2[df]	**6-mode**	**9**	**54**	6	15	(6)	(6)	6	6	**63**	**63**	**162**	**126**
E10ECS-3[df]	**6-mode**	**9**	**54**	6	15	(6)	(6)	6	6	**63**	**63**	**162**	**126**
E10-31	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-32	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-33	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18

Attachment IX

Sampling Media Requirements

E10-34	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-35	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-36	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-37	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-38	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10-39	2-mode	3	6	2	5	(2)	(2)	2	2	9	9	18	18
E10ECS-4[df]	**2-mode**	**9**	**18**	6	15	(6)	(6)	6	6	**27**	**27**	**54**	**54**
E10ECS-5[df]	**2-mode**	**9**	**18**	6	15	(6)	(6)	6	6	**27**	**27**	**54**	**54**
E10ECS-6[df]	**2-mode**	**9**	**18**	6	15	(6)	(6)	6	6	**27**	**27**	**54**	**54**
Total Samples			**420**	**80**	**200**	**(80)**	**(80)**	**80**	**80**	**540**	**540**	**1260**	**1080**
Blanks			**80**	**34**	**68**	**(34)**	**(34)**	**34**	**34**			**120**	**120**
Total Filters			**500**	**114**	**268**	**(114)**	**(114)**	**114**	**114**			**1380**	**1200**

Attachment X

Test Periods and Staff Time Allotments

NUMBER	DISPLACEMENT (cc)	TEST CYCLE	DURABILITY PERIOD	NUMBER OF TESTS	ENGINE BREAK-IN TIME (hours)	TOTAL TESTING TIME* (hours)	ACCUMULATION TIME (hours)
E10-2/13D10	208	6-mode	125	3	12	12	NA
E10-3	36	2-mode	300	3	12	6	NA
E10-4	190	6-mode	125	3	12	12	NA
E10-7	32	2-mode	50	3	12	6	NA
E10-11	344	6-mode	250	3	12	12	NA
E10-12	603	6-mode	250	3	12	12	NA
E10-14	25	2-mode	300	3	12	6	NA
E10-16	208	6-mode	250	3	12	12	NA
E10-19	161	6-mode	250	3	12	12	NA
E10-21	179	6-mode	500	3	12	12	NA
E10-24	159	6-mode	250	3	12	12	NA
E10-26	25.4	2-mode	300	3	12	6	NA
E10-30	≥ 225	6-mode	1000	3	12	12	NA
E10ECS-1[df]	**≤ 80**	**2-mode**	**300**	**9**	NA	18	**264**
E10ECS-2[df]	**81-224**	**6-mode**	**500**	**9**	NA	36	**440**
E10ECS-3[df]	**≥ 225**	**6-mode**	**1000**	**9**	NA	36	**940**
E10-31	27	2-mode	125	3	12	6	NA
E10-32	30	2-mode	300	3	12	6	NA
E10-33	30	2-mode	125	3	12	6	NA
E10-34	42	2-mode	125	3	12	6	NA
E10-35	22	2-mode	50	3	12	6	NA
E10-36	24	2-mode	300	3	12	6	NA

Attachment X

Test Periods and Staff Time Allotments

E10-37	50	2-mode	300	3	12	6	NA
E10-38	26	2-mode	50	3	12	6	NA
E10-39	25	2-mode	50	3	12	6	NA
E10ECS-4[df]	**≤ 80**	**2-mode**	**300**	**9**	NA	18	**264**
E10ECS-5[df]	**≤ 80**	**2-mode**	**300**	**9**	NA	18	**264**
E10ECS-6[df]	**≤ 80**	**2-mode**	**300**	**9**	NA	18	**264**
ZEE-1	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-2	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-3	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-4	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-5	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-6	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-7	≤ 80	2-mode	300	3	NA	6	TBD
ZEE-8	81-224	5-mode	500	3	NA	6	TBD
ZEE-9	81-224	5-mode	500	3	NA	6	TBD
ZEE-10	≥ 225	5-mode	1000	3	NA	6	TBD