

Engine Sampling Plan Requirements

Applicability: This document is applicable to Off-Road Large Spark-Ignition Engines (LSIE), Spark-Ignition Marine Engines (SIME), and Small Spark-Ignition Engines (SSIE).

References: Title 13, California Code of Regulations (CCR)
For LSIE - Section 2437(b)(2)(A)
For SIME - Section 2446(a)
For SSIE - Section 2407(b)(1)

Title 13, California Code of Regulations (CCR) requires manufacturers to submit a sampling plan and to obtain Air Resources Board (ARB) approval for their method of randomly selecting engines or units of equipment for the purpose of quality audit testing. The sampling plan must be approved by the ARB prior to the start of production. Issuance of an Executive Order is not considered approval of a sampling method. ARB staff has prepared the following "Information to Include in Engine Sampling Plans" as a guideline to be used by manufacturers in preparing their sampling plans.

All test engines must be selected at the "end of the assembly line" as defined in Title 13. Because the determination of "end of assembly line" must be made prior to selecting engines for testing, ARB staff is asking manufacturers to include a description of the "end of assembly line" as part of their sampling plans. The first two questions in the guideline document will help to determine if the engines are actually selected at that point.

Manufacturer's responses to questions 3 through 5 are used to ensure that the selection method being used is representative of the engine manufacturer's California sales, and that all engine models in each engine family are included in the sample pool.

It is important to note that if a manufacturer has already obtained approval of a sampling method, a request for approval must be submitted again if there is any change to the method of selection or a change in the definition of "end of assembly". Please submit all requests to your assigned certification engineer.

November 15, 2002

INFORMATION TO INCLUDE IN ENGINE SAMPLING PLANS

(Engine Selection from End of Assembly Line and Sampling Procedures)

1. Engine selection

- a. As the certifying manufacturer, are you an engine manufacturer or an equipment manufacturer, or both? Where is the engine production line testing (PLT) facility? Who supplies the base engine? Who is/are the equipment manufacturer(s)?
- b. At what point in the assembly process are engines selected for PLT, completely assembled or incomplete? Is it at the end of the engine assembly line or at the equipment manufacturer assembly line? Does the engine have all of the required emission control equipment as listed on the warranty statement installed? Has it passed an inspection test at the end of the assembly line where PLT engines are selected? What constitutes an inspection test and are all engines subject to this test or only PLT engines?
- c. If emission components need to be added after the engine is assembled, before it can be tested as it was certified, what are the parts, and who is responsible for supplying them? Who is responsible for acquiring and installing these parts before engines are distributed to California and what assurance is there that these parts are properly installed?

2. Representativeness of California production engines

- a. If components need to be added to an engine before it is tested, how are they connected? Please list the parts. Is there more than one way to install them - could they be installed incorrectly?
- b. At what point in the assembly line do the final adjustments and the final inspection take place? Is the engine selected for testing after the final adjustments have been made, or are there more emission-related adjustments made to the engine after it is installed in the equipment?
- c. Are any emission components removed from an engine for shipment and then reinstalled when the engine is assembled for testing?
- d. Is there any quality control, testing, or assembly procedures that will be used on any test engine or any portion thereof including parts and subassemblies, that will not be used during the production and assembly of all other engines of that family (i.e. does a test engine receive any extra quality control procedures or special testing that other engines do not receive)?
- e. For PLT testing, the selected engine should be tested "as is" from the assembly line without changes being made to the engine including replacement of components, calibration changes or use of master components. Is this the protocol being followed in your PLT program? If not, please explain.
- f. What adjustable parameters were identified at certification (e.g., idle speed, ignition timing, air/fuel mixture, etc.) and at what point in the assembly process are they finalized (include any tamper resistant measures)?

- g. What are the modifications (relative to certification testing), if any, to the engine and/or test set-up to accommodate PLT?

3. Method of random sampling

- a. What method of sampling is the manufacturer using (1% or cum sum)?
- b. What method is used to generate random numbers and how is this random system connected to the selection of engines? (Random number generator, table, dice, or what?)
- c. Who selects test engines, and are selected engines blind to the production line staff?
- d. Does each engine leaving the assembly line have a unique number to identify it?
- e. Are all engines representative of the manufacturer's California sales in the sample pool, and how does the manufacturer ensure all models in the engine family are in the sample pool? Do all engines in the sample pool have an equal possibility of being selected?

4. Method of determining how many engines will be tested in a quarter

- a. Does the manufacturer use production estimates or actual sales numbers for the quarter to create the selection pool for random sampling? What are the estimates based on (please describe in detail)?
- b. If estimates are used, are the sales volumes based on engine family, model, or total production? And how often are sales volumes revised (e.g., annually, quarterly, etc.)?
- c. How does the manufacturer provide for undersampling in the case of 1% testing?
- d. How are more engines selected if the cum sum statistic requires more than the minimum 2 engines per quarter be tested?
- e. How does this method distribute the remaining number of test engines evenly throughout the remainder of the model year?

5. Cum Sum Analysis

- a. Is the cum sum analysis programmed so that the number of tests to be conducted will be at the maximum rate if the accumulated average exceeds the emission standard for any regulated pollutant?
- b. If, at the end of production for an engine family, the calculated N value requires more engines to be tested for PLT, how will there be a sufficient number of production engines made available to meet the testing requirements?