Environmental Protection Agency

§ 91.506 Engine sample selection.

(a) At the start of each model year, the marine SI engine manufacturer will begin to randomly select engines from each engine family for production line testing at a rate of one percent. Each engine will be selected from the end of the assembly line.

(1) For newly certified engine families: After two engines are tested, the manufacturer will calculate the required sample size for the model year according to the Sample Size Equation in paragraph (b) of this section.

(2) For carry-over engine families: After one engine is tested, the manufacturer will combine the test with the last test result from the previous model year and then calculate the required sample size for the model year according to the Sample Size Equation in paragraph (b) of this section.

(b)(1) Manufacturers will calculate the required sample size for the model year for each engine family using the Sample Size Equation below. N is calculated from each test result. The number N indicates the number of tests...
required for the model year for an engine family. \( N \), is recalculated after each test. Test results used to calculate the variables in the Sample Size Equation must be final deteriorated test results as specified in §91.509(c).

\[
N = \left( \frac{t_{0.5} \cdot \sigma}{(x - \text{FEL})} \right)^2 + 1
\]

where:
- \( N \): required sample size for the model year.
- \( t_{0.5} \): 95% confidence coefficient. It is dependent on the actual number of tests completed, \( n \), as specified in the table in paragraph (b)(2) of this section. It defines one-tail, 95 percent confidence intervals.
- \( \sigma \): actual test sample standard deviation calculated from the following equation:

\[
\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}
\]

- \( x_i \): emission test result for an individual engine
- \( \bar{x} \): mean of emission test results of the actual sample
- \( \text{FEL} \): Family Emission Limit
- \( n \): The actual number of tests completed in an engine family

(2) Actual Number of Tests (\( n \)) & 1-tail Confidence Coefficients (\( t_{0.5} \))

<table>
<thead>
<tr>
<th>( n )</th>
<th>( t_2 )</th>
<th>( t_{13} )</th>
<th>( t_{24} )</th>
<th>( t_{34} )</th>
<th>( t_{44} )</th>
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<td>1.72</td>
<td>1.645</td>
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</table>

(3) A manufacturer must distribute the testing of the remaining number of engines needed to meet the required sample size \( N \), evenly throughout the remainder of the model year.

(4) After each new test, the required sample size, \( N \), is recalculated using updated sample means, sample standard deviations and the appropriate 95% confidence coefficient.

(5) A manufacturer must continue testing and updating each engine family’s sample size calculations according to paragraphs (b)(1) through (b)(4) of this section until a decision is made to stop testing as described in paragraph (b)(6) of this section or a noncompliance decision is made pursuant to §91.510(b).

(6) If, at any time throughout the model year, the calculated required sample size, \( N \), for an engine family is less than or equal to the actual sample size, \( n \), and the sample mean, \( x \), for HC+NO\(_x\) is less than or equal to the FEL, the manufacturer may stop testing that engine family.

(7) If, at any time throughout the model year, the sample mean, \( x \), for HC+NO\(_x\) is greater than the FEL, the manufacturer must continue testing that engine family at the appropriate maximum sampling rate.

(8) The maximum required sample size for an engine family (regardless of the required sample size, \( N \), as calculated in paragraph (b)(1) of this section) is the lesser of thirty tests per model year or one percent of projected annual production for that engine family for that model year.

(9) Manufacturers may elect to test additional randomly chosen engines. All additional randomly chosen engines tested in accordance with the testing procedures specified in §91.507 must be included in the Sample Size and Cumulative Sum equation calculations as defined in paragraph (b)(1) of this section and §91.508(a), respectively.

(c) The manufacturer must produce and assemble the test engines using its normal production and assembly process for engines to be distributed into commerce.

(d) No quality control, testing, or assembly procedures will be used on any test engine or any portion thereof, including parts and subassemblies, that have not been or will not be used during the production and assembly of all other engines of that family, unless the Administrator approves the modification in production or assembly procedures.

§91.507 Test procedures.

(a)(1) For marine SI engines subject to the provisions of this subpart, the prescribed test procedures are specified in subpart B of this part.

(2) The Administrator may, on the basis of a written application by a