

§ 1051.310

40 CFR Ch. I (7-1-04 Edition)

(g) *Retesting after invalid tests.* You may retest a vehicle or engine if you determine an emission test is invalid. Explain in your written report reasons for invalidating any test and the emission results from all tests. If you retest a vehicle or engine, you may ask us to substitute results of the new tests for the original ones. You must ask us within ten days of testing. We will generally answer within ten days after we receive your information.

§ 1051.310 How must I select vehicles or engines for production-line testing?

(a) Use test results from two vehicles or engines for each engine family to calculate the required sample size for the test period. Update this calculation with each test.

(1) For engine families with projected annual sales of at least 1600, the test periods are consecutive quarters (3 months). If your annual production period is less than 12 months long, define your test periods by dividing your annual production period into approximately equal segments of 70 to 125 calendar days.

(2) For engine families with projected annual sales below 1600, the test period is the whole model year.

(b) Early in each test period, randomly select and test an engine from the end of the assembly line for each engine family.

(1) In the first test period for newly certified engines, randomly select and test one more engine. Then, calculate the required sample size for the test period as described in paragraph (c) of this section.

(2) In later test periods or for engine families relying on previously submitted test data, combine the new test result with the last test result from the previous test period. Then, calculate the required sample size for the new test period as described in paragraph (c) of this section.

(c) Calculate the required sample size for each engine family. Separately calculate this figure for HC, NO_x (or HC+NO_x), and CO (and other regulated pollutants). The required sample size is the greater of these calculated values. Use the following equation:

$$N = \left[\frac{(t_{95} \times \sigma)}{(x - \text{STD})} \right]^2 + 1$$

Where:

- N = Required sample size for the model year.
- t₉₅ = 95% confidence coefficient, which depends on the number of tests completed, n, as specified in the table in paragraph (c)(1) of this section. It defines 95% confidence intervals for a one-tail distribution.
- x = Mean of emission test results of the sample.
- STD = Emission standard (or family emission limit, if applicable).
- σ = Test sample standard deviation (see paragraph (c)(2) of this section).

(1) Determine the 95% confidence coefficient, t₉₅, from the following table:

n	t ₉₅	n	t ₉₅	n	t ₉₅
2	6.31	12	1.80	22	1.72
3	2.92	13	1.78	23	1.72
4	2.35	14	1.77	24	1.71
5	2.13	15	1.76	25	1.71
6	2.02	16	1.75	26	1.71
7	1.94	17	1.75	27	1.71
8	1.90	18	1.74	28	1.70
9	1.86	19	1.73	29	1.70
10	1.83	20	1.73	30+	1.70
11	1.81	21	1.72

(2) Calculate the standard deviation, σ, for the test sample using the following formula:

$$\sigma = \sqrt{\frac{\sum (X_i - x)^2}{n - 1}}$$

Where:

- X_i = Emission test result for an individual vehicle or engine.
- n = The number of tests completed in an engine family.

(d) Use final deteriorated test results to calculate the variables in the equations in paragraph (c) of this section (see §1051.315(a)).

(e) After each new test, recalculate the required sample size using the updated mean values, standard deviations, and the appropriate 95-percent confidence coefficient.

(f) Distribute the remaining vehicle or engine tests evenly throughout the rest of the year. You may need to adjust your schedule for selecting vehicles or engines if the required sample size changes. Continue to randomly select vehicles or engines from each engine family; this may involve testing

vehicles or engines that operate on different fuels.

(g) Continue testing any engine family for which the sample mean, \bar{x} , is greater than the emission standard. This applies if the sample mean for either HC, NO_x (or HC+NO_x), or CO (or other regulated pollutants) is greater than the emission standard. Continue testing until one of the following things happens:

(1) The sample size, n , for an engine family is greater than the required sample size, N , and the sample mean, \bar{x} , is less than or equal to the emission standard. For example, if $N = 3.1$ after the third test, the sample-size calculation does not allow you to stop testing.

(2) The engine family does not comply according to § 1051.325.

(3) You test 30 vehicles or engines from the engine family.

(4) You test one percent of your projected annual U.S.-directed production volume for the engine family.

(5) You choose to declare that the engine family fails the requirements of this subpart. (h) If the sample-size calculation allows you to stop testing for a pollutant, you must continue measuring emission levels of that pollutant for any additional tests required under this section. However, you need not continue making the calculations specified in this section for that pollutant. This paragraph does not affect the requirements in section § 1051.320.

(i) You may elect to test more randomly chosen vehicles or engines than we require. Include these vehicles or engines in the sample-size calculations.

§ 1051.315 How do I know when my engine family fails the production-line testing requirements?

This section describes the pass-fail criteria for the production-line testing requirements. We apply this criteria on an engine family basis. See § 1051.320 for the requirements that apply to individual vehicles or engines that fail a production-line test. (a) Calculate your test results. Round them to the number of decimal places in the emission standard expressed to one more decimal place.

(1) *Initial and final test results.* Calculate and round the test results for each vehicle or engine. If you do sev-

eral tests on a vehicle or engine, calculate the initial test results, then add them together and divide by the number of tests and round for the final test results on that vehicle or engine.

(2) *Final deteriorated test results.* Apply the deterioration factor for the engine family to the final test results (see § 1051.240(c)).

(b) Construct the following CumSum Equation for each engine family for HC, NO_x (or HC+NO_x), and CO emissions (and other regulated pollutants):

$$C_i = C_{i-1} + X_i - (\text{STD} + 0.25 \times \sigma)$$

Where:

C_i = The current CumSum statistic.

C_{i-1} = The previous CumSum statistic. For the first test, the CumSum statistic is 0 (i.e. $C_1 = 0$).

X_i = The current emission test result for an individual vehicle or engine.

STD = Emission standard.

(c) Use final deteriorated test results to calculate the variables in the equation in paragraph (b) of this section (see § 1051.315(a)).

(d) After each new test, recalculate the CumSum statistic.

(e) If you test more than the required number of vehicles or engines, include the results from these additional tests in the CumSum Equation.

(f) After each test, compare the current CumSum statistic, C_i , to the recalculated Action Limit, H , defined as $H = 5.0 \times \sigma$.

(g) If the CumSum statistic exceeds the Action Limit in two consecutive tests, the engine family fails the production-line testing requirements of this subpart. Tell us within ten working days if this happens. You may request to amend the application for certification to raise the FEL of the engine family at this point if you meet the requirements of § 1051.225(f).

(h) If you amend the application for certification for an engine family under § 1051.225, do not change any previous calculations of sample size or CumSum statistics for the model year.

§ 1051.320 What happens if one of my production-line vehicles or engines fails to meet emission standards?

(a) If you have a production-line vehicle or engine with final deteriorated test results exceeding one or more