

Environmental Protection Agency

§ 1048.315

from the end of the assembly line for each engine family.

(c) Calculate the required sample size for each engine family. Separately calculate this figure for HC+NO_x and for CO. The required sample size is the greater of these two 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.
- 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 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 §1048.315(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 engine tests evenly throughout the rest of the year. You may need to adjust your schedule for selecting engines if the required sample size changes. Continue to randomly select engines from each engine family; this may involve testing engines that operate on different fuels.

(g) Continue testing any engine family for which the sample mean, x, is greater than the emission standard. This applies if the sample mean for either HC+NO_x or for CO 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, 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 §1048.325.
- (3) You test 30 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 does not comply with 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 (h) does not affect the requirements in section §1048.320.

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

§ 1048.315 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 §1048.320 for the requirements that apply to individual engines that fail a production-line test.

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(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 engine. If you do several tests on an 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 engine.

(2) *Final deteriorated test results.* Apply the deterioration factor for the engine family to the final test results (see § 1048.240(c)).

(b) Construct the following CumSum Equation for each engine family (for HC+NO_x and for CO emissions):

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

Where:

C_i = The current CumSum statistic.

C_{i-1} = The previous CumSum statistic. For the first test, CumSum statistic is 0 (i.e. C₁ = 0).

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

STD = Emission standard.

(c) Use final deteriorated test results to calculate the variables in the equation in paragraph (b) of this section (see § 1048.315(a)).

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

(e) If you test more than the required number of 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 × σ.

(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.

(h) If you amend the application for certification for an engine family (see § 1048.225), do not change any previous calculations of sample size or CumSum statistics for the model year.

§ 1048.320 What happens if one of my production-line engines fails to meet emission standards?

If you have a production-line engine with final deteriorated test results exceeding one or more emission standards (see § 1048.315(a)), the certificate of conformity is automatically suspended for that failing engine. You must take the following actions before your certificate of conformity can cover that engine:

(a) Correct the problem and retest the engine to show it complies with all emission standards.

(b) Include in your written report a description of the test results and the remedy for each engine (see § 1048.345).

§ 1048.325 What happens if an engine family fails the production-line requirements?

(a) We may suspend your certificate of conformity for an engine family if it fails under § 1048.315. The suspension may apply to all facilities producing engines from an engine family, even if you find noncompliant engines only at one facility.

(b) We will tell you in writing if we suspend your certificate in whole or in part. We will not suspend a certificate until at least 15 days after the engine family fails. The suspension is effective when you receive our notice.

(c) Up to 15 days after we suspend the certificate for an engine family, you may ask for a hearing (see § 1048.820). If we agree before a hearing that we used erroneous information in deciding to suspend the certificate, we will reinstate the certificate.

(d) Section § 1048.335 specifies steps you must take to remedy the cause of the production-line failure. All the engines you have produced since the end of the last test period are presumed noncompliant and should be addressed in your proposed remedy. We may require you to apply the remedy to engines produced earlier if we determine that the cause of the failure is likely to have affected the earlier engines.

§ 1048.330 May I sell engines from an engine family with a suspended certificate of conformity?

You may sell engines that you produce after we suspend the engine