
40 C.F.R. § 1065.650

Emission calculations.

(a) *General.* Calculate brake-specific emissions over each applicable duty cycle or test interval. For test intervals with zero work (or power), calculate the emission mass (or mass rate), but do not calculate brake-specific emissions. Unless specified otherwise, for the purposes of calculating and reporting emission mass (or mass rate), do not alter any negative values of measured or calculated quantities. You may truncate negative values in chemical balance quantities listed in § 1065.655(c) to facilitate convergence. For duty cycles with multiple test intervals, refer to the standard-setting part for calculations you need to determine a composite result, such as a calculation that weights and sums the results of individual test intervals in a duty cycle. If the standard-setting part does not include those calculations, use the equations in paragraph (g) of this section. This section is written based on rectangular integration, where each indexed value (*i.e.*, “_i”) represents (or approximates) the mean value of the parameter for its respective time interval, delta-t. You may also integrate continuous signals using trapezoidal integration consistent with good engineering judgment.

(b) *Brake-specific emissions over a test interval.* We specify three alternative ways to calculate brake-specific emissions over a test interval, as follows:

(1) For any testing, you may calculate the total mass of emissions, as described in paragraph (c) of this section, and divide it by the total work generated over the test interval, as described in paragraph (d) of this section, using the following equation:

$$e = \frac{m}{W} \quad \text{Eq. 1065.650-1}$$

Example:

$$m_{\text{NO}_x} = 64.975 \text{ g } W = 25.783 \text{ kW} \cdot \text{hr} \quad e_{\text{NO}_x} = 64.975/25.783 \quad e_{\text{NO}_x} = 2.520 \text{ g}/(\text{kW} \cdot \text{hr})$$

(2) For discrete-mode steady-state testing, you may calculate the brake-specific emissions over a test interval using the ratio of emission mass rate to power, as described in paragraph (e) of this section, using the following equation:

$$e = \frac{\bar{m}}{\bar{P}} \quad \text{Eq. 1065.650-2}$$

(3) For field testing, you may calculate the ratio of total mass to total work, where these individual values are determined as described in paragraph (f) of this section. You may also use this approach for laboratory testing, consistent with good engineering judgment. Good engineering judgment dictates that this method not be used if there are any work flow paths described in § 1065.210 that cross the system boundary, other than the primary output shaft (crankshaft). This is a special case in which you use a signal linearly proportional to raw

exhaust molar flow rate to determine a value proportional to total emissions. You then use the same linearly proportional signal to determine total work using a chemical balance of fuel, DEF, intake air, and exhaust as described in § 1065.655, plus information about your engine's brake-specific fuel consumption. Under this method, flow meters need not meet accuracy specifications, but they must meet the applicable linearity and repeatability specifications in subpart D or J of this part. The result is a brake-specific emission value calculated as follows:

$$e = \frac{\dot{m}}{\dot{W}} \quad \text{Eq. 1065.650-3}$$

Example:

$$m \dot{n} = 805.5 \text{ g} \quad W \dot{n} = 52.102 \text{ kW} \cdot \text{hr} \quad e_{\text{CO}} = 805.5/52.102 \quad e_{\text{CO}} = 2.520 \text{ g}/(\text{kW} \cdot \text{hr})$$

(c) *Total mass of emissions over a test interval.* To calculate the total mass of an emission, multiply a concentration by its respective flow. For all systems, make preliminary calculations as described in paragraph (c)(1) of this section to correct concentrations. Next, use the method in paragraphs (c)(2) through (4) of this section that is appropriate for your system. Finally, if necessary, calculate the mass of NMHC as described in paragraph (c)(5) of this section for all systems. Calculate the total mass of emissions as follows:

(1) *Concentration corrections.* Perform the following sequence of preliminary calculations on recorded concentrations:

(i) Use good engineering judgment to time-align flow and concentration data to match transformation time, t_{50} , to within ± 1 s.

(ii) Correct all gaseous emission analyzer concentration readings, including continuous readings, sample bag readings, and dilution air background readings, for drift as described in § 1065.672. Note that you must omit this step where brake-specific emissions are calculated without the drift correction for performing the drift validation according to § 1065.550(b). When applying the initial THC and CH_4 contamination readings according to § 1065.520(f), use the same values for both sets of calculations. You may also use as-measured values in the initial set of calculations and corrected values in the drift-corrected set of calculations as described in § 1065.520(f)(7).

(iii) Correct all THC and CH_4 concentrations for initial contamination as described in § 1065.660(a), including continuous readings, sample bags readings, and dilution air background readings.

(iv) Correct all concentrations measured on a “dry” basis to a “wet” basis, including dilution air background concentrations, as described in § 1065.659.

(v) Calculate all NMHC and CH_4 concentrations, including dilution air background concentrations, as described in § 1065.660.

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