

Environmental Protection Agency**§ 1065.672****§ 1065.672 Drift correction.**

(a) *Scope and frequency.* Perform the calculations in this section to determine if gas analyzer drift invalidates the results of a test interval. If drift does not invalidate the results of a test interval, correct that test interval's gas analyzer responses for drift according to this section. Use the drift-corrected gas analyzer responses in all subsequent emission calculations. Note that the acceptable threshold for gas analyzer drift over a test interval is specified in § 1065.550 for both laboratory testing and field testing.

(b) *Correction principles.* The calculations in this section utilize a gas analyzer's responses to reference zero and span concentrations of analytical gases, as determined sometime before and after a test interval. The calculations correct the gas analyzer's responses that were recorded during a test interval. The correction is based

on an analyzer's mean responses to reference zero and span gases, and it is based on the reference concentrations of the zero and span gases themselves. Validate and correct for drift as follows:

(c) *Drift validation.* After applying all the other corrections—except drift correction—to all the gas analyzer signals, calculate brake-specific emissions according to § 1065.650. Then correct all gas analyzer signals for drift according to this section. Recalculate brake-specific emissions using all of the drift-corrected gas analyzer signals. Validate and report the brake-specific emission results before and after drift correction according to § 1065.550.

(d) *Drift correction.* Correct all gas analyzer signals as follows:

(1) Correct each recorded concentration, x_i , for continuous sampling or for batch sampling, \bar{x} .

(2) Correct for drift using the following equation:

$$x_{\text{idriftcorrected}} = x_{\text{refzero}} + (x_{\text{refspan}} - x_{\text{refzero}}) \cdot \frac{2x_i - (x_{\text{prezero}} + x_{\text{postzero}})}{(x_{\text{prespan}} + x_{\text{postspan}}) - (x_{\text{prezero}} + x_{\text{postzero}})}$$

Eq. 1065.672-1

Where:

$x_{\text{idriftcorrected}}$ = concentration corrected for drift.
 x_{refzero} = reference concentration of the zero gas, which is usually zero unless known to be otherwise.

x_{refspan} = reference concentration of the span gas.

x_{prespan} = pre-test interval gas analyzer response to the span gas concentration.

x_{postspan} = post-test interval gas analyzer response to the span gas concentration.

x_i or \bar{x} = concentration recorded during test, before drift correction.

x_{prezero} = pre-test interval gas analyzer response to the zero gas concentration.

x_{postzero} = post-test interval gas analyzer response to the zero gas concentration.

Example:

$x_{\text{refzero}} = 0 \mu\text{mol/mol}$
 $x_{\text{refspan}} = 1800.0 \mu\text{mol/mol}$
 $x_{\text{prespan}} = 1800.5 \mu\text{mol/mol}$
 $x_{\text{postspan}} = 1695.8 \mu\text{mol/mol}$
 $x_i \text{ or } \bar{x} = 435.5 \mu\text{mol/mol}$
 $x_{\text{prezero}} = 0.6 \mu\text{mol/mol}$
 $x_{\text{postzero}} = -5.2 \mu\text{mol/mol}$

$$x_{\text{idriftcorrected}} = 0 + (1800.0 - 0) \cdot \frac{2 \cdot 435.5 - (0.6 + (-5.2))}{(1800.5 + 1695.8) - (0.6 + (-5.2))}$$

$$x_{\text{idriftcorrected}} = 450.2 \mu\text{mol/mol}$$

(3) For any pre-test interval concentrations, use concentrations deter-

mined most recently before the test interval. For some test intervals, the most recent pre-zero or pre-span might

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have occurred before one or more previous test intervals.

(4) For any post-test interval concentrations, use concentrations determined most recently after the test interval. For some test intervals, the most recent post-zero or post-span might have occurred after one or more subsequent test intervals.

(5) If you do not record any pre-test interval analyzer response to the span gas concentration, x_{prespan} , set x_{prespan} equal to the reference concentration of the span gas:

$$x_{\text{prespan}} = x_{\text{refspan}}.$$

(6) If you do not record any pre-test interval analyzer response to the zero gas concentration, x_{prezero} , set x_{prezero} equal to the reference concentration of the zero gas:

$$x_{\text{prezero}} = x_{\text{refzero}}.$$

(7) Usually the reference concentration of the zero gas, x_{refzero} , is zero: $x_{\text{refzero}} = 0 \mu\text{mol/mol}$. However, in some cases you might know that x_{refzero} has a non-zero concentration. For example, if you zero a CO₂ analyzer using ambient air, you may use the default ambient air concentration of CO₂, which is 375 μmol/mol. In this case, $x_{\text{refzero}} = 375 \mu\text{mol/mol}$. Note that when you zero an analyzer using a non-zero x_{refzero} , you must set the analyzer to output the actual x_{refzero} concentration. For example, if $x_{\text{refzero}} = 375 \mu\text{mol/mol}$, set the analyzer to output a value of 375 μmol/mol when the zero gas is flowing to the analyzer.

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§ 1065.675 CLD quench verification calculations.

Perform CLD quench-check calculations as follows:

(a) Perform a CLD analyzer quench verification test as described in § 1065.370.

(b) Estimate the maximum expected mole fraction of water during emission testing, $x_{\text{H}_2\text{Oexp}}$. Make this estimate where the humidified NO span gas was introduced in § 1065.370(e)(6). When estimating the maximum expected mole fraction of water, consider the maximum expected water content in combustion air, fuel combustion products, and dilution air (if applicable). If you introduced the humidified NO span gas into the sample system upstream of a sample dryer during the verification test, you need not estimate the maximum expected mole fraction of water and you must set $x_{\text{H}_2\text{Oexp}}$ equal to $x_{\text{H}_2\text{Omeas}}$.

(c) Estimate the maximum expected CO₂ concentration during emission testing, $x_{\text{CO}_2\text{exp}}$. Make this estimate at the sample system location where the blended NO and CO₂ span gases are introduced according to § 1065.370(d)(10). When estimating the maximum expected CO₂ concentration, consider the maximum expected CO₂ content in fuel combustion products and dilution air.

(d) Calculate quench as follows:

$$\text{quench} = \left(\left(\frac{\frac{x_{\text{NOwet}}}{1 - x_{\text{H}_2\text{Omeas}}} - 1 \right) \cdot \frac{x_{\text{H}_2\text{Oexp}}}{x_{\text{H}_2\text{Omeas}}} + \left(\frac{x_{\text{NOmeas}}}{x_{\text{NOact}}} - 1 \right) \cdot \frac{x_{\text{CO}_2\text{exp}}}{x_{\text{CO}_2\text{act}}} \right) \cdot 100\% \quad \text{Eq. 1065.675-1}$$

Where:

quench = amount of CLD quench.

x_{NOdry} = concentration of NO upstream of a bubbler, according to § 1065.370(e)(4).

x_{NOwet} = measured concentration of NO downstream of a bubbler, according to § 1065.370(e)(9).

$x_{\text{H}_2\text{Oexp}}$ = maximum expected mole fraction of water during emission testing, according to paragraph (b) of this section.

$x_{\text{H}_2\text{Omeas}}$ = measured mole fraction of water during the quench verification, according to § 1065.370(e)(7).

x_{NOmeas} = measured concentration of NO when NO span gas is blended with CO₂ span gas, according to § 1065.370(d)(10).