

§ 1065.675

40 CFR Ch. I (7-1-07 Edition)

$x_{\text{refspan}} = 1800.0 \text{ } \mu\text{mol/mol}$   
 $x_{\text{prespan}} = 1800.5 \text{ } \mu\text{mol/mol}$   
 $x_{\text{postspan}} = 1695.8 \text{ } \mu\text{mol/mol}$

$x_i$  or  $\bar{x} = 435.5 \text{ } \mu\text{mol/mol}$   
 $x_{\text{prezero}} = 0.6 \text{ } \mu\text{mol/mol}$   
 $x_{\text{postzero}} = -5.2 \text{ } \mu\text{mol/mol}$

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

$x_{\text{idrift corrected}} = 450.8 \text{ } \mu\text{mol/mol}$

(3) For any pre-test interval concentrations, use concentrations determined most recently before the test interval. For some test intervals, the most recent pre-zero or pre-span might 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,  $x_{\text{prespan}}$ , set  $x_{\text{prespan}}$  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,  $x_{\text{prezero}}$ , set  $x_{\text{prezero}}$  equal to the reference concentration of the zero gas:

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

(7) Usually the reference concentration of the zero gas,  $x_{\text{refzero}}$ , is zero:  $x_{\text{refzero}} = 0 \text{ } \mu\text{mol/mol}$ . However, in some

cases you might know that  $x_{\text{refzero}}$  has a non-zero concentration. For example, if you zero a CO<sub>2</sub> analyzer using ambient air, you may use the default ambient air concentration of CO<sub>2</sub>, which is 375  $\mu\text{mol/mol}$ . In this case,  $x_{\text{refzero}} = 375 \text{ } \mu\text{mol/mol}$ . Note that when you zero an analyzer using a non-zero  $x_{\text{refzero}}$ , you must set the analyzer to output the actual  $x_{\text{refzero}}$  concentration. For example, if  $x_{\text{refzero}} = 375 \text{ } \mu\text{mol/mol}$ , set the analyzer to output a value of 375  $\mu\text{mol/mol}$  when the zero gas is flowing to the analyzer.

§ 1065.675 CLD quench verification calculations.

Perform CLD quench-check calculations as follows:

(a) Calculate the amount of water in the span gas,  $x_{\text{H}_2\text{Ospan}}$ , assuming complete saturation at the span-gas temperature.

(b) Estimate the expected amount of water and CO<sub>2</sub> in the exhaust you sample,  $x_{\text{H}_2\text{Oexp}}$  and  $x_{\text{CO}_2\text{exp}}$ , respectively, by considering the maximum expected amounts of water in combustion air, fuel combustion products, and dilution air concentrations (if applicable).

(c) Calculate water quench as follows:

$$\text{quench} = \left( \frac{x_{\text{NOwet}} / (1 - x_{\text{H}_2\text{Omeas}})}{x_{\text{NOdry}}} - 1 \right) \cdot \frac{x_{\text{H}_2\text{Oexp}}}{x_{\text{H}_2\text{Omeas}}} + \frac{x_{\text{NO,CO}_2} - x_{\text{NO,N}_2}}{x_{\text{NO,N}_2}} \cdot \frac{x_{\text{CO}_2\text{exp}}}{x_{\text{CO}_2\text{meas}}} \quad \text{Eq. 1065.672-1}$$

Where:  
*quench* = amount of CLD quench.

$x_{\text{NOdry}}$  = measured concentration of NO upstream of a bubbler, according to § 1065.370.

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$x_{\text{NOwet}}$  = measured concentration of NO downstream of a bubbler, according to §1065.370.

$x_{\text{H}_2\text{Oexp}}$  = expected maximum amount of water entering the CLD sample port during emission testing.

$x_{\text{H}_2\text{Omeas}}$  = measured amount of water entering the CLD sample port during the quench verification specified in §1065.370.

$x_{\text{NO,CO}_2}$  = measured concentration of NO when NO span gas is blended with CO<sub>2</sub> span gas, according to §1065.370.

$x_{\text{NO,N}_2}$  = measured concentration of NO when NO span gas is blended with N<sub>2</sub> span gas, according to §1065.370.

$x_{\text{CO}_2\text{exp}}$  = expected maximum amount of CO<sub>2</sub> entering the CLD sample port during emission testing.

$x_{\text{CO}_2\text{meas}}$  = measured amount of CO<sub>2</sub> entering the CLD sample port during the quench verification specified in §1065.370.

*Example:*

$x_{\text{NOdry}} = 1800.0 \text{ } \mu\text{mol/mol}$

$x_{\text{NOwet}} = 1760.5 \text{ } \mu\text{mol/mol}$

$x_{\text{H}_2\text{Oexp}} = 0.030 \text{ mol/mol}$

$x_{\text{H}_2\text{Omeas}} = 0.017 \text{ mol/mol}$

$x_{\text{NO,CO}_2} = 1480.2 \text{ } \mu\text{mol/mol}$

$x_{\text{NO,N}_2} = 1500.8 \text{ } \mu\text{mol/mol}$

$x_{\text{CO}_2\text{exp}} = 2.00\%$

$x_{\text{CO}_2\text{meas}} = 3.00\%$

$$\text{quench} = \left( \frac{1760.5/(1-0.017)}{1800.0} - 1 \right) \cdot \frac{0.030}{0.017} + \frac{1480.2 - 1500.8}{1500.8} \cdot \frac{2.00}{3.00}$$

$$\text{quench} = -0.00888 - 0.00915 = -1.80\%$$

### § 1065.690 Buoyancy correction for PM sample media.

(a) *General.* Correct PM sample media for their buoyancy in air if you weigh them on a balance. The buoyancy correction depends on the sample media density, the density of air, and the density of the calibration weight used to calibrate the balance. The buoyancy correction does not account for the buoyancy of the PM itself, because the mass of PM typically accounts for only (0.01 to 0.10)% of the total weight. A correction to this small fraction of mass would be at the most 0.010%.

(b) *PM sample media density.* Different PM sample media have different densities. Use the known density of your sample media, or use one of the densities for some common sampling media, as follows:

(1) For PTFE-coated borosilicate glass, use a sample media density of 2300 kg/m<sup>3</sup>.

(2) For PTFE membrane (film) media with an integral support ring of polymethylpentene that accounts for 95% of the media mass, use a sample media density of 920 kg/m<sup>3</sup>.

(3) For PTFE membrane (film) media with an integral support ring of PTFE, use a sample media density of 2144 kg/m<sup>3</sup>.

(c) *Air density.* Because a PM balance environment must be tightly controlled to an ambient temperature of (22 ±1) °C and a dewpoint of (9.5 ±1) °C, air density is primarily function of atmospheric pressure. We therefore specify a buoyancy correction that is only a function of atmospheric pressure. Using good engineering judgment, you may develop and use your own buoyancy correction that includes the effects of temperature and dewpoint on density in addition to the effect of atmospheric pressure.

(d) *Calibration weight density.* Use the stated density of the material of your metal calibration weight. The example calculation in this section uses a density of 8000 kg/m<sup>3</sup>, but you should know the density of your weight from the calibration weight supplier or the balance manufacturer if it is an internal weight.

(e) *Correction calculation.* Correct the PM sample media for buoyancy using the following equations: