

Environmental Protection Agency

§ 1065.690

x_{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 CO₂ span gas, according to §1065.370.

$x_{\text{NO,N}_2}$ = measured concentration of NO when NO span gas is blended with N₂ span gas, according to §1065.370.

$x_{\text{CO}_2\text{exp}}$ = expected maximum amount of CO₂ entering the CLD sample port during emission testing.

$x_{\text{CO}_2\text{meas}}$ = measured amount of CO₂ 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/m³.

(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/m³.

(3) For PTFE membrane (film) media with an integral support ring of PTFE, use a sample media density of 2144 kg/m³.

(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/m³, 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:

$$m_{\text{cor}} = m_{\text{uncor}} \cdot \left(\frac{1 - \frac{\rho_{\text{air}}}{\rho_{\text{weight}}}}{1 - \frac{\rho_{\text{air}}}{\rho_{\text{media}}}} \right) \quad \text{Eq. 1065.690-1}$$

Where:

- m_{cor} = PM mass corrected for buoyancy.
- m_{uncor} = PM mass uncorrected for buoyancy.
- ρ_{air} = density of air in balance environment.
- ρ_{weight} = density of calibration weight used to span balance.
- ρ_{media} = density of PM sample media, such as a filter.

$$\rho_{\text{air}} = \frac{\rho_{\text{abs}} \cdot M_{\text{mix}}}{R \cdot T_{\text{amb}}} \quad \text{Eq. 1065.690-2}$$

Where:

- ρ_{abs} = absolute pressure in balance environment.
- M_{mix} = molar mass of air in balance environment.
- R = molar gas constant.
- T_{amb} = absolute ambient temperature of balance environment.

Example:

- $\rho_{\text{abs}} = 99.980 \text{ kPa}$
- $T_{\text{sat}} = T_{\text{dew}} = 9.5 \text{ }^\circ\text{C}$
- Using Eq. 1065.645-2,
- $\rho_{\text{H}_2\text{O}} = 1.1866 \text{ kPa}$
- Using Eq. 1065.645-3,
- $x_{\text{H}_2\text{O}} = 0.011868 \text{ mol/mol}$
- Using Eq. 1065.640-8,
- $M_{\text{mix}} = 28.83563 \text{ g/mol}$
- $R = 8.314472 \text{ J/(mol}\cdot\text{K)}$
- $T_{\text{amb}} = 20 \text{ }^\circ\text{C}$

$$\rho_{\text{air}} = \frac{99.980 \cdot 28.83563}{8.314472 \cdot 293.15}$$

- $\rho_{\text{air}} = 1.18282 \text{ kg/m}^3$
- $m_{\text{uncor}} = 100.0000 \text{ mg}$
- $\rho_{\text{weight}} = 8000 \text{ kg/m}^3$
- $\rho_{\text{media}} = 920 \text{ kg/m}^3$

$$m_{\text{cor}} = 100.0000 \cdot \left[\frac{1 - \frac{1.18282}{8000}}{1 - \frac{1.18282}{920}} \right]$$

$m_{\text{cor}} = 100.1139 \text{ mg}$

§ 1065.695 Data requirements.

(a) To determine the information we require from engine tests, refer to the standard-setting part and request from

your Designated Compliance Officer the format used to apply for certification or demonstrate compliance. We may require different information for different purposes, such as for certification applications, approval requests for alternate procedures, selective enforcement audits, laboratory audits, production-line test reports, and field-test reports.

(b) See the standard-setting part and § 1065.25 regarding recordkeeping.

(c) We may ask you the following about your testing, and we may ask you for other information as allowed under the Act:

(1) What approved alternate procedures did you use? For example:

- (i) Partial-flow dilution for proportional PM.
- (ii) CARB test procedures.
- (iii) ISO test procedures.

(2) What laboratory equipment did you use? For example, the make, model, and description of the following:

- (i) Engine dynamometer and operator demand.
- (ii) Probes, dilution, transfer lines, and sample preconditioning components.
- (iii) Batch storage media (such as the bag material or PM filter material).

(3) What measurement instruments did you use? For example, the make, model, and description of the following:

- (i) Speed and torque instruments.
- (ii) Flow meters.
- (iii) Gas analyzers.
- (iv) PM balance.

(4) When did you conduct calibrations and performance checks and what were the results? For example, the dates and results of the following:

- (i) Linearity checks.
- (ii) Interference checks.
- (iii) Response checks.
- (iv) Leak checks.
- (v) Flow meter checks.