

$$\dot{n}_{\text{exh}} = \frac{7.559 \cdot 0.869 \cdot (1 + 0.10764)}{12.0107 \cdot 0.09987}$$

$\dot{n}_{\text{exh}} = 6.066 \text{ mol/s}$

(f) *Calculated raw exhaust molar flow rate from measured intake air molar flow rate, dilute exhaust molar flow rate, and dilute chemical balance.* You may calculate the raw exhaust molar flow rate, \dot{n}_{exh} , based on the measured intake air molar flow rate, \dot{n}_{int} , the measured dilute exhaust molar flow rate, \dot{n}_{dexh} , and the values calculated using the chemical balance in paragraph (c) of this section. Note that the chemical balance must be based on dilute exhaust gas concentrations. For continuous-flow calculations, solve for the chemical balance in paragraph (c) of this section at the same frequency that you

update and record \dot{n}_{int} and \dot{n}_{dexh} . This calculated \dot{n}_{exh} may be used for the PM dilution ratio verification in §1065.546; the calculation of dilution air molar flow rate in the background correction in §1065.667; and the calculation of mass of emissions in §1065.650(c) for species that are measured in the raw exhaust.

(1) *Crankcase flow rate.* If engines are not subject to crankcase controls under the standard-setting part, calculate raw exhaust flow as described in paragraph (e)(1) of this section.

(2) *Dilute exhaust and intake air molar flow rate calculation.* Calculate \dot{n}_{exh} as follows:

$$\dot{n}_{\text{exh}} = (x_{\text{raw/exhdry}} - x_{\text{int/exhdry}}) \cdot (1 - x_{\text{H}_2\text{Oexh}}) \cdot \dot{n}_{\text{dexh}} + \dot{n}_{\text{int}}$$

Eq. 1065.655-22

Example:

$\dot{n}_{\text{int}} = 7.930 \text{ mol/s}$
 $x_{\text{raw/exhdry}} = 0.1544 \text{ mol/mol}$
 $x_{\text{int/exhdry}} = 0.1451 \text{ mol/mol}$
 $x_{\text{H}_2\text{Oexh}} = 32.46 \text{ mmol/mol} - 0.03246 \text{ mol/mol}$
 $\dot{n}_{\text{dexh}} = 49.02 \text{ mol/s}$
 $\dot{n}_{\text{exh}} = (0.1544 - 0.1451) \cdot (1 - 0.03246) \cdot 49.02 + 7.930 = 0.4411 + 7.930 = 8.371 \text{ mol/s}$

[73 FR 37331, June 30, 2008, as amended at 73 FR 59334, Oct. 8, 2008; 75 FR 23051, Apr. 30, 2010; 76 FR 57458, Sept. 15, 2011]

§ 1065.659 Removed water correction.

(a) If you remove water upstream of a concentration measurement, x , or upstream of a flow measurement, \dot{n} , correct for the removed water. Perform this correction based on the amount of water at the concentration measurement, $x_{\text{H}_2\text{O[emission]meas}}$, and at the flow meter, $x_{\text{H}_2\text{Oexh}}$, whose flow is used to determine the mass emission rate or total mass over a test interval. For continuous analyzers downstream of a sample dryer for transient and ramped-

modal cycles, you must apply this correction on a continuous basis over the test interval, even if you use one of the options in §1065.145(e)(2) that results in a constant value for $x_{\text{H}_2\text{O[emission]meas}}$ because $x_{\text{H}_2\text{Oexh}}$ varies over the test interval. For batch analyzers, determine the flow-weighted average based on the continuous $x_{\text{H}_2\text{Oexh}}$ values determined as described in paragraph (c) of this section. For batch analyzers, you may determine the flow-weighted average $x_{\text{H}_2\text{Oexh}}$ based on a single value of $x_{\text{H}_2\text{Oexh}}$ determined as described in paragraphs (c)(2) and (3) of this section, using flow-weighted average or batch concentration inputs.

(b) Determine the amount of water remaining downstream of a sample dryer and at the concentration measurement using one of the methods described in §1065.145(e)(2). If you use a sample dryer upstream of an analyzer and if the calculated amount of water remaining downstream of the sample

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dryer and at the concentration measurement, $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$, is higher than the amount of water at the flow meter, $x_{\text{H}_2\text{Oexh}}$. Set $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$ equal to $x_{\text{H}_2\text{Oexh}}$. If you use a sample dryer upstream of storage media, you must be able to demonstrate that the sample dryer is removing water continuously (*i.e.*, $x_{\text{H}_2\text{Oexh}}$ is higher than $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$ throughout the test interval).

(c) For a concentration measurement where you did not remove water, you may set $x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}$ equal to $x_{\text{H}_2\text{Oexh}}$. You may determine the amount of water at the flow meter, $x_{\text{H}_2\text{Oexh}}$, using any of the following methods:

(1) Measure the dewpoint and absolute pressure and calculate the amount of water as described in § 1065.645.

(2) If the measurement comes from raw exhaust, you may determine the amount of water based on intake-air humidity, plus a chemical balance of fuel, intake air, and exhaust as described in § 1065.655.

(3) If the measurement comes from diluted exhaust, you may determine the amount of water based on intake-air humidity, dilution air humidity, and a chemical balance of fuel, intake air, and exhaust as described in § 1065.655.

(d) Perform a removed water correction to the concentration measurement using the following equation:

$$x = x_{[\text{emission}]\text{meas}} \cdot \left[\frac{1 - x_{\text{H}_2\text{Oexh}}}{1 - x_{\text{H}_2\text{O}[\text{emission}]\text{meas}}} \right] \quad \text{Eq. 1065.659-1}$$

Example:

$x_{\text{COmeas}} = 29.0 \mu\text{mol/mol}$

$x_{\text{H}_2\text{O}[\text{COmeas}]} = 8.601 \text{ mmol/mol} = 0.008601 \text{ mol/mol}$

$x_{\text{H}_2\text{Oexh}} = 34.04 \text{ mmol/mol} = 0.03404 \text{ mol/mol}$

$$x_{\text{CO}} = 29.0 \cdot \left[\frac{1 - 0.03404}{1 - 0.008601} \right]$$

$x_{\text{CO}} = 28.3 \mu\text{mol/mol}$

[73 FR 37335, June 30, 2008, as amended at 76 FR 57462, Sept. 15, 2011]

§ 1065.660 THC, NMHC, and CH₄ determination.

(a) *THC determination and initial THC/CH₄ contamination corrections.* (1) If we require you to determine THC emissions, calculate $x_{\text{THC}[\text{THC-FID}]\text{cor}}$ using the initial THC contamination concentration $x_{\text{THC}[\text{THC-FID}]\text{init}}$ from § 1065.520 as follows:

$$x_{\text{THC}[\text{THC-FID}]\text{cor}} = x_{\text{THC}[\text{THC-FID}]\text{uncor}} - x_{\text{THC}[\text{THC-FID}]\text{init}}$$

Eq. 1065.660-1

Example:

$x_{\text{THCuncor}} = 150.3 \mu\text{mol/mol}$

$x_{\text{THCinit}} = 1.1 \mu\text{mol/mol}$

$x_{\text{THCcor}} = 150.3 - 1.1$

$x_{\text{THCcor}} = 149.2 \mu\text{mol/mol}$

(2) For the NMHC determination described in paragraph (b) of this section, correct $x_{\text{THC}[\text{THC-FID}]}$ for initial THC contamination using Equation 1065.660-1. You may correct $x_{\text{THC}[\text{NMHC-FID}]}$ for initial contamination of the CH₄ sample train

using Equation 1065.660-1, substituting in CH₄ concentrations for THC.

(3) For the CH₄ determination described in paragraph (c) of this section, you may correct $x_{\text{THC}[\text{NMHC-FID}]}$ for initial THC contamination of the CH₄ sample train using Equation 1065.660-1, substituting in CH₄ concentrations for THC.

(b) *NMHC determination.* Use one of the following to determine NMHC concentration, x_{NMHC} :