§ 1066.610 Dilution air background correction.

(a) Correct the emissions in a gaseous sample for background using the following equation:

\[
x_{\text{emission}} = x_{\text{emission}}^{\text{desh}} - x_{\text{emission}}^{\text{bkgnd}} \left(1 - \frac{1}{DF}\right)
\]

Eq. 1066.610-1

Where:
- \(x_{\text{emission}}^{\text{desh}}\) = measured emission concentration in dilute exhaust (after dry-to-wet correction, if applicable).
- \(x_{\text{emission}}^{\text{bkgnd}}\) = measured emission concentration in the dilution air (after dry-to-wet correction, if applicable).
- DF = dilution factor, as determined in paragraph (b) of this section.

\[
V_{\text{flow}} = \bar{Q} \cdot \Delta t
\]

Eq. 1066.605-9

*Example:*

\[
\bar{Q}_{\text{CVS}} = 0.338 \text{ m}^3/\text{s}
\]

\[
\Delta t = 505 \text{ s}
\]

\[
V_{\text{CVS}} = 0.338 \cdot 505
\]

\[
V_{\text{CVS}} = 170.69 \text{ m}^3
\]
Example:

\[ x_{NO_{x\text{esh}}} = 1.08305 \text{ ppm} \]
\[ x_{NO_{x\text{bgnd}}} = 0.12456 \text{ ppm} \]
\[ DF = 9.14506 \]
\[ x_{NO} = 1.08305 - 0.12456 \left(1 - \frac{1}{9.14506}\right) = 0.97211 \text{ ppm} \]

(b) Except as specified in paragraph (c) of this section, determine the dilution factor, \( DF \), over the test interval using the following equation:

\[
DF = \frac{1}{\left(1 + \frac{\alpha}{2} + 3.76 \left(1 + \frac{\alpha}{4} - \frac{\beta}{2}\right)\right) \left(x_{CO_{2}} + x_{\text{NMHC}} + x_{CH_4} + x_{CO}\right)}
\]

Eq. 1066.610-2

Where:
\[ x_{CO_{2}} = \text{amount of CO}_2 \text{ measured in the sample over the test interval.} \]
\[ x_{\text{NMHC}} = \text{amount of C}_1\text{-equivalent NMHC measured in the sample over the test interval.} \]
\[ x_{CH_4} = \text{amount of CH}_4 \text{ measured in the sample over the test interval.} \]
\[ x_{CO} = \text{amount of CO measured in the sample over the test interval.} \]
\[ \alpha = \text{atomic hydrogen-to-carbon ratio of the test fuel. You may measure } \alpha \text{ or use default values from Table 1 of 40 CFR 1065.655.} \]
\[ \beta = \text{atomic oxygen-to-carbon ratio of the test fuel. You may measure } \beta \text{ or use default values from Table 1 of 40 CFR 1065.655.} \]
Example:

\[ x_{\text{CO}_2} = 1.456\% = 0.01456 \]
\[ x_{\text{NMHC}} = 0.84\text{ ppm} = 0.00000084 \]
\[ x_{\text{CH}_4} = 0.26\text{ ppm} = 0.00000026 \]
\[ x_{\text{CO}} = 80.4\text{ ppm} = 0.0000804 \]
\[ \alpha = 1.92 \]
\[ \beta = 0.03 \]
\[ DF = \frac{1}{\left(1 + \frac{1.92}{2} + 3.76 \left(1 + \frac{1.92}{4} + 0.03 \frac{0.01456 + 0.00000084 + 0.00000026 + 0.0000804}{2}\right)\right)} = 9.14506 \]

(c) Determine the dilution factor, \( DF \), over the test interval for partial-flow dilution sample systems using the following equation:

\[
DF = \frac{V_{\text{dextstd}}}{V_{\text{exhstd}}}
\]

Eq. 1066.610-3

Where:
\( V_{\text{dextstd}} = \text{total dilute exhaust volume sampled over the test interval, corrected to standard reference conditions.} \)
\( V_{\text{exhstd}} = \text{total exhaust volume sampled from the vehicle, corrected to standard reference conditions.} \)

Example:

\[ V_{\text{dextstd}} = 170.9\text{ m}^3 \]
\[ V_{\text{exhstd}} = 15.9\text{ m}^3 \]

\[ DF = \frac{170.9}{15.4} = 11.1 \]

(d) Determine the time-weighted dilution factor, \( DF_{\text{t}} \), over the duty cycle using the following equation:
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\[
DF_w = \frac{\sum_{i=1}^{N} t_i}{\sum_{i=1}^{N} \frac{1}{DF_i} \cdot t_i}
\]

Eq. 1066.610-4

Where:

\( N \) = number of test intervals.  
\( i \) = test interval number  
\( t \) = duration of the test interval.  
\( DF \) = dilution factor over the test interval.

Example:

\( N = 3 \)

\( DF_1 = 14.40 \)

\( t_1 = 505 \text{ s} \)

\( DF_2 = 24.48 \)

\( t_2 = 867 \text{ s} \)

\( DF_3 = 17.28 \)

\( t_3 = 505 \text{ s} \)

\[
DF_w = \frac{505 + 867 + 505}{\left( \frac{1}{14.40} \cdot 505 \right) + \left( \frac{1}{24.48} \cdot 867 \right) + \left( \frac{1}{17.28} \cdot 505 \right)} = 18.82
\]

§ 1066.615 NO\textsubscript{X} intake-air humidity correction.

You may correct NO\textsubscript{X} emissions for intake-air humidity as described in this section if the standard-setting part allows it. See § 1066.605(c)(1) for the proper sequence for applying the NO\textsubscript{X} intake-air humidity correction.

(a) For vehicles at or below 14,000 pounds GVWR, apply a correction for vehicles with reciprocating engines operating over specific test cycles as follows:

(1) Calculate a humidity correction using a time-weighted mean value for ambient humidity over the test interval. Calculate absolute ambient humidity, \( H \), using the following equation: