Environmental Protection Agency

§ 1065.640 Flow meter calibration calculations.

This section describes the calculations for calibrating various flow meters. After you calibrate a flow meter using these calculations, use the calculations described in §1065.642 to calculate flow during an emission test. Paragraph (a) of this section first describes how to convert reference flow meter outputs for use in the calibration equations, which are presented on a molar basis. The remaining paragraphs describe the calibration calculations that are specific to certain types of flow meters.

(a) Reference meter conversions. The calibration equations in this section use molar flow rate, \( \dot{n}_{\text{ref}} \), as a reference quantity. If your reference meter outputs a flow rate in a different quantity, such as standard volume rate, \( V_{\text{stdref}} \), or mass rate, \( \dot{m}_{\text{ref}} \), convert your reference meter output to a molar flow rate using the following equations, noting that while values for volume rate, mass rate, pressure, temperature, and molar mass may change during an emission test, you should ensure that they are as constant as practical for each individual set point during a flow meter calibration:

\[
\dot{n}_{\text{ref}} = \frac{\dot{V}_{\text{stdref}}}{P_t T_t \sqrt{R} \left( \frac{M_{\text{std}}}{M_{\text{ref}}} \right) } \
\dot{n}_{\text{ref}} = \frac{\dot{m}_{\text{ref}}}{M_{\text{ref}}} \
\]

Where:
- \( \dot{V}_{\text{stdref}} \) = standard volume rate, in m³/s
- \( P_t \) = ambient pressure, in kPa
- \( T_t \) = ambient temperature, in °C
- \( R \) = universal gas constant, in kPa·m³/°C·mol
- \( M_{\text{std}} \) = molecular weight of standard gas (e.g., air), in kg/mol
- \( M_{\text{ref}} \) = molecular weight of reference gas (e.g., dry air), in kg/mol

\[
\dot{n}_{\text{ref}} = 9.7803267715 \cdot [1 + s] 
+ 5.2790414 \cdot 10^{-3} \cdot \sin^2 (\theta) + 
2.32718 \cdot 10^{-5} \cdot \sin^4 (\theta) + 
1.262 \cdot 10^{-7} \cdot \sin^6 (\theta) + 
7 \cdot 10^{-10} \cdot \sin^8 (\theta) 
\]

Eq. 1065.630-1

Where:
- \( \theta \) = Degrees north or south latitude.

Example:

\( \theta = 45^\circ \)

\[
a_g = 9.8176291229 \text{ m/s}^2 
\]

§ 1065.630 1980 international gravity formula.

The acceleration of Earth’s gravity, \( a_g \), varies depending on your location. Calculate \( a_g \) at your latitude, as follows: