
40 C.F.R. § 1065.642

PDP, SSV, and CFV molar flow rate calculations.

This section describes the equations for calculating molar flow rates from various flow meters. After you calibrate a flow meter according to § 1065.640, use the calculations described in this section to calculate flow during an emission test.

- (a) *PDP molar flow rate.* (1) Based on the speed at which you operate the PDP for a test interval, select the corresponding slope, a_1 , and intercept, a_0 , as calculated in § 1065.640, to calculate PDP molar flow rate,, as follows:

$$\dot{n} = f_{n\text{PDP}} \cdot \frac{V_{\text{rev}} \cdot p_{\text{in}}}{R \cdot T_{\text{in}}}$$

Eq. 1065.642-1

Where:

$f_{n\text{PDP}}$ = pump speed. V_{rev} = PDP volume pumped per revolution, as determined in paragraph (a)(2) of this section. p_{in} = static absolute pressure at the PDP inlet. R = molar gas constant. T_{in} = absolute temperature at the PDP inlet.

- (2) Calculate V_{rev} using the following equation:

$$V_{\text{rev}} = \frac{a_1}{f_{n\text{PDP}}} \cdot \sqrt{\frac{p_{\text{out}} - p_{\text{in}}}{p_{\text{out}}}} + a_0$$

Eq. 1065.642-2

p_{out} = static absolute pressure at the PDP outlet.

Example:

$a_1 = 0.8405 \text{ (m/s)}$ $f_{n\text{PDP}} = 12.58 \text{ r/s}$ $p_{\text{out}} = 99.950 \text{ kPa}$ $p_{\text{in}} = 98.575 \text{ kPa} = 98575 \text{ Pa} = 98575 \text{ kg/(m}\cdot\text{s)}$ $a_0 = 0.056 \text{ (m/r)}$ $R = 8.314472 \text{ J/(mol}\cdot\text{K)} = 8.314472 \text{ (m}\cdot\text{kg)/(s}\cdot\text{mol}\cdot\text{K)}$ $T_{\text{in}} = 323.5 \text{ K}$

$$V_{\text{rev}} = \frac{0.8405}{12.58} \cdot \sqrt{\frac{99.950 - 98.575}{99.950}} + 0.056$$

$$\dot{n} = 12.58 \cdot \frac{98575 \cdot 0.06383}{8.314472 \cdot 323.5}$$

$n = 29.428 \text{ mol/s}$

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