

## Standard Flow Rate vs. Volumetric Flow Rate

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This application note applies to all TSI flowmeters.

TSI flowmeters are considered mass flowmeters and indicate flow rates with reference to a set of standard conditions. For TSI instruments, standard conditions are defined as 21.1° C (70° F) and 101.3 kPa (14.7 psia). Other manufacturers may use different values.

Standard flow rate is the equivalent flow rate the gas would be moving if the temperature and pressure were at standard conditions. It is usually the most useful measure of gas flow because it defines the mass flow, number of molecules, and heat-carrying capacity of the gas.

Volumetric flow rate is the actual volume flow of the gas exiting the flowmeter.

In some instances, volumetric flow rate rather than standard flow rate may be of interest. To output the volumetric flow rate, the instrument will multiply the standard flow measurement by the following density correction factor:

$$\text{VolumetricFlow} = Q * \left( \frac{T_m}{T_{std}} \right) \left( \frac{P_{std}}{P_m} \right)$$

Where      Q = Standard flow rate  
               T<sub>m</sub> = Absolute temperature of gas in flow tube  
               P<sub>m</sub> = Absolute pressure in flow tube

TSI flowmeters use T<sub>std</sub> = 21.11 °C and P<sub>std</sub> = 101.3 kPa absolute

Example:

The mass flow rate measured by the flowmeter is 100 Std L/min at 15 °C and 117.0 kPa. The flowmeter calculates and outputs the volumetric flow as follows.

$$\text{VolumetricFlow} = (100 \text{ std L/min}) \left( \frac{273.15 + 15^\circ\text{C}}{273.15 + 21.11^\circ\text{C}} \right) \left( \frac{101.3 \text{ kPa}}{117.0 \text{ kPa}} \right) = 84.78 \text{ L/min}$$