

HOW TO SELECT YOUR ROTAMETER

This article is intended to help the user to select the best rotameter/variable area meter for a particular application. For general information on these flowmeters, please refer to the "Variable Area Flowmeters" flow reference section on page B-5.

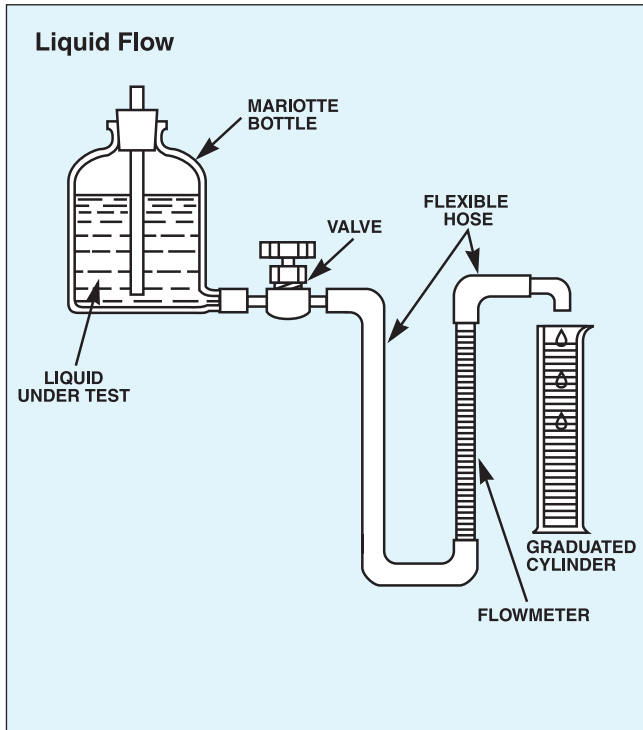
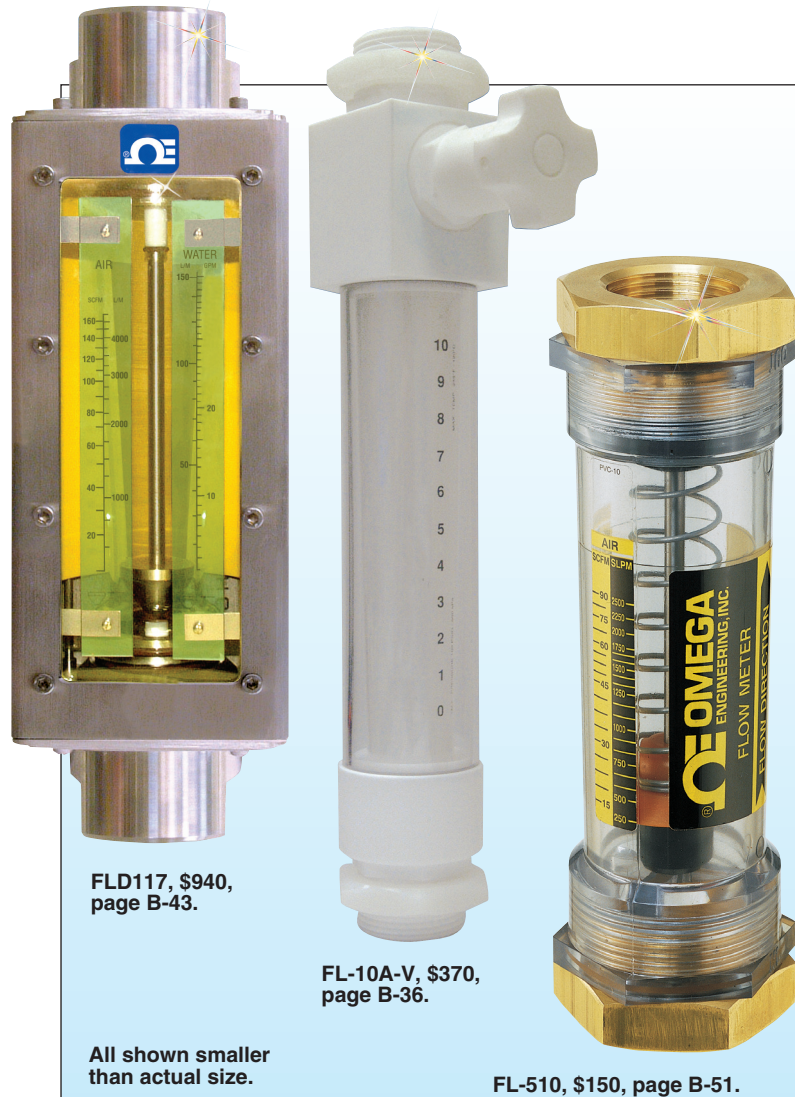


Figure 1

I see that rotameters and variable area meters are generally calibrated for water or air operating at 21°C (70°F) and 14.7 psia. What if I am using other materials at other operating conditions?

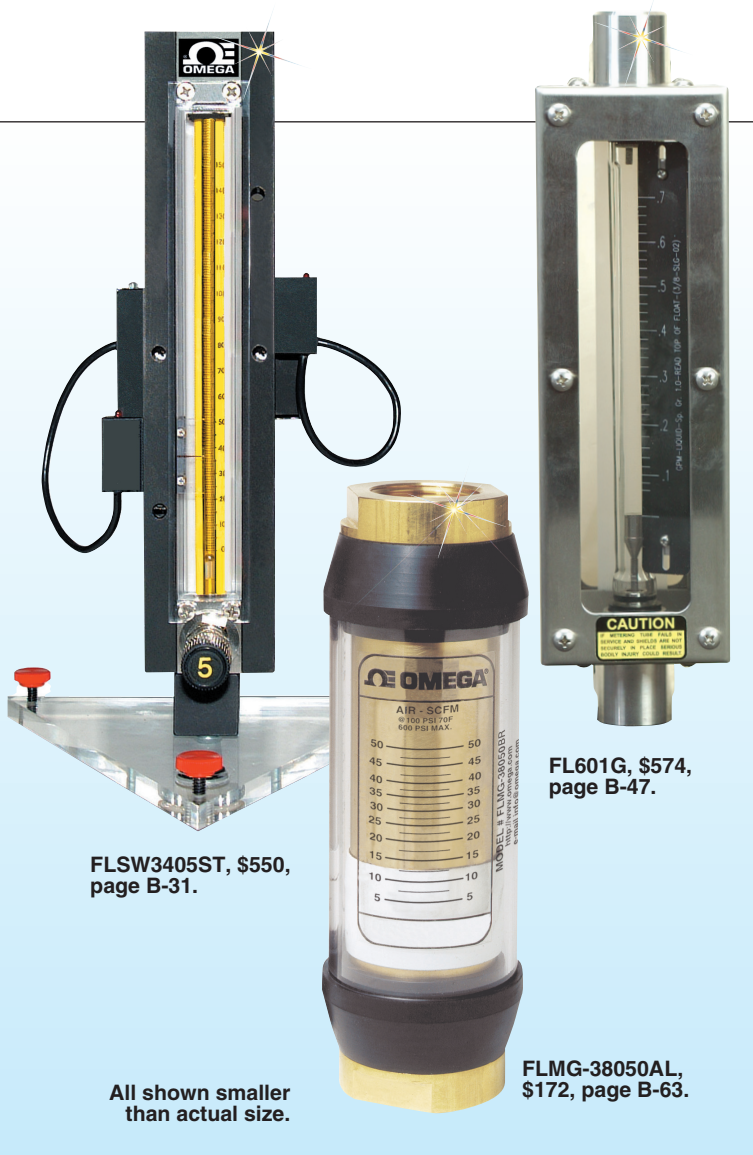
The reading from rotameters and variable area meters is sensitive to the condition of the fluid passing through it; namely, the gas temperature, pressure and density, or liquid viscosity and density. For air the temperature and pressure have been selected as 21°C (70°F) and 14.7 psia because this is representative of the many gas applications where the gas is at room temperature and the rotameter outlet vents into the open air or into an enclosure which vents to the open air. Mathematical correlations have been developed so that when a rotameter or variable area meter is used for a different fluid at different conditions, a multiplying factor can be applied to the reading of the flowmeter so the actual flowrate of the new fluid can be obtained.



How do the correlations work?

For OMEGA's general purpose rotameters, the equations shown on page B-7 are utilized. For liquids, the correlations do not take into account viscosity, which has a very significant effect on rotameters with ball floats or plumb bob floats. Empirical data has been derived for certain general purpose rotameters as to the effect of density and viscosity on their performance. For further details, consult OMEGA's engineering department.

For gases, the specific gravity of the gas can be calculated by dividing the molecular weight of the gas by 28.8 (28.8 is the molecular weight of air). In gas correlations, it is important to realize that the



correlations generate the flowrate at standard conditions, not actual conditions (for example: in standard cubic feet per minute, not actual cubic feet per minute). Standard cubic feet represent the volume that a gas would occupy if its temperature and pressure were 21°C (70°F) and 14.7 psia (not the actual operating temperature and pressure).

To convert actual cubic feet per minute, (ACFM or actual liters per minute, or any actual flowrate) to standard conditions (SCFM), the following relation is used:

$$Q_s = Q_a \times (P_a/P_s) \times (530/(T_a + 460))$$

where:

P_a = actual operating pressure (in psia)

P_s = 14.7 psia

T_a = actual operating temperature (in °F)

Q_a = volumetric flowrate at actual operating conditions (e.g., ACFM)

Q_s = volumetric flowrate at standard conditions (e.g., SCFM)

What about variable area meters?

Variable area meters of a piston-and-tapered cone construction are only slightly affected by viscosities up to 20 centipoise. Their correlation equations are given on page B-8.

Are correlation equations all I need to determine my flowrate?

Correlation equations are approximations; for highest accuracy, field calibration is recommended.

How is field calibration performed?

For liquids, the process fluid is moved through the rotameter until a stable reading is obtained. The outflow from the rotameter is then timed and collected in a bucket and timed. Knowing the volume of flow over a given time period indicates flowrate. This is then repeated for different rotameter readings. See Fig. 1 (page B-3).

For gases, the same technique is used, except that the gas must be collected with a graduated cylinder under water, (or with a bubble meter for very low flows.) When the gas is collected under water, the pressure of the gas and the water vapor in the gas must be compensated for to (determine accurately) the volume of the gas collected. See Fig. 2 below.

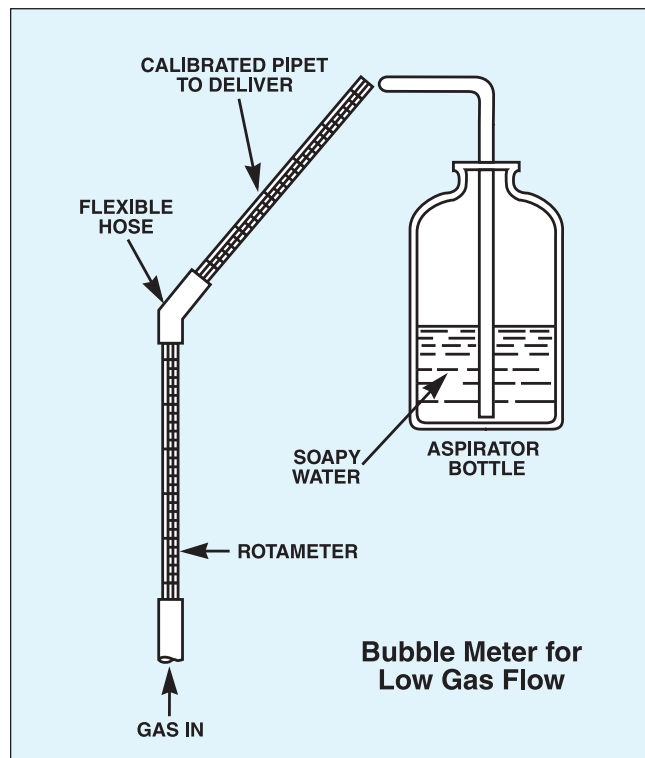


Figure 2: Soapy water is squirted into the calibrated pipette. As bubbles form and travel up the pipette, they are timed with a stopwatch to determine cc/min flow rate.