Conversion Information

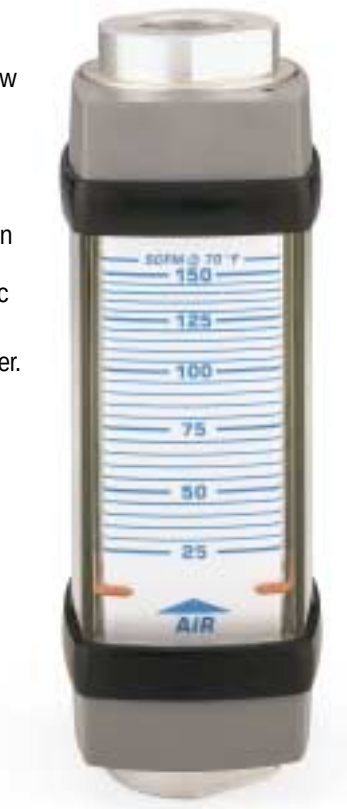
Chart Calculations and Flow Meter Sizing (SCFM Applications)

Compressibility of Gases
Since gases are significantly compressible, their density varies with pressure and temperature. Table 1 & 2 of the Conversion Chart shown in Figure 3 is used to convert "indicated" scfm flow rates to "actual" scfm flow rates for your application.

Effects of Specific Gravity
Standard scales are calibrated for air with a specific gravity of 1.0. Table 3 of the Conversion Chart shown in Figure 3 is used to calculate "actual" scfm flow rates of gases with a specific gravity other than 1.0.

Example: Measuring Natural Gas with Air Meter.

Operating Parameters
Fluid ~ Natural Gas
Line Pressure ~ 140 psig
Temperature ~ 40°F
Desired Maximum Flow ~ 85 scfm
Pressure Drop ~ 10 psid maximum
Port Size ~ 1/2 inch NPTF desired



1. Pressure correction for 140 psi

$$f_1 = \sqrt{\frac{114.7}{14.7 + 140}} = \sqrt{\frac{114.7}{154.7}} = .861$$

2. Temperature correction for 40°F

$$f_2 = \sqrt{\frac{460 + 40}{530}} = \sqrt{\frac{500}{530}} = .971$$

3. Specific gravity correction for natural gas, s.g. = 0.60

$$f_3 = \sqrt{.60} = .775$$

4. Make total correction calculation, f total

$$f_{total} = f_1 \times f_2 \times f_3 = .861 \times .971 \times .775 = .648$$

5. To determine actual flow vs. indicated flow: read indicated flow at 100 psi vertical line on the multipressure scale (see Figure 1) and apply correction factor.

$$\text{scfm (actual)} = \frac{55 \text{ scfm (indicated)}}{.648\ (f_{total})} = 84.9$$

6. 10 psid maximum
See page 56 for pressure drop (ΔP) to find the appropriate size/flow range to meet the 10 psid requirements.

7. To determine which standard Hedland meter is required to achieve desired maximum flow of 85 scfm.

$$85 \text{ scfm (max flow)} \times .648\ (f_{total}) = 55.1 \text{ scfm}$$

8. From the example – model H671A-100 or H771A-100 can be selected. Both meet the 55.1 scfm flow requirement and operate with less than 10 psid. The actual scale range can be calculated as follows:

10 scfm (standard) ÷ .648 (f total) = 15.4 scfm (actual)
100 scfm (standard) ÷ .648 (f total) = 154.3 scfm (actual)

DETERMINE FLOW RATES USING DIFFERENT PRESSURES & TEMPERATURES

$$\text{scfm (actual)} = \frac{\text{scfm (indicated)}}{f_1 \times f_2 \times f_3}$$

Where f_1 = Conversion factor for inlet pressure
f_2 = Conversion factor for temperature
f_3 = Conversion factor for specific gravity

TABLE 1 PRESSURE CORRECTION FACTOR (f_1) Operat'ng Pressure

psig	25	50	75	100	125	150	175	200	225	250
BAR	1.7	3.5	5.2	6.9	8.6	10.4	12.1	13.8	15.5	17.2
kPa	172	345	517	689	862	1034	1207	1379	1551	1724
f_1	1.700	1.331	1.131	1.00	.902	.835	.778	.731	.692	.658

$$f_1 = \sqrt{\frac{114.7}{14.7 + \text{psig}}} \qquad f_1 = \sqrt{\frac{7.914}{1.014 + \text{BAR}}} \qquad f_1 = \sqrt{\frac{790.857}{101.357 + \text{kPa}}}$$

TABLE 2 TEMPERATURE CORRECTION FACTOR (f_2)

°F	+10	+30	+50	+70	+90	+110	+130	+150	+170	+190
°C	-12.2	-1.1	+9.9	+21.0	+32.1	+43	+54	+65	+76	+88
f_2	.942	.962	.981	1.00	1.018	1.037	1.055	1.072	1.090	1.107

$$f_2 = \sqrt{\frac{460 + °F}{530}} \qquad f_2 = \sqrt{\frac{273 + °C}{293}}$$

TABLE 3 SPECIFIC GRAVITY CORRECTION FACTOR (f_3)

$$f_3 = \sqrt{\text{Sp. Gr.}}$$

Figure 3. Conversion Chart

Fluid Selection Chart

Fluid	Specific Gravity	Correction Factor of Standard Scale	Internal Body Material: Aluminum	Brass	T316 SST	T303 SST	External Press. Seals: Viton®	EPR	Dust Guard: Polycarbonate	Nylon	Pyrex™
Air	1.0	1.000	R	R	R	R	R	R	R	R	R
Argon (A)	1.38	1.175	R	R	R	R	R	R	R	R	R
Carbon Dioxide (CO_2)	1.53	1.237	R	R	R	R	R	R	R	R	R
Freon 11 (CCl_3F)	4.92	2.218	R	R	R	R	R	R	R	R	R
Freon 12 (CCl_2F)	4.26	2.060	R	R	R	R	R	R	R	R	R
Helium (HE)	0.14	0.374	R	R	R	R	R	R	R	R	R
Hydrogen (H_2)	0.07	0.265	R	R	R	R	R	R	R	R	R
Natural Gas	0.60	0.775	C	C	R	C	R	N	C	R	R
Nitrogen (N_2)	0.97	0.985	C	C	R	R	R	R	C	R	R
Oxygen (O_2)	1.10	1.049	R	R	R	R	R	R	R	R	R
Propane (C_3H_8)	1.57	1.253	R	R	R	R	R	N	N	R	R

R - Recommended N - Not Recommended C - Consult Factory

Figure 4. Specific Gravity and Correction Factor for Common Gases

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