

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

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

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.

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

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.

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

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:

$$10 \text{ scfm (standard)} \div .648 (f_{\text{total}}) = 15.4 \text{ scfm (actual)}$$

$$100 \text{ scfm (standard)} \div .648 (f_{\text{total}}) = 154.3 \text{ scfm (actual)}$$



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) Operating 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	
$f_1 = \sqrt{\frac{114.7}{14.7 + \text{psig}}}$ $f_1 = \sqrt{\frac{7.914}{1.014 + \text{BAR}}}$ $f_1 = \sqrt{\frac{790.857}{101.357 + \text{kPa}}}$											
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	
$f_2 = \sqrt{\frac{460 + \text{°F}}{530}}$ $f_2 = \sqrt{\frac{273 + \text{°C}}{293}}$											
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				External Press. Seals			Dust Guard	
			Aluminum	Brass	T316 SST	T303 SST	Viton®	EPR	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 ₃ F)	4.92	2.218	R	R	R	R	R	R	R	R	R
Freon 12 (CCl ₂ F)	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 ₃ H 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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