Equations and Fluid Power Symbols

Note: be careful to distinguish between p and P, v and V.

$$p = \frac{F}{A}$$

$$p = \gamma h$$

$$A_{\text{circle}} = \frac{\pi}{4} d^2$$

$$\beta = \frac{-\Delta p}{\Delta V / V}$$

$$V = S\,A$$

$$v = \frac{S}{t}$$

$$\gamma = \frac{W}{V} \qquad \rho = \frac{m}{V}$$

$$\gamma_{water} = 62.4 \frac{\text{lb.}}{\text{ft.}^3} = 9800 \frac{\text{N}}{\text{m}^3}$$

$$Q = \frac{V}{t}$$

$$Q_1 = Q_2 \frac{p_2}{p_1} \frac{T_1}{T_2}$$

$$P = pQ = \frac{F\,S}{t}$$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\eta = \frac{P_{out}}{P_{in}}$$

$$1 \frac{\text{ft.}^3}{\text{s}} = 449 \text{ gpm}$$

$$1 \text{ hp} = 745.5 \text{ W}$$

$$1 \text{ hp} = 1714 \text{ psi} \cdot \text{gpm} = 550 \frac{\text{ft.lb.}}{\text{s}}$$

$$\text{N} = \frac{\text{kg m}}{\text{s}^2} \qquad \text{Pa} = \frac{\text{N}}{\text{m}^2} \qquad \text{W} = \frac{\text{N} \cdot \text{m}}{\text{s}}$$

1 gal. = 231 in.^{3} = 128 fluid ounces

1 psi = 6895 Pa

1 lb. = 4.448 N

1 m^3 = 1000 liters

$p_{(psia)} = p_{(psig)} + 14.7$ psi

$p_{(Pa\ abs)} = p_{(Pa\ ga.)} + 101{,}000$ Pa

$T_{(°R)} = T_{(°F)} + 460°$

$T_{(K)} = T_{(°C)} + 273°$

$$V_r = \frac{14.7 t (Q_r - Q_c)}{p_{max} - p_{min}}$$ for t (min.), Q (scfm), p (psi), V_r (ft.^{3})

$$V_r = \frac{101 t (Q_r - Q_c)}{p_{max} - p_{min}}$$ for t (min.), Q (std. m^3/min.), p (kPa), V_r (m^3)

Metric prefixes

M-	mega-	10^6
k-	kilo-	10^3
c-	centi-	10^{-2}
m-	milli-	10^{-3}

Topic covered in previous semesters:

- General knowledge
- p/A/F relationships
- Q/P/v relationships
- Bulk modulus
- Gas laws
- Orifices
- Q/capacity coeff./p relationships
- Compressor/receiver
- p vs. depth
- Draw pneumatic or hydraulic circuit
- Lab experiences