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Computer Engineering ENG 214

① $L = 2m$

$v_1 = 5 m/s$

$v_2 = 2 m/s$

$P = \frac{0.35(v_1 - v_2)^2}{2g}$ Ph at smaller head = 2.8m

$\frac{P_2}{w} = \frac{P_1}{w} \pm \frac{(v_1^2 + v_2^2)}{2g} + (z_1 - z_2)h$

$= 2.5 + \frac{5^2 + 2^2}{2 \cdot 9.81} + \frac{2(0.3(5-2)^2)}{2 \cdot 9.81}$

$= 2.5 + 1.07 + 2 - 0.16055$

∴ Pressure at lower head

$= 5.409$ bar ≈ 5.41 bar

② Inlet diameter $= 0.2m$

Throat diameter $= 0.1m$

$C_d = 0.98$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi \times 0.2^2}{4} = 0.0314 m^2$

$A_2 = \frac{\pi d}{4} = \frac{\pi \times 0.1^2}{4} = 7.85 \times 10^{-3} m^2$

$h = \frac{P_1}{\rho w} = \frac{P_2}{w}$

$\frac{P_1}{w} = \frac{1.796 \times 10^{-2} N/m}{9.81} = 1.799 \times 10^{-3}$ $\frac{P_2}{w} = 0.3 \times 13.6 = -4.08$

$h = \frac{P_1}{w} - \frac{P_2}{w} = 1.799 \times 10^{-3} - (-4.08) = 4.082m$

$\therefore Q = \frac{0.98 \times 0.0314 \times 0.785 \times 10^{-2}}{\sqrt{(0.0314)^2 - (7.85 \times 10^{-3})^2}} \times \sqrt{2 \times 9.81 \times 4.082}$

$Q = \frac{0.00216}{0.0303} = 0.0713 m^3/s$

(b) $D_1 = 0.15$; $D_2 = 0.3m$

$= 0.9$; $C_d = 0.64$

$$A_1 = \frac{\pi D^2}{4} = \frac{\pi \times 0.15^2}{4} = 0.0176m^2$$

$$A_2 = \frac{\pi D^2}{4} = \frac{\pi \times 0.3^2}{4} = 0.07069m$$

$$h = 0.5\left(\frac{13.6}{0.9} - 1\right) = 7.05m$$

$$Q = \frac{C_d A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$= \frac{0.64 \times 0.0167 \times 0.07069 \times \sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0176)^2 - (0.07069)^2}}$$

$$= \sqrt{0.2.03 \times 10^{-3} m^3 s^{-1}}$$

(c) $A_{air} = 1.8m$

$120mmhg$ $(0.12m)$

$S_g\ Hg = 13.6$

S_g of sea water $= 1.026$

$$h = 0.12\left(\frac{13.6}{1.026} - 1\right)$$

$h = 2.083m$

$v = \sqrt{2gh}$

$= 6.39 m/s$