Hammed Abdulganiyat Fawaz
18/ENG06/025
Mechanical
ENG 214

① $L = 2.0m$

V_1 (smaller end) = 5m/s

V_2 (lower end) = 2m/s

$$h_L = \frac{0.35(V_1 - V_2)^2}{2g}$$

P at smaller head 2.5m

$$\frac{P_2}{w} = \frac{P_1}{w} + \left(\frac{V_1^2 - V_2^2}{2g}\right) + (Z_1 - Z_2)$$

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

$= 2.5 + 1.07 + 2 - 0.16055$

Pressure at lower end

$= 5.409$ bar ≈ 5.41 bar

② Inlet diameter = 0.2m

Throat diameter = 0.1m

$Cd = 0.98$

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

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

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

$$\frac{P_1}{w} = \frac{1.765 \times 10^{-2} N/m}{9.81}$$

$= 1.799 \times 10^{-3}$

$$\frac{P_2}{w} = 0.3 \times 13.6 = 4.08$$

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

$h = 4.082m$

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

$\times \sqrt{2 \times 9.81 \times 4.082}$

$$Q = \frac{0.0002415 \times 89.49}{\sqrt{0.00092}}$$

$$Q = \frac{0.00216}{0.0303}$$

$= 0.0713 m^3/s$

③ $d_1 = 0.15m$, $d_2 = 0.3m$

$S.G = 0.9$ $Cd = 0.64$

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

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

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

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

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

$$= \frac{0.000796 \times 11.7609}{\sqrt{0.000309}} = 0.00499$$

④ $h = 13 = 15m$

170mm (0.17m)

SG Hg 13.6

SG of sea water = 1.026

$$h = 0.17\left(\frac{13.6}{1.026} - 1\right)$$

$= 2.082m$

$v = \sqrt{2gh}$

$= \sqrt{2 \times 9.81 \times 2.083}$

$= 6.39 m/s$