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18/ENG04/054
Electrical/Electronics
ENG 214
Fluid Mechanics

Number 1

d_1 = D of Inlet = 0.3m

A_1 = Area of Inlet = $\frac{\pi(0.3)^2}{4} = 0.0707 m^2$

d_2 = D of throat = 0.15m

A_2 = Area of throat = $\frac{\pi(0.15)^2}{4} = 0.0177 m^2$

S.gr of mercury = 13.6

S.gr of oil = 0.9

Reading of differential manometer = 0.25m

$$h = y\left(\frac{S_{mg}}{S_o} - 1\right)$$

$$h = 0.25\left(\frac{13.6}{0.9} - 1\right)$$

$$h = 0.25(15.11 - 1)$$

$$h = 0.25(14.11)$$

$$h = 3.5275 m$$

Discharge of oil (Q) = $C_d \times \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2gh}$

$$Q = \frac{0.98 \times 0.0707 \times 0.0177}{\sqrt{0.0707^2 - 0.0177^2}} \times \sqrt{2 \times 9.81 \times 3.5275}$$

$$Q = \frac{0.0102}{0.0684} = 0.1491 m^3/s$$

ii) Pressure difference between entrance and throat

$$h = \left(\frac{P_1}{\omega} + Z_1\right) - \left(\frac{P_2}{\omega} + Z_2\right)$$

$$h = \left(\frac{P_1}{\omega} + 0\right) - \left(\frac{P_2}{\omega} + 0.3\right)$$

$$h = \frac{P_1}{\omega} - \frac{P_2}{\omega} - 0.3$$

$$0.3 + 3.5275 = \frac{P_1}{\omega} - \frac{P_2}{\omega}$$

$$\frac{P_1 - P_2}{\omega} = 3.8275$$

$$P_1 - P_2 = 3.8275 \times 1000 \times 9.81$$

$$\Delta P = P_1 - P_2 = 37547.775 \ N/m^2$$

Number 2

Relative density = 0.8

d_1 = D of Inlet diameter = 0.15m

A_1 = A of Inlet = $\frac{\pi (0.15)^2}{4} = 0.0177 m^2$

d_2 = D of throat ~~dia~~ 0.075m

A_2 = A of throat = $\frac{\pi \times (0.075)^2}{4} = 0.0044 m^2$

$Q = 40 l/s = 0.04 m^3/s$

$Cd = 0.96$

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

$$0.04 = 0.96 \times \frac{0.0177 \times 0.0044}{\sqrt{0.0177^2 - 0.0044^2}} \times \sqrt{2 \times 9.81 \times h}$$

$$0.04 = \frac{3.3117 \times 10^{-4}}{0.0171} \times \sqrt{h}$$

$$6.84 \times 10^{-4} = 3.3117 \times 10^{-4} \times \sqrt{h}$$

$$\sqrt{h} = \frac{6.84 \times 10^{-4}}{3.3117 \times 10^{-4}}$$

$$\sqrt{h} = 2.0654$$

$$h = 2.0654^2$$

$$h = 4.2659 m$$