$\frac{[9.130]^2}{2 \times 9.81} = \frac{83.3569}{19.62}$

$= 4.24m$

$h = \left[\frac{P_1}{w_1} + z_1\right] - \left[\frac{P_2}{w_2} + z_2\right]$

$h = \left[\frac{P_1}{w_1} - \frac{P_2}{w_2}\right] + [z_1 - z_2]$

$4.24 = \frac{P_1 - P_2}{w} + [z_1 - z_2]$

$\frac{P_1 - P_2}{w} = 4.24 + [23 - 7.0]$

$\frac{P_1 - P_2}{w} = [4.24 + 0.15]$

$\frac{P_1 - P_2}{w} = 4.39$

$P_1 - P_2 = 4.39 \times 10$

$P_1 - P_2 = 4.39 \times [0.8 \times 9.81 \times 1000]$

$P_1 - P_2 = 4.39 \times 7848$

$P_1 - P_2 = 34452.72 N/m^2$

(a) inlet $d_1 = 300mm = 300 \times 10^{-3} m$, $A_1 = 0.0069$

Throat $d_2 = 150mm = 150 \times 10^{-3} m$, $A_2 = 0.0177$

Sp gd mercury = 13.6, Cd = 0.98

Sp gd oil = 0.9

Differential manometer = 25cm = 0.25m

$h = \left[\frac{S.L}{Sp} - 1\right]$

$h = \left[\frac{13.6}{0.8} - 1\right]$

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18/ENG04/026
Elect/Elect Engineering
Fluid Mechanics Assignment

Relative Density = 0.8
inlet diameter d_1 = 150mm = 150×10^{-3} m
Throat diameter d_2 = 75mm = 75×10^{-3} m
Qact = 40l/sec = $0.04 m^3/secs$
Cd = 0.96
$Z_2 - Z_1$ = 150mm = 0.15m

$$A_1 = \frac{\pi d_1^2}{4} = \frac{\pi \times [150 \times 10^{-3}]^2}{4}$$

$$= 0.0177 m^2$$

$$A_2 = \frac{\pi d_2^2}{4} = \frac{\pi \times [75 \times 10^{-3}]^2}{4}$$

$$= 4.419 \times 10^{-3} m^3$$

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

$$\therefore Q \sqrt{(A_1^2 - A_2^2)} = C_d A_1 A_2 \sqrt{2gh}$$

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

$$2gh = \left[\frac{Q\sqrt{(A_1^2 - A_2^2)}}{C_d A_1 A_2}\right]^2$$

$$h = \frac{\left[\frac{Q\sqrt{(A_1^2 - A_2^2)}}{C_d A_1 A_2}\right]^2}{2g}$$

$$h = \frac{\left[\frac{0.04\sqrt{(0.0177)^2 - [4.419 \times 10^{-3}]^2}}{0.96 \times 0.0177 \times 4.419 \times 10^{-3}}\right]^2}{2 \times 9.81}$$

$$h = \left[\frac{6.835749 \times 10^{-4}}{7.50876 \times 10^{-5}}\right]$$

$h = [14 - 11] \times 0.25$

$h = 3.528m$

$$Q = \frac{Cd \cdot A_1 A_2 \sqrt{2gh}}{\sqrt{[A_1^2 - A_2^2]}}$$

$$Q = \frac{0.98 \times 0.07069 \times 0.0177 \times \sqrt{2 \times 9.81 \times 3.528}}{\sqrt{(0.07069^2 - 0.0177^2)}}$$

$$Q = \frac{0.0102}{0.0689}$$

$$Q = 0.149 m^3/s$$

$$h = \left[\frac{P_1}{w} + Z_1\right] - \left[\frac{P_2}{w} + Z_2\right]$$

$$3.528 = \left[\frac{P_1}{w} - \frac{P_2}{w}\right] - \left[Z_1 - Z_2\right]$$

$$3.528 + [Z_2 - Z_1] = \left[\frac{P_1}{w} - \frac{P_2}{w}\right]$$

ReCall, $Z_2 - Z_1 = 300mm = 0.3m$

$$[3.528 + 0.3] = \left[\frac{P_1 - P_2}{w}\right]$$

$$\frac{P_1 - P_2}{w} = 3.828$$

$$P_1 - P_2 = 3.828 \times w$$

ReCall: $w = 9.81 \times 0.9$

$$P_1 - P_2 = 3.828 \times 9.81 \times 0.9$$

$$P_1 - P_2 = 33.79 kN/m^2$$