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18/ENG04/055

$D_1 = \frac{300}{1000} = 0.3m$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi (0.3)^2}{4} = 0.07m^2$

$D_2 = \frac{150mm}{1000} = 0.15m$

$A_2 = \frac{\pi d^2}{4} = \frac{\pi (0.15)^2}{4}$

Sg of mercury = 18.6

Sg of oil = 0.9

Reading from the manometer

(y) = 250mm = 0.25m

The difference in head in

$y\left[\frac{Sh}{Sp} - 1\right] = 0.26\left[\frac{136}{0.9} - 1\right]$

h = 3.53m of oil

1) Discharge of oil

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

$$Q = \frac{0.98 \times 0.07 \times 0.01767}{\sqrt{0.07^2 - 0.01767^2}} \times \sqrt{2 \times 9.81 \times 3.57}$$

$Q = 0.1489 m^3/s$

11 $\frac{P_1}{w} - \frac{P_2}{w} + (Z_1 - Z_2) = h$

$\frac{P_1 - P_2}{w} - 0.3 = 3.53$

$P_1 - P_2 = 3.83 \times w$

$w = (9.81 \times 0.9) = 8.829$

$P_1 - P_2 = 3.83 \times 8.829$

$= 33.8 kN/m^2$

1) $D_1 = 150mm = 0.15m$

$D_2 = 75mm = 0.075m$

$Z_1 - Z_2 = 150mm = 0.15m$

$Q = 40L/S = \frac{40L/S}{1000} = 0.4m^3/s$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi(0.15)^2}{4}$

$A_1 = 0.175m^2$

$A_2 = \frac{\pi d^2}{4} = \frac{\pi(0.075)^2}{4}$

$A_2 = 0.4178 \times 10^{-3}$

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

$0.04 = 0.96 \times \frac{0.1767 \times 4.4176150^{-3}}{\sqrt{0.1767 \times 4.4176(-3)}} \times 2 \times 9.81 \times \sqrt{h}$

$0.04 = 0.96 \times 0.0279 \times 4.424 \times \sqrt{h}$

$\sqrt{h} = \frac{0.04}{0.96 \times 0.0299 \times 4.424}$

$\sqrt{h} = 0.3778$

$h = 0.1427m$

But $h = \left(\frac{P_1 - P_2}{w}\right) + (z_1 - z_2)$

$0.1427 = \left(\frac{P_1 - P_2}{w}\right) - 0.15$

$\left(\frac{P_1 - P_2}{w}\right) = 0.1427 + 0.15$

$\left(\frac{P_1 - P_2}{w}\right) = 0.2927 \div (P_1 - P_2) = 0.2927 \times w$

$= 0.2927 \times (0.8 \times 1000 \times 9.81)$

$= 2297.1 \text{ km/m}^2$