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18/ENG04/051
ELECT/ELECT
ENG 214 ASS

Specific gravity of mercury (Sm) = 13.6
Specific gravity of oil (Sp) = 0.9
Reading on Manometer (y) = 250mm = 0.25mm
$D_1 = 300mm = 0.3m$
$A_1 = \frac{\pi}{4} \times 0.3^2 = 0.07m^2$

$D_2 = 150mm = 0.15m$
$A_2 = \frac{\pi}{4} \times 0.15^2 = 0.01767m^2$

Differential head = $y\left[\frac{Sm}{Sp} - 1\right]$

$= 0.25\left[\frac{13.6}{0.9} - 1\right]$

$h = 3.53m$

1. Discharge of oil

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

$Q = \frac{0.98 \times 0.07 \times 0.01767}{\sqrt{0.07^2 \times 0.01767^2}} \times \sqrt{2 \times 9.81 \times 3.53}$

$= 0.1487 m^3/s$

4 | $V_R \cdot g\left(\frac{P_1}{w} - \frac{P_2}{w}\right) + (z_1 - z_2) = h$

$$\frac{P_1 - P_2}{w} - 0.3 = 3.73$$

$$P_1 - P_2 = 33.3 \times w$$

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

$$P_1 - P_2 = 3.33 \times 8.829$$

$$= 33.6 \text{ kN/m}^2$$

2. Sp gravity = 0.8

$D_1 = 150\text{mm} = 0.15\text{m}$

$D_2 = 75\text{mm} = 0.075\text{m}$

$z_1 - z_2 = 150\text{mm} = 0.15\text{m}$

$Q = 40\text{ltrs/sec} = 0.04\text{m}^3/\text{s}$

$$A_1 = \frac{\pi}{4} \times 0.15^2 = 0.01767\text{m}^2$$

$$A_2 = \frac{\pi}{4} \times 0.075^2 = 0.00442\text{m}^2$$

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

$$= Cd = \frac{A_1 A_2}{\sqrt{A_1^2 - A_2^2}} \times \sqrt{2g} \times \sqrt{h}$$

$$0.04 \times 0.96 \times \frac{0.01767 \times 0.00442}{\sqrt{0.01767^2 - 0.00442^2}} \times \sqrt{2 \times 9.81} \times \sqrt{h}$$

$$0.04 \times 0.96 \times 0.04765 \times 4.429\sqrt{h}$$

$$\sqrt{h} = \frac{0.04}{0.96 \times 0.04765 \times 4.429}$$

$$\sqrt{h} = 2.060$$

$$h = 4.244\text{m}$$

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

$$4.244 = \left(\frac{P_1 - P_2}{w}\right) - 0.15$$

$$\frac{P_1 - P_2}{w} = 4.244 + 0.15$$

$$= 4.397$$

$$(P_1 - P_2) = 4.394 \times w$$

$$= 4.394 \times (0.8 \times 1000 \times 9.81)$$

$$= 34.51 \text{ kgf/m}^2.$$