OMENDKU PERPETUAL ISHIOMA
18/ENG 061060
MECHANICAL ENGINEERING

1.) Specific gravity = 0.8

Inlet diameter d_1 = 150mm = 0.15m

throat diameter d_2 = 75mm = 0.075m

m ; $z_2 - z_1$ = 0.15m

Q_{act} = 40Ltr/sec

C_{cl} = 0.96

a) Pressure difference

$A_1 = \pi/4 \times 0.15^2 = 0.001767 m^2$

$A_2 = \pi/4 \times 0.075^2 = 0.0042 m^2$

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

$$0.04 = 0.96 \times \frac{0.00176 \times 0.0042}{\sqrt{0.00176^2 - 0.004^2}} \times \sqrt{2 \times 9.81} \times \sqrt{h}$$

Sq.

$$h = \left(\frac{0.04}{0.96 \times 0.00456 \times 4.429}\right)^2$$

$h = 4.247m$

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

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

$$4.247 = \frac{P_1 - P_2}{Pg} - 0.15$$

$(4.247 + 0.15) Pg = P_1 - P_2$

$P_1 - P_2 = 4.397 \times 0.8 \times 1000 \times 9.81 = P_1 - P_2$

$\therefore P_1 - P_2 = 34.51 KN/m^2$ //

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4) According to newtons law

$F = ma$

2) Inlet diameter $d_1 = 300mm = 0.3m$

Area of $d_1 = \pi/4 \times 0.3^2 = 0.07m^2$

Throat diameter $d_2 = 150mm = 0.15m$

Area of $d_2 = \pi/4 \times 0.15^2 = 0.0176m^2$

Sp of mercury $(S_h) = 13.6$

Sp of oil $(S_g) = 0.9$

Reading of differential manometer $y = 250mm = 0.25m$

Recall

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

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

$$= 3.53m \text{ of oil}$$

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

$$Q = \frac{0.07 \times 0.0176}{\sqrt{0.07^2 - 0.0176^2}} \times 0.98 \times \sqrt{2 \times 9.81 \times 3.53}$$

$$Q = 0.1489 m^3/s$$

ii) Pressure difference between entrance and throat sections P_1 P_2

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

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

Recall $z_2 - z_1 = 0.3$

$$h = 3.53 = \left[\frac{P_1}{w} - \frac{P_2}{w}\right] + 0.3 \qquad \text{so } z_1 - z_2 = -0.3$$

$$3.83 = \frac{P_1}{w} - \frac{P_2}{w}$$

$$3.83 = \frac{P_1 - P_2}{w}$$

$$3.83 \times Pg = P_1 - P_2$$

$$3.83 \times (9.81 \times 09) = P_1 - P_2$$

$$P_1 - P_2 = 33.8 KN/m^2 //$$