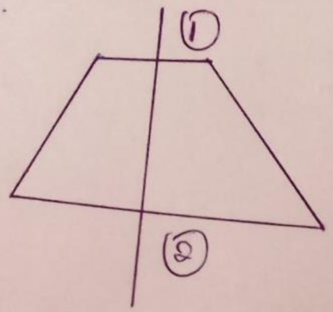
Name: Martins Imikan.
Mat No: 18/ENG04/044
Dept: Electrical

1 Solution.



Let smaller end be represented by (1)
lower end be represented by (2).

Solution

$L = 2.0m$ $P_1/\rho g = 2.5m$

$V_1 = 5m/s$ $V_2 = 2m/s$.

loss of head $= h_L = \frac{0.35(V_1 - V_2)^2}{2g} = \frac{0.35(5-2)^2}{2g} = \frac{0.35(3)^2}{2 \times 9.81} = \frac{0.35(9)}{2 \times 9.81} = 0.16m$

Pressure Head $= P_2/\rho g = ?(m)$.

Applying Bernoulli's equation at (1) & (2)

$P_1/\rho g + V_1^2/2g + Z_1 = P_2/\rho g + V_2^2/2g + Z_2 + h_L$

$Z_2 = 0, \; Z_1 = 2.0$

$\therefore \; 2.5 + \frac{(5)^2}{2 \times 9.81} + 2.0 = P_2/\rho g + \frac{(2)^2}{2 \times 9.81} + 0.016$

$2.5 + 1.27 + 2.0 = P_2/\rho g + 0.203 + 0.16$

$P_2/\rho g = (2.5 + 1.27 + 2.0) - (0.203 + 0.16)$

$= 5.77 - 0.363 = 5.407$

$= 5.4m$ of fluid.

② DATA

Inlet diameter $(D_1) = 20cm = 0.2m$

throat diameter $(D_2) = 100 = 0.10m$

Area of inlet $a_1 = \frac{\pi}{4} \times (0.2)^2 = 0.03146m^2$.

Area of throat $= \frac{\pi}{4} \times (d_2) = \pi/4 \times (0.1)^2 = 0.007854cm$

$Cd = 0.98$

Pressure $(P_1) = 17.685 \times 10^4 N/m^2$.

$\rho = 10000 kg/m^3$

$\therefore P^1/P_{4}g = \frac{17.653 \times 10^4}{9.81 \times 1000} = 18m$

$P_2/P_4g = 30cm$ of mercury $= -0.3 \times 13.6 = -4.08$.

Differential head $= h = P_1/P_4 - P_2/P_4 = 18 - (-4)$

$= 22.08m$ (water).

$$Q = \frac{Cd \times a_1 \, a_2 \sqrt{2gh}}{\sqrt{(a_1)^2 - (a_2)^2}}$$

$$= \frac{0.98 \times 314.16 \times 0.007854}{\sqrt{(314.16)^2 - (0.001854)^2}}$$

$= 5032883 7.21 \times 165355$

(30 LE

165.56 lit/s.

(3)

DATA.

Orifice Diameter = 15cm.

Pipe Diameter = 30cm.

Coefficient of dischage of the metre = 0.64.

Flow of oil specific gravity = 0.9

Soln:

$A_o = \frac{\pi}{4}(15)^2 = 176.714 cm^2$ (A_o area of the orifice).

$A_p = \frac{\pi}{4}(30)^2 = 706.858 cm^2$ (Area of A_p pipe).

$H = \left[\frac{13.6}{0.9}\right] \times 50$ cm of oil

$= [15.1 - 1] \times 50 = 14.1 \times 50$

$= 705 \times 56$

$\therefore Q = \frac{C_d A_o A_p}{\sqrt{(A_p)^2 - (A_o)^2}} \sqrt{2gh}$

$Q = \frac{(0.64 \times 176.71 \times 706.86 \times \sqrt{2 \times 9.81 \times 7.05 \times 100}}{\sqrt{706.85)^2 - (176.74)^2}}$

$= \frac{0.64 \times 176.71 \times 706.85}{\sqrt{706.858^2 - 176.74)^2}} \times \sqrt{2 \times 9.81 \times 7.05 \times 100}$ cm^3/sec.

$Q = 137414\ 25 cm^3/sec$

litres = 137.41425 lit/sec

Rate of flow of Oil = 137.414 lit/sec.

(4)

Diff of Mercury level, $x = 170mm = 0.17m$

Sp gr of Mercury = 13.6

Specific gravity (Sp) of Seawater = 1.026

Solution

$$H = x\left[\frac{S_g}{S_o} - 1\right] = 0.17\left[\frac{13.6}{1.026} - 1\right]$$

$= 2.0834m$

$V = \sqrt{2gh}$.

$= 2 \times 9.81 \times 2.08$

$= 6.39 m/s$

$$= \frac{6.39 \times 60 \times 60}{1000}$$

$= 23004/1000 = 23.0004$

Speed of Sub = 23.004 Km/hr

(5)

Rate of Pump = $0.05 m^3/min = 5000 dm^3/min$
Pressure Change = 15 bar.
Speed of Rotation = 1700 rev/min.
Normal displacement = $10 cm^3/rev$
Torque enpect = 15 N/m

Solution.

Ideal flow rate = Normal displacement × Speed
= 15 × 1700 = 25,500 cm^3/min
= 25.500 dm^3/min.
≃ 25.5

Volumetric Efficiency
= $\frac{\text{Actual flow}}{\text{Ideal flow}} = \frac{500}{25.5} = 19.60$

$Q = \frac{(500 \times 10^{-3})}{60 m^3/s} = 83.3 \times 10^{-4} m^3/s$

Fluid Power

$\Delta P = 100 \times 10^5 N/m^2$

Fluid Power = $Q \Delta P = 83.3 \times 10^{4} \times 100 \times 10^5$

Fluid power = 83300W

Shaft Power =
$= 2\pi NT/60 = \frac{2\pi \times 1700 \times 25.5}{60} = 4541.4 N/m$

Overall Efficiency.

$= \frac{\text{Fluid power}}{\text{Shaft Power}} = \frac{83,300}{4541.4} = 18.342.$

Overall Efficiency = 18.342 or 1834.2 %