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Computer Engineering.

(1) $L = 2.0m$
$V_1 = 5m/s$, $V_2 = 2m/s$
$P_s = 2.5m$

Loss of head $= H_L = \frac{0.35(V_1 - V_2)^2}{2g}$

$= \frac{0.35(3)^2}{2 \times 9.81} = 0.161m$

$P_L = ?$

$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2 + H_L$

$Z_1 = 2.0$, $Z_2 = 0$, $P_1/\rho g = P_s$, $P_2/\rho g = P_L$

$\therefore 2.5 + \frac{5^2}{2(9.81)} + 2.0 = P_L + \frac{2^2}{2(9.81)} + 0 + 0.161$

$\therefore P_L = 5.774 - 0.365 = 5.409m$ of Liquid

(2) $D_1 = 20cm$, $D_2 = 10cm$,
$A_1 = 314.16cm^3$ $A_2 = 78.54cm^2$
$\rho(water) = 1000kg/m^3$

pressure at inlet $= 17.658 N/cm^2 = 17.658 \times 10^4 N/m^2$

$\therefore P_3 = P_1/\rho g = \frac{17.658 \times 10^4}{1000 \times 9.81} = 18m$

$\frac{P_2}{\rho g} = -30cm$ of Hg, $sg_{Hg} = 13.6$

$P_2 = \frac{P_2}{\rho g} = -30 \times 10^{-2} \times 13.6 = -4.08m$

$\therefore H_d = P_3 - P_2 = 18 - (-4.08) = 22.08m$
$= 2208cm$

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

$= \frac{0.98 \sqrt{2 \times 9.81 \times 2208} \times 314.16 \times 78.54}{\sqrt{314.16^2 - 78.54^2}}$

$= 165455.3 cm^3/s = 165.455 L/s$

3 $d_1 = 30cm$, $d_2 = 15cm$, $A_1 = 706.86cm^2$, $A_2 = 176.72cm^2$

$S_0 = 0.9$, $S_{Hg} = 13.6$

Differential Manometer Reading, $X_1 = 50cm$ Hg

$C_d = 0.64$

$H_d = 50\left(\frac{13.6}{0.9} - 1\right) = 705.56cm$ of Oil

$\therefore Q = \dfrac{0.64 \times \sqrt{2 \times 9.81 \times 705.56} \times 706.86 \times 176.72}{\sqrt{(706.86)^2 - (176.72)^2}}$

$Q = 137443.29 cm^3/s = 137.44 l/s$

4) difference of mercury = 170mm = 0.17m
S_{Hg} = 13.6, Specific gravity of sea water = 1.026
speed, $V = \sqrt{2gh}$
$h = 0.17\left[\frac{13.6}{1.026} - 1\right] = 2.0834m$

$\therefore V = \sqrt{2 \times 9.81 \times 2.0834} = 6.393 m/s$

5 Q = $50 dm^3/min$, $P_0 = 15 \times 10^5 N/m^2$, Speed = 1700 rev/min
T = 15Nm, VD = $10 cm^3/rev$

i) Volumetric efficiency (V.E) = $\dfrac{\text{Actual flow rate}}{\text{Ideal flow rate}} \times 100\%$
Ideal flow rate = $0.017 m^3/min$, Actual = $0.05 m^3/min$

$\therefore V.E = \dfrac{0.05}{0.017} \times 100 = 294\%$

ii Fluid power = $15 \times 10^5 \times \dfrac{0.05}{60}$ = 1249.5W

iii) Shaft power = $\dfrac{2\pi NT}{60} = \dfrac{2 \times \pi \times 1700 \times 15}{60}$
= 2670.35W

iv Overall efficiency = $\dfrac{1249.5}{2670.35} \times 100$
= 46.9%