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18/ENG06/005
MECHANICAL ENGINEERING

2) $L = 2.0$

Velocity flow of smaller end $V_1 = 5m/s$

Velocity flow of larger end $V_2 = 2m/s$

let the loss of head $= \frac{0.32(V_1 - V_2)^2}{2g} = 0.16m$

Using bernoullis method

$$\frac{P_1}{\rho g} + \frac{V^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V^2}{2g} + z_2 + 4$$

where $P_3 = \frac{P_1}{\rho g}$ $\quad P_e = \frac{P_2}{\rho g}$

$$2.5 + \frac{25}{19.62} + 2 = P_2 + \frac{4}{19.62} + 0.161$$

$$5.774 - 0.365 = P_2$$

$$P_2 = 5.409m$$

2) $D_1 = 20cm$ $\quad A_1 = 314.16\ cm^2$

$D_2 = 40cm$ $\quad A_2 = 78.54\ cm^2$

$P = 1000\ kg/m^3$

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

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

$$= 4.08m$$

$$= 18 + 4.08 = 2208 \times 100$$

$$= 0.98\sqrt{(2 \times 9.81 \times 22.08)} \times (314.16 \times 78.54)$$

$$= \sqrt{(314.16)^2 - (78.54)^2}$$

$$= 165455.3\ cm^3/s$$

3 $d_1 = 30$ $A_1 = 706.86cm^2$

$d_2 = 15$ $A_2 = 176.72cm$

S.g of oil = 0.9

S.g of mercury = 13.6

Differential manometer reading $x = 50cm$

$$h = 50\left(\frac{13.6}{0.9} - 1\right)$$

$h = 705.56cm$

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

$$Q = \frac{137443.29}{1000} = 137.443\,l$$

4) S.g of mercury = 13.6

S.g of water = 1.026

mercury load = 170mm $U = ??$

$$h = 0.17\left[\frac{13.6}{1.026} - 1\right] = 2.0834$$

$U = \sqrt{2gh} = 6.393\,m/s$

$$U = \frac{6.393 \times 60^2}{1000} = 23.01\,km/hr$$