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17/ENG03/056

Eng 214 Fluid Mech.

1) L = 2.0m

v_1 Smaller end = 5m/s

v_2 lower end = 2m/s

$h = \frac{0.35(v_1 - v_2)^2}{2g}$

P_1 at Smaller head = 2.5m

$\frac{P_2}{w} = \frac{P_1}{w} + \frac{(v_1^2 - v_2^2)}{2g} + (Z_1 - Z_2)$

$= 2.5 + \frac{5^2 - 2^2}{2 \times 9.81} + \frac{2(0.35(5-2))^2}{2 \times 9.81}$

$= 2.5 + 1.07 + 2 - 0.16050$

$P_2 = 5.409$ bar

Pressure at lower end is 5.409 bar

2) Inlet diameter = 20cm

Throat diameter = 10cm

$P_1 = 17.658N$

J = 300m of mercury

$C_d = 0.98$

$A_1 = \frac{\pi d^2}{4} = \frac{\left(\frac{20}{100}\right)^2 \times 3.14}{4}$

$= 0.0314 m^2$

$A_2 = \frac{\pi D}{4} = \frac{\left(\frac{10}{100}\right)^2 \times 3.14}{4}$

$= 7.853 \times 10^{-3}$

J = 30cm ~~of mer~~ (0.3m of mercury)

$P_1 = 17.658$

$= \frac{17.658}{1000} = 1.7658 \times 10^{-3}$ N/mm

$\frac{P_1}{w} = \frac{1.7658 \times 10^{-3}}{9.81} = 1.8 \times 10^{-4}$

$\frac{P_2}{w} = \frac{1.7658 \times 10^{-3}}{9.81} = 1.8 \times 10^{-4}$

$\frac{P_2}{w} = 0.3 \times 13.6 = -4.08$ of H_2O

$h = \frac{P_1}{w} - \frac{P_2}{w} = 1.8 \times 10^{-4} - (-4.08)$

$h = 4.08018m$

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

$Q = \frac{0.98 \times 0.0314 \times 7.853 \times 10^{-3}}{\sqrt{(0.0314)^2 - (7.853 \times 10^{-3})^2}}$

$Q = \frac{0.000241 \times 8.947}{0.0304}$

$Q = 0.0709 m^3/s$

3) D_1 = 15cm D_2 = 30cm

500m of mercury = 0.5m Q = ?

$S.G = 0.9$ $C_d = 0.64$

$A_1 = \frac{\pi d^2}{4} = \frac{\left(\frac{15}{100}\right)^2 \times 3.14}{4}$

$= 0.0176 m^2$

$A_2 = \frac{\pi d^2}{4} = \frac{\left(\frac{30}{100}\right)^2 \times 3.14}{4} = 0.0706$

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

$h = 0.5\left[\frac{13.6}{0.9} - 1\right]$

$h = 1.05m$ of oil

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

$Q = \frac{0.64 \times 0.0176 \times 0.0706 \sqrt{2 \times 9.81 \times 7.05}}{\sqrt{(0.0706)^2 - (0.0176)^2}}$

$Q = \frac{9.95 \times 10^{-3}}{4.0112}$

$Q = 2.55 \times 10^{-3} m^3/s$

4) A_{xis} = 15m

170mm of mercury (0.17m)

SG of mercury (13.6)

SG of sea water = 1.026 water

$h = J\left(\frac{S_g}{S} - 1\right)$

$h = 0.17\left(\frac{13.6}{1.026} - 1\right)$

$h = 2.0863$

$v = \sqrt{2gh}$

$v = \sqrt{2 \times 9.81 \times 2.0863}$

$v = 6.39 ms^{-1}$

5 $0.05 m^3/m^n$

15 bar

17500 Pa

10 cm^2 Pa

15 Nm