I CHIKOBORA DANIEL MINE ~~18/ENG04/~~
18/ENG04/042

ENG214

SINGLE CASH

1 $Z_1 = 2m$, $Z_2 = 0m$, $L = 2m$, $V_1 = 5m/s$, $V_2 = 2m/s$

$\frac{P_1}{W} = 2.5m$

Head loss $= \frac{0.35(5.2)^2}{2 \times 9.81}$

Head loss $= 0.160m$

Applying Bernoulli equation

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

$2.5 + \frac{5^2}{2 \times 9.81} + 2 = \frac{P_2}{W} + \frac{2^2}{2 \times 9.81} + 0 + 0.160$

$5.774m = \frac{P_2}{W} + 0.3640$

$\frac{P_2}{W} = 5.7742 - 0.3640$

$\frac{P_2}{W} = 5.4102m$

2 $d_1 = 20cm = 0.2m$, $Cd = 0.98$

$A = \frac{\pi(d^2)}{4} = \frac{\pi \times 0.2^2}{4} = 0.0314m^2$

$d_2 = 10cm = 0.1m$

$A_2 = \frac{\pi(d_2)^2}{4} = 0.00785m^2$

$P_1 = 17.658N/cm^2 = 176580N/m^2$

$\frac{P_1}{W} = \frac{P_1}{\rho g} = \frac{176580}{1000 \times 9.8} = 18m$

Vacuum pressure $= 30cm$ of mercury (Hg)

$= -0.3m$ mercury (Hg)

$P_2 = -0.3 \times 13.6$

$\frac{P_2}{W} = -4.08$

$h = \frac{P_1 - P_2}{W} = 22.08$

SINGLE CASH

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

$Q_{actual} = \frac{0.98 \times 0.03142 \times 0.00785 \times \sqrt{2 \times 9.81 \times 22.08}}{\sqrt{0.03142^2 - 0.00785^2}}$

$Q_{actual} = \frac{5.03472 \times 10^{-3}}{0.03042}$

$Q_{actual} = 0.1655m^3/s$

3 $d_0 = 15cm = 0.15m$

$A_0 = \frac{\pi d^2}{4} = 0.0707m^2$ $Cd = 0.64$

difference reading $(y) = 0.5m$

S_{Hg}) specific gravity of mercury $= 13.6$

Specific gravity of oil (soil) $= 0.9$

Difference head $(L) = y\left[\frac{S_{Hg}}{S_{oil}} - 1\right]$

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

$= 7.055m$

$Q = \frac{Cd A_0 A_1 \times \sqrt{2gh}}{\sqrt{A_1^2 - A_0^2}}$

$Q = \frac{0.64 \times 0.177 \times 0.0707 \times \sqrt{2 \times 7.81 \times 7.055}}{\sqrt{0.0707^2 - 0.0177^2}}$

$Q = \frac{9.4226 \times 10^{-3}}{0.0684}$

$Q = 0.1378m^3/s$