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DEPARTMENT: AERONAUTICAL ENGINEERING

COURSE: ENG214

ASSIGNMENT

1. Discharge (Q) = 40litres/sec = $\frac{40m^3}{1000\ secs}$ = 0.04m^3/sec

Diameter of inlet (d_1) = 150mm = 0.15m

Area of inlet (A_1) = $\frac{\pi \times d1^2}{4} = \frac{\pi \times 0.15^2}{4}$ = 0.0177m^2

Diameter of throat (d_2) = 75mm = 0.075m

Area of inlet (A_2) = $\frac{\pi \times d2^2}{4} = \frac{\pi \times 0.075^2}{4}$ = 4.42×10^{-3}m^2

C_d = 0.96

Datum head (H) = $Z_2 - Z_1$ = 150mm = 0.15m

$Q = \frac{Cd \times A2 \times A1 \times \sqrt{(2 \times g \times (h-H))}}{\sqrt{(A1^2 - A2^2)}}$

Hence, $h = H + \frac{Q^2}{(Cd \times A2 \times A1)^2} \times \frac{A1^2 - A2^2}{2 \times g}$

$h = 0.15 + \frac{0.04^2}{(0.96 \times 0.0177 \times 4.42 \times 10^{-3})^2} \times \frac{(0.0177^2 - (4.42 \times 10^{-3})^2)}{2 \times 9.81}$

h = 4.4m

$h = \frac{P1 - P2}{w}$

where $w = \rho_{liquid} \times g$

$\rho_{liquid} = S.G_{liquid} \times \rho_{water}$

ρ_{water} = 1000kg/m^3

$S.G_{liquid}$ = 0.8

ρ_{liquid} = 0.8×1000 = 800kg/m^3

W = 800×9.81 = 7848N/m^3

$P_1 - P_2 = w \times h$

$P_1 - P_2 = 7848 \times 4.4$

$P_1 - P_2 = 34531.2 N/m^2$.

2. Diameter of inlet (d_1) = 300mm = 0.3m

   Diameter of throat (d_2) = 150mm = 0.15m

   Area of inlet (A_1) = $\frac{\pi \times d1^2}{4} = \frac{\pi \times 0.3^2}{4}$ = $0.071 m^2$

   Area of throat (A_2) = $\frac{\pi \times d2^2}{4} = \frac{\pi \times 0.15^2}{4}$ = $0.0177 m^2$

   Datum head (H) = Z_2 - Z_1 = 300mm = 0.3m

   C_d = 0.98

   Differential manometer reading (y) = 250mm = 0.25m

   $S.G_{oil}$ =0.9

   $S.G_{Hg}$ = 13.6

   $h = y \times [\frac{S.GHg}{S.Goil} - 1]$

   $h = 0.25 \times [\frac{13.6}{0.9} - 1]$

   h = 3.528m

   $Q = \frac{Cd \times A2 \times A1 \times \sqrt{(2 \times g \times (h - H))}}{\sqrt{(A1^2 - A2^2)}}$

   $Q = \frac{0.98 \times 0.0177 \times 0.071 \times \sqrt{(2 \times 9.81 \times (3.528 - 0.3))}}{\sqrt{(0.071^2 - 0.0177^2)}}$

   $Q = 0.142 m^3/sec$//

   $h = \frac{P1 - P2}{w}$

   where w = $\rho_{oil} \times g$

   $\rho_{liquid} = S.G_{oil} \times \rho_{water}$

   ρ_{water} = $1000 kg/m^3$

   $S.G_{liquid}$ = 0.9

   ρ_{liquid} = $0.9 \times 1000 = 900 kg/m^3$

   W = $900 \times 9.81 = 8829 N/m^3$

   $P_1 - P_2 = w \times h$

$P_1 - P_2 = 8829 \times 3.528$

$P_1 - P_2 = 31146.75 N/m^2$.