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18/Eng03/031

1) $V_1 = 5m/s$ $V_2 = 2m/s$

~~$P_1/w = P_1/w = 2.5m$~~

$P_{T1} = 2.5m$ ~~P_{T2}~~ $= ?$

$P_{T1} - P_{T2} = 0.35 \frac{(V_1 - V_2)}{2g} = \frac{0.35 \times 3^2}{2 \times 9.81} = 0.16$

$\therefore P_{T1} - P_{T2} = 0.16$

$2.5 - P_{T2} = 0.16$

$P_{T2} = 2.5 - 0.161$

$P_{T2} = 2.07m$

2) $P_1 = 17.058 N/cm^2$

$P_2 = 30cm\ Hg$

$Cd = 0.98$

$Q = ?$

$A = \frac{\pi \times (20 \times 10^{-2})^2}{4}$ $A_2 = \frac{\pi \times (10 \times 10^{-2})^2}{4}$

$= 0.03m^2$ $= 7.85 \times 10^{-3} m^2$

$P_2/w = 0.3 \times 13.6 = 4.08mHg$

$\frac{P_2}{w} = 4.08$ (due to vacum pressure)

$P_1/w = \frac{17.058 \times 10^4}{9.81 \times 10^3} = 18$

$h = \frac{P_1}{w} - \frac{P_2}{w} = 18 - 4.08 = 22.08$

$Q = \frac{Cd A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2}} = \frac{0.98 \times 0.03 \times (7.85 \times 10^{-3}) \times (\sqrt{2 \times 9.81 \times 22.08}}{\sqrt{(0.03)^2 - (7.85 \times 10^{-3})^2)}}$

$Q = 0.1667 m^3/s$

3) $d_0 = 15\times10^{-2}m$

$$A_0 = \frac{\pi \times (15\times10^{-2})^2}{4} = 0.017$$

$d_1 = 30\times10^{-2}m$

$Cd = 0.64$

$y = 50\times10^{-2} mHg$

S_g of soil $= 0.9$

$\delta_m = 13.6$

$\delta_0 = 0.9$

$$A_1 = \frac{\pi (30\times10^{-2})^2}{4} = 0.707 m^2$$

$$H = 50\times10^{-2}\left[\frac{13.6}{0.9} - 1\right]$$

$H = 7.055 m$

$$Q = \frac{Cd\, A_0 A_1 \sqrt{2gh}}{\sqrt{A_1^2 - A_0^2}} = \frac{0.64\times0.017\times0.0707\times\sqrt{2\times9.8\times7.055}}{0.0707^2 - 0.0178^2}$$

$Q = 0.187 m^3/s$

4) $y = 170 mmHg$

δ_y of mercury $= 13.6$

δ_y of sea water 1.026

$V = \sqrt{2gH}$ $\qquad H = y \times \frac{\delta_{h_1}}{\delta_{h_0}} - 1$

$V = \sqrt{2\times9.81\times2.08}$ $\qquad H = 170\times10^{-3}\times\left(\frac{13.6}{1.026} - 1\right)$

$V = 6.39 m/s$

$H = 2.08 m$

5) Q =

Volum

Actua

Ideal

Ideal

v =

Fluid

8

s ha

w

w

The

12

2

5) Q = 5dm³/min = 8.33×10^{-5}

P = 15 bar = 15×10^{5} N/m2

N = 1700 r/min = 28.33 m/s

T = 15 N/m normal displacement = 100cms

= 1.10 m3/rev

Volumetric efficiency

$\frac{\text{Actual flowrate}}{\text{Ideal flowrate}} \times 100\%$

Ideal flowrate = displacement × speed

$\eta = \epsilon = \frac{8.33 \times 10^{-5}}{2.833 \times 10^{-4}} \times 100$

Fluid power (Q × ΔP)

$8.33 \times 10^{-5} \times 15 \times 10^{5}$ = 124.95 watt

Shaft power = T × ω

ω = 2 × π ω

= T × ω

ω = 15 × 178 = 2620

The overall efficiency

$\frac{\text{Fluid power}}{\text{Shaft power}} \times 100$

$\frac{124.95}{2620} \times 100 = 4.68\%$