ii) Volumetric Efficiency = $\frac{\text{Actual flowrate}}{\text{Ideal flowrate}} \times 100$

$= \frac{8.33 \times 10^{5}}{2.83 \times 10^{-4}} \times 100$

$= 29.45\%$

iii) Fluid power, $P_F = Q \times \Delta P$

$= 8.83 \times 10^{-3} \times 15 \times 10^{5}$

$= 124.95 \text{ watts}$

iii) Shaft power, $= T \times \omega$

$\omega = 2 \times \pi \times$ speed of rotation

$\omega = 2 \times \pi \times 28.3$

$\omega = 177.81 \text{ rad/sec}$

Shaft power $= 15 \times 177.81$

$= 2667.2 \text{ watts}$

iv) Overall Efficiency = $\frac{\text{fluid power}}{\text{Shaft power}} \times 100$

$= \frac{124.95}{2667.2} \times 100$

$= 4.68\%$

olator

$5hl = 13.6$

$y = 50 \times 10^{-2}$

$h = 50 \times 10^{-2} \left[\frac{13.6}{0.9} - 1 \right]$

$h = 50 \times 10^{-2} \times 14.11$

$= 7.055m$

$Q = \frac{C_d A_0 A_p \sqrt{2gh}}{\sqrt{A_p^2 - A_0^2}}$

$= \frac{0.64 \times 0.01767 \times 0.07069 \times \sqrt{2 \times 9.81 \times 7.055}}{\sqrt{(0.07069^2) - (0.01767^2)}}$

$= \frac{7.994 \times 10^{-4} \times 11.765}{\sqrt{4.68 \times 10^{-3}}}$

$= 0.1374 m^3/s$

4) $y = 170mmHg = 0.17mHg$, $S.g_{Hg} = 13.6$

$\Delta h = y \left(\frac{S.g_{Hg}}{S.g_w} - 1 \right)$

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

$\Delta h = 2.08m$

$v = \sqrt{2g\Delta h}$

$v = \sqrt{2 \times 9.81 \times 2.08}$

$v = 6.388 m/s$

5) $Q = 0.05 dm^3/mm = 8.33 \times 10^{-5} m^3/sec$

Speed of Rotation $= 1700 Rev/min = 28.3 Rev/sec$

Nominal Displacement $= 10 cm^3/rev = 10^{-5} m^3/rev$

Torque Input $= 15 Nm$

Pressure change $= 15 bar = 15 \times 10^5 N/m^2$

Ideal flowrate = Nominal displacement x speed Rotation

$= 10^{-5} \times 28.3 = 2.83 \times 10^{-4} m^3/sec$

i) Volumetric

ii) Fluid p

iii) Shaft p

$w = 2 \times$

$w = 2 \times$

$w = 17$

Shaft pow

iv) Overal

$\frac{P_1}{w} - \frac{P_2}{w} = h$

$P_1 = 17.668 \times 10^4 N/m^2$

$w = 9.81 \times 10^3 N/m^3$

But we have that throat vacuum pressure = 30cm of Hg
= 0.3m of Hg

$= 0.3 \times 13.6 = 4.08$

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

$\frac{P_1}{w} = \frac{17.658 \times 10^4}{9.81 \times 10^3} = 18$

$\therefore \frac{P_1}{w} - \frac{P_2}{w} ; 18 - (-4.08) = 22.08$

$Q = Cd A_1 A_2 \sqrt{\frac{2gh}{(A_1^2 - A_2^2)}}$

$= 0.98 \times 0.0314 \times 7.85 \times 10^{-3} \times \sqrt{\frac{2 \times 9.81 \times 22.08}{(0.0314^2 - (7.85 \times 10^{-3})^2)}}$

$= 2.4156 \times 10^{-4} \times 684.59$

$= 0.1653 m^3/s$

3) Orificemeter; Given that

$d_o = 15cm = 15 \times 10^{-2} m$

$A_o = \frac{\pi \times (15 \times 10^{-2})^2}{4}$

$= 0.01767 m^2$

$dp = 30cm = 30 \times 10^{-2} m$

$Ap = \frac{\pi \times (30 \times 10^{-2})^2}{4}$

$= 0.07069 m^2$

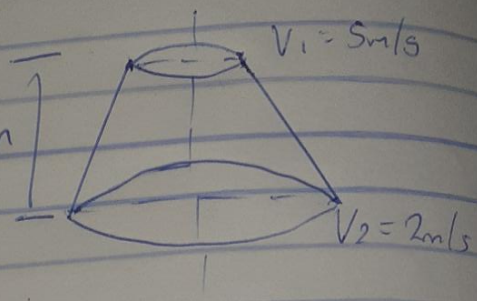
S.P.G of Oil = 0.9 (S_o)

Coefficient of discharge = 0.64

Reading of differential = 50cm Hg

Differential head $h_1 = y \left[\frac{S_1}{S_0} - 1\right]$

BITRUS JESSE
Computer Engineering
18/ENG02/028



1) $\frac{P_1}{w} = \frac{P_1}{w}$

$= 2.5m$

$H_L = \frac{0.35(V_1 - V_2)^2}{2g}$

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

$\frac{P_2}{w} - \frac{P_1}{w} = \frac{V_1^2 - V_2^2}{2g} + (Z_1 - Z_2) - \frac{0.35(V_1 - V_2)^2}{2g}$

$\frac{P_2}{w} = 2.5 + \frac{5^2 - 2^2}{2(9.81)} + 2 - \frac{0.35(5-2)^2}{2(9.81)}$

$\frac{P_2}{w} = 2.5 + 1.07 + 2 - 0.161$

$\frac{P_2}{w} = 5.409m$

2) $D_1 = 20cm = 20 \times 10^{-2} m$

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

$A_1 = 0.0314 m^2$

$P_1 = 17.668 N/cm^2$

$= 17.668 \times 10^4 N/m^2$

$Cd = 0.98$

Throat diameter $d_2 = 10cm = 10 \times 10^{-2} m$

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

$A_2 = 7.85 \times 10^{-3} m^2$