18|ENG03|013

(1) $L = 2m$

$V_1 = 5m/s$

$V_2 = 2m/s$

$h_1 = 2.5m \Rightarrow \frac{P_1}{w} + z$

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

$h_f = 0.35 \frac{(5 - 2)^2}{2g}$

$h_f = 0.16$

from Bernouli's equation

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

$$25 + \frac{5^2}{19.62} = \left(\frac{P_2}{\rho g} + Z_2\right) + \frac{2^2}{2g} + 0.16$$

$$25 + \frac{25}{19.62} - \frac{4}{19.62} - 0.16 = h_2$$

$h_2 = 25.9 \simeq 80$

$Q = 0.98 ($

$Q = 0.98 (2$

$Q = 1.46 \times$

(3) $d_1 = 15cm$

$d_2 = 30cm$

$d_1 \simeq 0.15m$

$d_2 \simeq 0.30m$

$A_1 = \pi \frac{d_1^2}{4}$

$A_2 = \pi \frac{d_2^2}{4}$

$H = 5.6 m$

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

$$25 + \frac{5^2}{19.62} = \left(\frac{P_2}{\omega} + Z_2\right) + \frac{2^2}{2g} + 0.16$$

$$25 + \frac{25}{19.62} - \frac{4}{19.62} - 0.16 = h_2$$

$$h_2 = 25.9 \simeq 80$$

② $d_1 = 20cm \simeq 0.2m$

$d_2 = 10cm \simeq 0.1m$

$h = 30cm \simeq 300mm = 0.3m$

$P_1 = 17.658 N/cm^2 \simeq 17.658 \times 10^4 N/m^2$

$cd = 0.98$

$A_1 = \pi \frac{d_1^2}{4} = 0.0314 m^2$

$A_2 = \pi d_2^2/4 = 7.85 \times 10^{-3} m^2$

$$h_1 = \frac{P_1}{\omega} = \frac{17.658 \times 10^4}{1000 \times 9.81} = 1732.24$$

$h = 1732.24 + 0.3 = 1732.54$

$d_2 = 30cm$

$d_1 \simeq 0.15m$

$d_2 \simeq 0.30m$

$A_1 = \pi \frac{d_1^2}{4} = 1$ [illegible]

$A_2 = \pi d_2^2/4 =$ [illegible]

$H = S.G$ Mano [illegible]

$= 13.6 \times$ [illegible]

$= 6.8m$

$Q = cd \times a_1$ [illegible]

$= 0.64 (1.76$ [illegible]

$= 0.64 (123 \times 10$ [illegible] $/ 1.27 \times$ [illegible]

$= 8.26 \times 10$ [illegible]

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

$$Q = 0.98 \left(\frac{0.0314 \times 7.85 \times 10^{-3} \sqrt{2 \times 9.81 \times 1732.5}}{\sqrt{9.24 \times 10^{-4}}} \right)$$

$$Q = 0.98 \left(\frac{2.46 \times 10^{-4} \times 184.37}{\sqrt{9.24 \times 10^{-4}}} \right)$$

$$Q = 1.46 \times 10^{-6}$$

(3) $d_1 = 15cm$ $\quad$ $S.G = 0.9$

$d_2 = 30cm$ $\quad$ $cd = 0.64$

$d_1 \simeq 0.15m$ $\quad$ $h = 50cm \simeq 0.50m$

$d_2 \simeq 0.30m$

$$A_1 = \frac{\pi d_1^2}{4} = 1.76 \times 10^{-2}$$

$$A_2 = \frac{\pi d_2^2}{4} = 7.0 \times 10^{-2} m^2$$

$$H = \frac{S.G\ Manofluid \times S.G\ oil}{S.g\ oil} \times \text{guage reading}$$

$$= \frac{13.6 \times 0.9 \times 0.50m}{0.9}$$

$$= 6.8m$$

$$Q = cd \times \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \times \sqrt{2gh}$$

$$= 0.64 \left(\frac{1.76 \times 10^{-2} \times 7.0 \times 10^{-2}}{\ldots} \right) \times \ldots$$

+ Z_2 + h_f

+ $\frac{2^2}{2g}$ + 0.16

= h_2

$d_2 = 30cm$ $cd = 0.64$

$d_1 \simeq 0.15m$ $h = 50cm \simeq 0.50m$

$d_2 \simeq 0.30m$

$A_1 = \frac{\pi d_1^2}{4} = 1.76 \times 10^{-2}$

$A_2 = \pi d_2^2/4 = 7.0 \times 10^{-2} m^2$

$H = \frac{S.G\ Manofluid \times S.G\ oil \times guage\ reading}{S.g\ oil}$

$= \frac{13.6 \times 0.9 \times 0.50m}{0.9}$

$= 6.8m$

$Q = cd \times \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \times \sqrt{2gh}$

$= 0.64 \left(\frac{1.76 \times 10^{-2} \times 7.0 \times 10^{-2}}{\sqrt{(1.76 \times 10^{-2})^2 - (7.0 \times 10^{-2})^2}} \times \sqrt{2 \times 9.81 \times 6.8} \right)$

$= 0.64 \left(\frac{123 \times 10^{-3}}{1.27 \times 10^{-2}} \times 133.4 \right)$

$= 8.26 \times 10^{-4} m^3/s$

0.16

n/m^2

.24

2.54

(4) S.g of Mercury = 13.6
Sg of water = 1.026

$V = \sqrt{2gh}$

$H = x\left[\frac{S_g}{S_o} - 1\right]$

$x = \frac{170}{1000} = 0.17$

Substituting $V = \sqrt{2 \times g \times \left[x\left[\frac{S_g}{S_o} - 1\right]\right]}$

$V = \sqrt{2 \times 9.81 \times \left[0.17 \times \frac{13.6}{1.026} - 1\right]}$

$V = 6.4 \, m/s$

(5)

5) $Q = 0.05 m^3/min = 8.33 \times 10^{-5} m^3/s$

$P = 15 bar$

Speed = 1700 rpm = 28.33 m/s

displacement = $10 cm^3/rev = 1 \times 10^{-5} m^3/rev$

Torque = 15 n/m

1) Volumetric efficiency = $\frac{\text{actual flowrate}}{\text{Theoretical flow}} \times 100\%$

Theoretical flow = displacement × speed

$= 1 \times 10^{-5} \times 28.33 = 2.833 \times 10^{-4}$

Volumetric efficiency = $\frac{8.33 \times 10^{-5}}{2.833 \times 10^{-4}} \times 100\%$

$= 29.4\%$

2) Fluid power = $\frac{\text{Pressure} \times \text{flow}}{1714}$

$= 15 \times 10^5 \times 8.33 \times 10^{-5} = 124.9$ watts

~~1714~~

3) Shaft Power = $T \times \omega$

$= 15 \times (2 \times \pi \times 28.33)$

$= 2670$ watts

4) Overall efficiency

$\frac{\text{fluid Power}}{\text{Shaft Power}} \times 100\%$

$= \frac{124.9}{2670} \times 100 = 4.68\%$