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Elect Elect
ENG 214
18/ENG04/075

1) $Z_1 = 0$
$Z_2 = 20m$
$V_1 = 5m/s$
$V_2 = 2m/s$
The Pressure, h_1 $\frac{P_1}{w} = 2.5m$

$\frac{P_2}{w} = ?$

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

$$= \frac{0.35(5-2)^2}{2 \times 9.81} = \frac{0.35 \times 9}{2 \times 9.81}$$

$$= 0.1606m.$$

Apply Bernoulli's Equation

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

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

$$= 2.5 + \frac{5^2}{2 \times 9.81} + 0 - \frac{2^2}{2 \times 9.81} - 20 - 0.1606$$

$$= 2.5 + 1.274 - 0.0204 - 0.1606 - 2.0$$

$= 1.4094m$

$= 1.41m$

$\therefore h_2, \frac{P_2}{w} = 1.41m$

2) $d_1 = \frac{20}{100} = 0.2m$

$d_2 = \frac{10}{100} = 0.1m$

$$A_1 = \frac{\pi d^2}{4} = \frac{\pi (0.2)^2}{4}$$

$$= 0.0314m^2$$

$$A_2 = \frac{\pi d^2}{4} = \frac{\pi (0.1)^2}{4} = 0.00785m^2$$

$P_1 = 17.658 N/cm^2$
$= 17.658 \times 10^4$
$= 176580 N/m^2$

$P_2 = 30cm$ of Mercury
$= 0.3m$ of Hg
$= -0.3 m \times 13.6$
$h_n = 4.08m$

$$P_2 \; h_1 = \frac{P_1}{w} = \frac{176580}{1000 \times 9.81}$$

$= 18m$

$h = h_1 - h_1$
$h = 18 - (-4.08)$
$h = 22.08$

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

$$= \frac{0.98 \times 0.0314 \times 0.0785 \times}{\sqrt{(0.0314)^2} - (0.0078}$$

$Q = 0.1653 m^3/s$

SHOT ON REDMI 7
AI DUAL CAMERA

NO.3

Dyfferential head;

$y = 500m$

$= 0.5 m$

$h = \frac{P}{w} = y\left(\frac{S.G \text{ of Mercury}}{S.G \text{ of Oil or}^2} - 1\right)$

$= 0.5\left(\frac{13.6}{0.9} - 1\right)$

$h = 7.06\ m$

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

$= \frac{0.64 \times 0.01767 \times 0.07068}{\sqrt{(0.070686)^2 - (0.01767)^2}} - \sqrt{2 \times 9.81 \times 7.06}$

$Q = 0.1374\ m^3/s \simeq 0.137 m^3/s$

(4) Dyff Of Hg (y)

$y = 170\ mm = \frac{170}{1000} = 0.17 m$

SG of mercury $= 13.6$

S.G of Sea water $= 1.026$

$\therefore\ h = y\left(\frac{S.g \text{ of Mercury}}{S.g \text{ of Sea water}} - 1\right)$

$= y\left(\frac{13.6}{1.026} - 1\right)$

$= 0.17(12.255)$

$\simeq 2.08 m$

Velocity $= \sqrt{2gh}$

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

$v = 6.39 m/s$//

(5) Actual Flow Rate = $5 dm^3/min$

$= \frac{5 \times 10^{3}}{3} m^3/sec$

$= 8.33 \times 10^{-5} m^3/s$

Change in Pressure $dp = 1.5 bar = 1.5 \times 10^5 N/m^2$

Speed of rotation $N = 1700 rev/min = \frac{1700}{60} = 28.33 rev/secs$

Normal displacement $= 10cm^3/rev = \frac{10}{10^6} m^3/rev$

$= 1.5 \times 10^{-5} m^3/rev$

Torque Input, $T = 15 Nm$

(i) Volumetric Efficiency

$= \frac{\text{Actual Flow rate}}{\text{Ideal Flow rate}} \times 100\%$

Actual flow rate $= 8.33 \times 10^{-5} m^3/sec$

Ideal Flow rate = Speed of Rotation × nominal

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

$= 2.833 \times 10^{-4}$

∴ Volumetric Efficiency $= \frac{8.33 \times 10^{-5}}{2.833 \times 1 \times 10^{-5}} \times 100\%$

(ii) Fluid Power, $P_f = Q \times dp = 8.33 \times 10^{-5} \times 15 \times 10^{5} = 124.95$ watts

Shaft Power $= T \cdot \omega$

$T = 15 Nm$

$\omega = 2\pi N$ rad/s

$= \frac{2 \times 22}{7} \times 28.33 = 178.07 = 2671.11$ watts

∴ Overall efficiency $= \frac{FP}{SP} \times 100\% = \frac{124.95}{2671.11} \times 100 = 4.6$

∴ Overall Effiency is 4.68%.