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MATRIC N$^{O.}$: 18/ENG05/056

DEPARTMENT: Mechatronics Engineering

COURSE: ENG 214

Venturimeter Assignment

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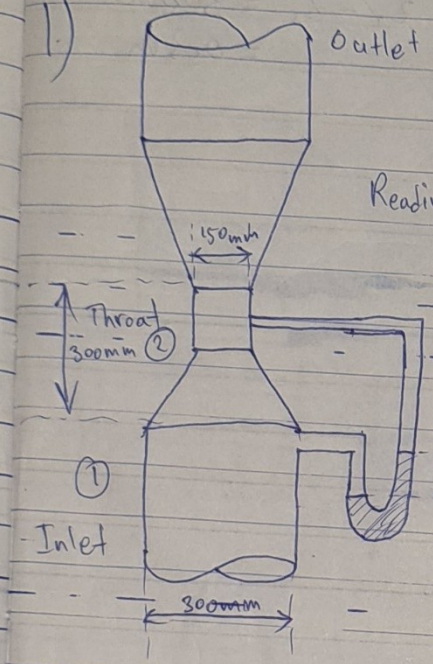
-18/ENG05/056
Mechatronics Engineering
ENG214 Assignment (Venturimeter)

1)



$S.G_{oil} = 0.9$

$S.G_{Hg} = 13.6$

Reading diff of manometer $= 250mm = 0.25m$

From Bernoulli's equation, difference in head (h) for a vertical venturimeter;

$$h = \left(\frac{P_1}{\rho g} + z_1\right) - \left(\frac{P_2}{\rho g} + z_2\right)$$

recall, $h = x\left(\frac{SG_{Hg}}{SG_{oil}} - 1\right)$

$h = 0.25\left(\frac{13.6}{0.9} - 1\right)$

$= 3.5278m$ of oil

$d_1 = 300mm = 0.3m$

$A_1 = \frac{\pi d_1^2}{4} = \frac{\pi}{4}(0.3)^2 = 0.0707m^2$

$d_2 = 150mm = 0.15m$

$A_2 = \frac{\pi d_2^2}{4} = \frac{\pi}{4}(0.15)^2 = 0.0177m^2$

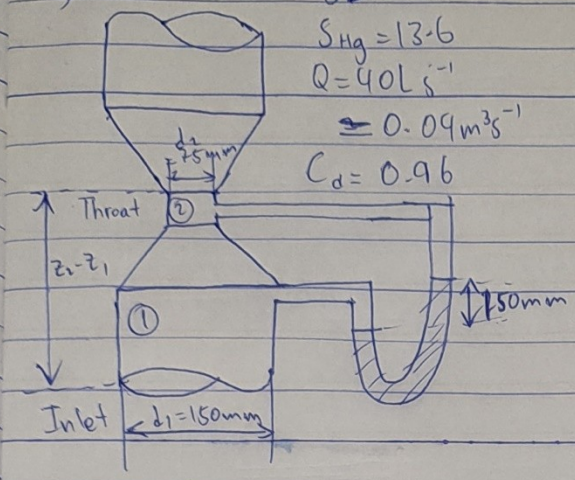
From continuity equation,

$$Q = \frac{C_d \cdot A_1 A_2 \times \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$$

$$Q = \frac{0.98 \times 0.0707 \times 0.0177 \times \sqrt{2 \times 9.81 \times 3.5278}}{\sqrt{(0.0707)^2 - (0.0177)^2}}$$

$Q = 0.14906 m^3 sec^{-1}$

2.)



$S_d = 0.8$

$S_{Hg} = 13.6$

$Q = 40 l s^{-1}$

$\cong 0.04 m^3 s^{-1}$

$C_d = 0.96$

$d_1 = 150mm = 0.15m$

$d_2 = 75mm\ 0.075m$

$A_1 = \frac{\pi d_1^2}{4} \cong 0.0177 m^2$

$A_2 = \frac{\pi d_2^2}{4} \cong 0.0044 mm^2$

Recall

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

$$0.04 = \frac{0.96 \times 0.0177 \times 0.0044 \sqrt{2 \times 9.81 h}}{\sqrt{(0.0177)^2 - (0.0044)^2}}$$

$$0.04 = \frac{7.4765 \times 10^{-5} \sqrt{19.62h}}{\sqrt{2.9393 \times 10^{-4}}}$$

$$0.04 = \frac{7.4765 \times 10^{-5} \sqrt{19.62h}}{0.0171}$$

$$0.000684 \cong 7.4765 \times 10^{-5} \sqrt{19.62h}$$

$$\frac{6.84}{0.74765} \cong \sqrt{19.62h}$$

$$\sqrt{19.62h} \cong 9.1487$$

$$19.62h \cong 83.6981$$

$$h \cong 4.266m \text{ of liquid}$$

Recall for a vertical venturimeter

$$h = \left(\frac{P_1}{\rho g} + z_1\right) - \left(\frac{P_2}{\rho g} + z_2\right)$$

taking z_1 as a reference point,

$z_1 = 0$

$$h = \left(\frac{P_1 - P_2}{\rho g}\right) + z_1 - z_2$$

$$\frac{P_1 - P_2}{\rho g} = h + z_2 - z_1$$

$$P_1 - P_2 = (h + z_2 - z_1)\rho g$$

$$P_1 - P_2 = (4.266 + \Delta z) \times 800 \times 9.81$$

~~$P_1 - P_2 = (7848 \Delta z + 34171.68) Nm^{-2}$~~

$$P_1 - P_2 = [7848(4.266 + \Delta z)] Nm^{-2}$$