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① Liquid of SG = 0.8
$d_1 = 150mm = 0.15m$
$d_2 = 75mm = 0.075m$
$Q = 40l/s$
$C_d = 0.96$
Calculate the pressure difference bw the inlet & throat in N/m^2
The pressure connection is 150mm above that at the inlet.
$z_2 - z_1 = 150mm$
$z_2 - z_1 = 0.15m$
$1m^3 = 1000l$
$x = 40l$
$x = 40l / 1000 m^3$
$x = 0.04m^3$
$Q = 0.04m^3/s$
$Q = A_1 V_1$
$A_1 = \frac{\pi d_1^2}{4}$
$A_1 = \frac{22}{7} \times \frac{(0.15)^2}{4}$
$A_1 = 0.01768m^2$
$V_1 = Q/A_1$
$V_1 = \frac{0.04m^3/s}{0.01768m^2}$
$V_1 = 2.27m/s$
$V_2 = Q/A_2$; $A_2 = \frac{\pi d_2^2}{4}$
$V_2 = \frac{0.04m^3/s}{4.4196 \times 10^{-3}}$ | $A_2 = \frac{22}{7} \times \frac{(0.075)^2}{4}$
$= 4.4196 \times 10^{-3} m^2$
$V_2 = 9.0505 m/s$

Using Bernoulli's Equation
$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2$
$\frac{P_2}{\rho g} - \frac{P_1}{\rho g} = \frac{V_1^2}{2g} - \frac{V_2^2}{2g} + z_1 - z_2$
$\rho_1 = SG_1 \times 1000 kg/m^3$
$\rho_1 = 0.8 \times 1000 kg/m^3$
$\rho_1 = 800 kg/m^3$
$P_2 - P_1 = 800 \times 9.81 \left(\frac{2.27^2 - 9.051^2}{2 \times 9.81} + (-0.15) \right)$
$P_2 - P_1 = -31884.28 N/m^2$
② $\frac{300}{1000}m$ by $\frac{150}{1000}mm$ rectangular
$S.G = 0.9$ $C_d = 0.98$
$z_2 - z_1 = 300mm$ $S.G = 13.8$
$y = 250mm$
$h = y\left(\frac{S_H}{S_o} - 1\right)$
$Q = \frac{C_d A_1 A_2 \sqrt{2gh}}{\sqrt{A_1^2 - A_2^2}}$
$h = 0.25\left(\frac{13.6}{0.9} - 1\right)$
$h = 3.528m$
$Q = 0.98 \times$
(I) Q_{II}
$A_1 = \frac{\pi d_1^2}{4}$
$A_1 = \frac{22}{7} \times \frac{(0.3)^2}{4} = 0.0707m^2$
$A_2 = \frac{22}{7} \times \frac{(0.15)^2}{4} = 0.0177$
$Q = 0.98 \times 0.0707 \times 0.0177 \sqrt{2 \times 9.81 \times 3.528}$
$\sqrt{(0.0707)^2 - (0.0177)^2}$
$Q = 0.149 m^3/s$

(ii) Pressure difference

$Q = A_1 V$

$V_1 = Q/A_1$

$V_1 = \frac{0.149 m^3/s}{0.0707 m^2}$

$V_1 = 2.107 m/s$

$V_2 = \frac{Q}{A_2}$

$V_2 = \frac{0.149 m^3/s}{0.0177}$

$V_2 = 8.418 m/s$

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

$\frac{P_1}{\rho g} - \frac{P_2}{\rho g} = \frac{(8.418)^2 - (2.107)^2}{2 \times 9.81} + 0.3m$

$\frac{P_1}{\rho g} - \frac{P_2}{\rho g} = 3.685 m$

$P_1 - P_2 = 3.685 \times 0.9 \times 1000 \times 9.81 \ N/m^2$

$= 32534.865 \ N/m^2$