Discharge Coefficient $C = 0.594$

4. $D = 10\,in = 0.83\,ft$

$Q = 25\,gal/min = 0056\,ft^3/s$

$\frac{25(0.1337)}{60}$

$sg = 0.83$

$\mu = 2.5 \times 10^{-6}\,lb\text{-}s/ft^2$

$d_1 = 1.0\,in$

$d_2 = 7.0\,in$

Velocity through section

$$V_1 = C\sqrt{\frac{2gh[(y_m/y_A)-1]}{(A_1/A_2)^2-1}}$$

deflection of manometer

$$h = \left(\frac{V_1}{C}\right)^2 \frac{(A_1/A_2)^2-1}{2g[(y_m/y_A)-1]}$$

Area of Pipe

$$A_1 = \frac{\pi(0.83)^2}{4} = 0.541\,ft^2$$

Area of the diameter

$$A_2 = \frac{\pi d^2}{4} = \frac{\pi(0.083)^2}{4} = 5.41 \times 10^{-3}\,ft^2$$

Specific Weight

$y_A = sg \cdot 62.4\,lb/ft^3$

$yA = (0.83)(62.4)$

$= 51.79\,lb/ft^3$

$yA = 51.79\,lb/ft^3$

Velocity Flow

$$V_1 = \frac{Q}{A} = \frac{0.056}{0.541} = 0.1035\,ft/s$$

$V_1 = \frac{\mu}{\rho}$

density of water $= 1.94$

$\rho = sg \times$ density of water

$0.83 \cdot 1.94$

$\rho = 1.6102\,slugs/ft^3$

$= \frac{2.5 \times 10^{-6}}{1.6102}$

$V = 1.55 \times 10^{-6}\,ft^2/s$

Reynolds number

$$N_R = \frac{V_1 D}{V}$$

$\frac{(0.1035)(0.83)}{1.55 \times 10^{-6}}$

$N_R = 5.54 \times 10^4$

$$h = \left(\frac{V_1}{C}\right)^2 \frac{(A_1/A_2)^2-1}{2g[(y_m/y_A)-1]}$$

$$= \left(\frac{0.1035}{0.594}\right)^2 \frac{[0.541/5.41 \times 10^{-3}]^2-1}{2(32.2)[(62.4/51.79)-1}$$

$h = 23\,ft$

b) Diameter of orifice is $7.0\,in = 058\,ft$

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

$\frac{\pi(0.58)^2}{4}$

$= 0.264\,ft^2$

Diameter ratio

$B = \frac{d}{D} = \frac{7.0}{10}$

$\beta = 0.7$

$$h = \left(\frac{0.1035}{0.594}\right)^2 \frac{(0.541/0.264)^2-1}{2(32.2)[(62.4/51.79)-1]}$$

$= 0.028\left(\frac{3.199}{13.193}\right)$

$h = 0.0078\,ft$