



$$Q = 2.5 \frac{\text{ft}^3}{\text{s}} \left(\frac{1 \text{ ft}}{12 \text{ in}} \right) \left(\frac{1 \text{ s}}{60 \text{ min}} \right) = 0.0557 \frac{\text{ft}^3}{\text{s}}$$

$$D = 10" = .8333' \text{ N.C.}$$

Find h if $\theta = 1"$ and $\theta = 7"$

$$S_g = .83$$

$$V = 2.5 \times 10^{-6} \frac{\text{ft}^3}{\text{s}}$$

$$A_1 = \frac{\pi}{4} (.8333)^2 = .5454 \text{ ft}^2$$

$$D_1 = .083'$$

$$D_2 = .5833'$$

$$A_2 = \frac{\pi}{4} (.083)^2$$

$$A_2 = \frac{\pi}{4} (.5833)^2$$

$$= .2672 \text{ ft}^2$$

$$= .00541 \text{ ft}^2$$

$$Q = A_1 V_1 = \frac{0.0557 \frac{\text{ft}^3}{\text{s}}}{.5454 \text{ ft}^2} = .102 \frac{\text{ft}}{\text{s}} = V_1$$

$$h = \frac{\left(\frac{Q^2}{C \times A_1} \right) \left(\left(\frac{A_1}{A_2} \right)^2 - 1 \right)}{2g \left(\frac{\gamma_a}{\gamma_w} - 1 \right)}$$

$$C \text{ for } \frac{d_1}{D} = \frac{.083}{.833} = .1 = .54 \text{ from chart}$$

$$C \text{ for } \frac{d_2}{D} = \frac{.5833}{.833} = .7 = .61 \text{ from chart}$$

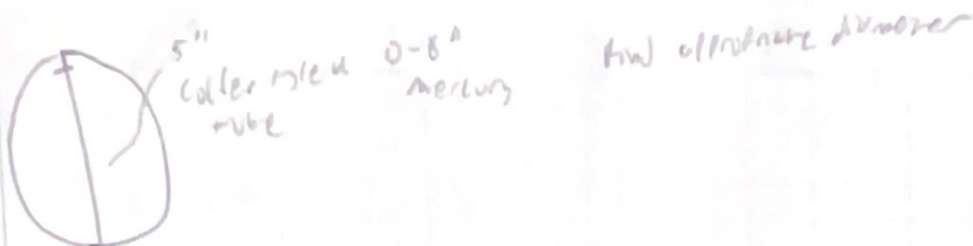
$$h = \frac{\left(\frac{.0557}{.5454 \times .54} \right)^2 \left(\left(\frac{.5454}{.00541} \right)^2 - 1 \right)}{2(32.2) \left(\frac{.83}{62.4} - 1 \right)} = \sqrt{-4.39'}$$

same for
7"

$$h = -1.0014'$$

Low speed oil @ 77°F / 25°C

$$Q = 700 \frac{\text{gal}}{\text{min}} = 1.56 \frac{\text{ft}^3}{\text{s}} \quad \text{to} \quad 1000 \frac{\text{gal}}{\text{min}} = 2.22 \frac{\text{ft}^3}{\text{s}}$$



Using 0" mercury, and 1000 $\frac{\text{gal}}{\text{min}}$ for Q
for L

Flow Area = $1.254 \times 10^{-1} \text{ ft}^2 = A_1$ from Appendix H

Manometer fluid = 54 = $(13.54) (62.4 \frac{\text{lb}}{\text{ft}^3}) = 844.9 \frac{\text{lb}}{\text{ft}^3}$

$$V = 3.56 \times 10^{-5} \frac{\text{m}}{\text{s}} \left(\frac{1 \text{ ft}}{.305 \text{ m}} \right) = 1.14 \times 10^{-4} \frac{\text{ft}}{\text{s}}$$

$$A_2 = 1.254 \times 10^{-1} \text{ ft}^2$$

$$\sqrt{\frac{(2)(32.2 \frac{\text{ft}}{\text{s}^2})(.667)' \left(\frac{844.9}{62.4} - 1 \right)}{\left(\frac{2.22 \frac{\text{ft}^3}{\text{s}}}{1.254 \times 10^{-1} \times .94} \right)^2 + 1}}$$

assume C to be .94

$$A_2 = 1.47 \times 10^{-1} \text{ ft}^2$$

$$d = .5 \text{ ft}$$

$$\frac{d}{D} = \frac{.5}{.7} = .714 \text{ too large for } C = .94$$

Some guesses

$$A_2 = \left(.014 \left(\frac{4}{\pi} \right) \right)^2 = \frac{.15'}{.51} = \boxed{.343' \text{ or } 4.72''}$$



$t = 50^\circ\text{C}$ manometer = .21" water
 = 6 mm $\downarrow$
 or .006 m water

find velocity

$$\gamma = 9.64 \frac{\text{N}}{\text{m}^3} \text{ at } 50^\circ\text{C}$$

$$\gamma_s = (9.64)(9.81) = 95 \frac{\text{N}}{\text{m}^3}$$

$$h = 6 \text{ mm or } .006 \text{ m}$$

$$V_1 = \frac{\sqrt{(2)(9.81 \frac{\text{m}}{\text{s}^2}) \left(95 \frac{\text{N}}{\text{m}^3} - 9.64 \frac{\text{N}}{\text{m}^3} \right)}}{9.64 \frac{\text{N}}{\text{m}^3}}$$

$$= 1.02 \frac{\text{m}}{\text{s}}$$