$Q = 25 \frac{gal}{min} \left(\frac{1 ft^3}{7.4805 gal}\right)\left(\frac{min}{60 sec}\right) = .0557 \frac{ft^3}{s}$

$D = 10" = .8333'/ft$ — Find h if $\theta = 1"$ and $\theta = 7"$

$Sg_1 = .83$

$\nu = 2.5 \times 10^{-5} \frac{lb}{ft^2}$

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

$D_1 = .083'$

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

$= .00541 ft^2$

$D_2 = .5833'$

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

$= .26724 ft^2$

$Q = A_1 V_1 \quad \frac{.0557 \frac{ft^3}{s}}{.5454 ft^2} = .102 \frac{ft}{s} = V_1$

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

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

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

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

same for 7"

$\boxed{h = -.0014'}$

Lubricating oil @ 77°F / 25°C

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

Using 8" Mercury, and $1000 \frac{gal}{min}$ for Q
for L

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

Manometer fluid: $\gamma_f = (13.54)\left(62.4 \frac{lb}{ft^3}\right) = 844.9 \frac{lb}{ft^3}$

$V = 3.56 \times 10^{-3} \frac{m}{s}\left(\frac{1\ ft}{.3\ m}\right) = 1.19 \times 10^{-2} \frac{ft}{s}$

$$A_2 = \frac{1.254 \times 10^{-1}\ ft^2}{\sqrt{\frac{(2)(32.2 \frac{ft}{s^2})(.667)'\left(\frac{844.9}{62.4} - 1\right)}{\left(\frac{2.22 \frac{ft^3}{s}}{1.254 \times 10^{-1} \times .94}\right)^2 + 1}}}$$

assume C to be .94

$A_2 = 1.33 \times 10^{-1}\ ft^2$

$d = .5\ ft$

$\frac{d}{D} = \frac{.5}{.71} = 1.25$ too large for C = .98

Some trials

$A_2 = (.014\,(\frac{d}{in}))^2 = \frac{.15)'}{.51} = \boxed{.343' \text{ or } 4.12''}$

HOMEWORK 2.3	FLUID MECHANICS	DEVIN PEPER	15.15

$b = 50°C$ manometer = .24" water = 6mm or .006m water

find velocity

$\gamma = 9.64 \frac{kN}{m^3}$ @ 50°C

$\gamma_g = (9.64)(9.81) = 95 \frac{kN}{m^3}$

$h = 6mm$ or $.006m$

$$V_1 = \sqrt{\frac{(2)(9.81 \frac{m}{s^2})(95 \frac{kN}{m^3} - 9.64 \frac{kN}{m^3})}{9.64 \frac{kN}{m^3}}}$$

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