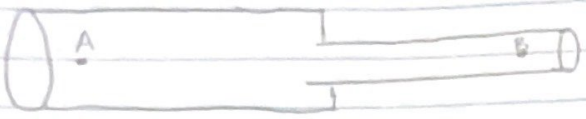
odd

Chpt 10 - 20, 37, 39, 43, 46, 48

20) DN 125 sch 80 steel pipe → DN 50 Sch 80 pipe

$Q = 500 \frac{L}{min}$

$Q = 0.00833 \frac{m^3}{s}$



$D_A = 0.1223$ $D_B = 0.0493\,m$

$V_A = \frac{Q}{A_A} = \frac{0.00833 \frac{m^3}{s}}{\frac{\pi}{4}(0.1223m)^2} = 0.71 \frac{m}{s}$

$h_B = K\left(\frac{V_B^2}{2g}\right)$

$\frac{D_A}{D_B} = \frac{0.1223}{0.0493} = 2.48 \approx 2.5$

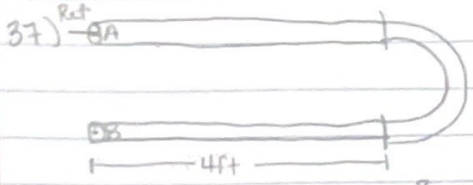
$V_B = \frac{Q}{A_B} = \frac{0.00833 \frac{m^3}{s}}{\frac{\pi}{4}(0.0493)^2} = 4.36 \frac{m}{s}$

$K = \left(1 - \frac{A_2}{A_1}\right)^2$

$K = 1 - \left(\frac{0.0019}{0.0117}\right) = 0.16$

$h_L = (0.16)\left(\frac{(4.36)^2}{2(9.81 \frac{m}{s^2})}\right) = 0.155m$

37) Rct



$\frac{1}{2}$ sch 40 $Q = 12.5 \frac{gal}{min}$ Ethylene @ 77°F

$Q = 1.671 \frac{ft^3}{min}$

$\frac{P_A}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h_{L_{A-B}}$

$\frac{P_A - P_B}{\gamma} = z_B + h_{L_{A-B}} + h_{L_{bend}}$

$= f\left(\frac{L}{D}\right)\left(\frac{V^2}{2g}\right)$

$K = 50(0.026)$

$K = 1.3$

$K = 50 f_T$

$D = 0.0518\,ft$

$A = \frac{\pi}{4}(0.0518ft)^2$

$= 0.0021\,ft^2$

$V = \frac{Q}{A} = \frac{1.671 \frac{ft^3}{min}}{0.0021 ft^2} = \frac{795.7 \frac{ft}{min}}{60} = 13.26 \frac{ft}{s}$

$h_{L_{Pipe}} = (2.63E-2)\left(\frac{4ft}{0.0518ft}\right)\left(\frac{13.26 \frac{ft^2}{s}}{2.624 \frac{ft}{s^2}}\right)$

$h_{L_{Pipe}} = 0.2158\,ft \cdot 2$

1.47E-5 $\frac{m^2}{s}$ line. $Re = \frac{VD}{\nu}$

10.7639

$Re = \frac{(13.26 \frac{ft}{s})(0.0518ft)}{1.366E-6 \frac{ft^2}{s}} = 502,831.66$

$\frac{D}{\varepsilon} = \frac{0.0518ft}{1.5E-4\,ft} = 345.3$ excel $\rightarrow f = 2.63E-2$ $f_T = 0.026$

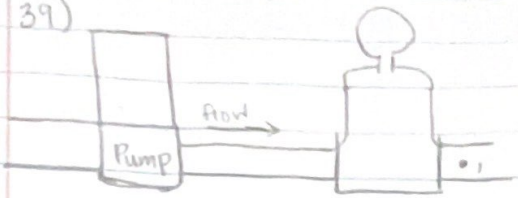
$h_{bend} = K\left(\frac{V^2}{2g}\right)$

$= (1.3)\left(\frac{13.26 \frac{ft^2}{s}}{2(62.4)}\right) = 0.138ft$

$\Delta P = 0.2158ft(1) + 0.138ft$

$= 0.3696\,ft$

39)



3 in sch 40 pipe
$T = 50^F \quad Q = 0.4 \frac{ft^3}{s}$

$A = \frac{\pi}{4}(0.2557ft)^2 = 0.051 ft^2$

$h_L = k\frac{V^2}{2g}$

$V = \frac{Q}{A} = \frac{0.4 \frac{ft^3}{s}}{0.051 ft^2} = 7.84 \frac{ft}{s}$

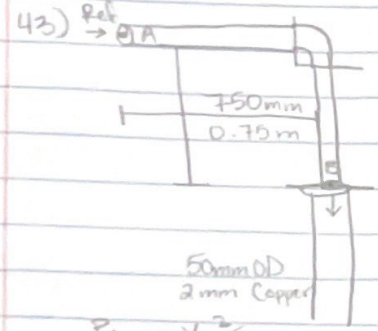
$k = f_T \left\{\frac{L_{eq}}{D}\right\} 20$

0.017 for 0.5

$k = (0.017)(20) = 0.34$

$h_L = (0.34)\left(\frac{7.84^2}{2(32.2)}\right) = 0.32 ft$

43)



$Q = \frac{750 L}{min}$ propyl @ 25°C $= 0.0125 \frac{m^3}{s}$

$D = 50 - (2 \cdot 2mm)$

$D = 0.046 m$

$A = \frac{\pi}{4}(0.046)^2 = 0.00166 m^2$

$V = \frac{(0.0125 \frac{m^3}{s})}{0.00166 m^2} = 7.53 \frac{m}{s}$

$\frac{P_A}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h_L$

$\frac{P_A - P_B}{\gamma} = + h_{L\,pipe} + h_{L\,bend}$

$h_L = f\frac{L}{D}\frac{V^2}{2g}$

$k = 30 f_T = 30(0.009)$

$k = 0.27$

$h_L = k\frac{V^2}{2g}$

$f = 9.05E-3$

$f_T = 0.009$

$\frac{D}{\varepsilon} = 1.5E-6 m$

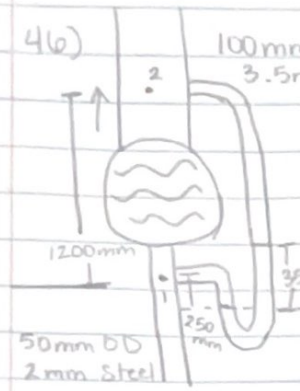
$Re = \frac{\rho V D}{\mu} = \frac{(800)(7.53)(0.046)}{0.002} = 138,552$

$h_L = (9.05E3)\left(\frac{0.75m}{0.046m}\right)\left(\frac{(7.53)^2}{2 \cdot 9.81}\right) = 426425 m$

$\rightarrow 4.26E5 m$

$h_L = (0.27)\left(\frac{7.53^2}{2 \cdot 9.81}\right) = 0.78 m$

46)



$Q = 6\times10^{-3}\frac{m^3}{s}$ $\quad h_{L_{1-2}} =$ $\quad k =$

$D_1 = 50 - 2(2) = 46mm = 0.046m$ $\quad D_2 = 100 - 2(35) = 93mm = 0.093m$

$A_1 = \frac{\pi}{4}(0.046m)^2 = 0.00166\,m^2$ $\quad A_2 = \frac{\pi}{4}(0.093m)^2 = 0.0068\,m^2$

$V_1 = \frac{6\times10^{-3}}{0.00166} = 3.6\frac{m}{s}$ $\quad V_2 = \frac{6\times10^{-3}}{0.0068} = 0.88\frac{m}{s}$

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + h_L$$

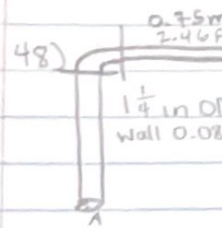
$$h_L = \left(\frac{P_1 - P_2}{\gamma}\right) + \left(\frac{3.6 - 0.88}{2(9.81\frac{m}{s^2})}\right)$$

$$\frac{\Delta P}{\gamma} = \rho_m g h_m = \left(13550\frac{kg}{m^3}\right)\left(9.81\frac{m}{s^2}\right)(0.35m) = 46{,}523.9\,Pa = 46.5\,kPa$$

$= 4.74m + 0.1386 = 4.88m$

$$h_L = k\frac{V_2^2}{2g} \Rightarrow k = h_L \cdot \frac{2g}{V_2^2} = (4.88m)\left(\frac{2(9.81)}{0.88^2}\right) = 123.6$$

48)



$Q = 27.5\frac{gal}{min}$ $\quad$ hydralic oil $\quad \gamma = 105.875\frac{in^3}{s}$ $\quad R = 3.25in$

$A = \frac{\pi}{4}(1.084)^2 = 0.923\,in^2$

$D = 1.25 - (2\cdot0.083) = 1.084in$

$V = \frac{105.875\frac{in^3}{s}}{0.923in^2} = 114.7\frac{in}{s}$ $\quad 9.56\frac{ft}{s}$

$\frac{R}{D} = \frac{3.25in}{1.084in} \approx 3$

$k = 0.35$ $\quad h_L = k\frac{V^2}{2g} \Rightarrow (0.35)\left(\frac{9.56\frac{ft^2}{s}}{2(62.4\frac{ft}{s^2})}\right) = 0.0268\,ft$

$$h_L = f\left(\frac{L}{D}\right)\left(\frac{V^2}{2g}\right)$$

$$= 0.31\left(\frac{2.46ft}{0.0903ft}\right)\left(\frac{9.56ft^2/s}{2(62.4)}\right) = 6.18\,ft$$

$h_{tot} = 6.18ft + 0.0268ft = 6.211\,ft$