What I took away from the lecture was a better understanding of pump selection. First off knowing which type of fluids you are dealing with. For more viscous fluids it would be best to utilize a positive displacement pump, rather than a kinetic pump that wouldn't perform well. Kinetic pumps have some aspect of control for flow rate. There are some cases where having a constant flow rate with a positive displacement pump in controlled spaces. Also for our project we should use a pump selected from sulzer's catalog. Pumps require an additional electrical component to supply power to the pump.

13.22 Describe each part of this centrifugal pump designation: 1½ X3 -6

1½ → Discharge connection size (nominal inch)

3" → Suction connection size (nominal inch)

6" → Casting size of the largest impeller (inch)

13.34 For each set of operating conditions, list at least one type of pump. * Using Figure 13.51

a. 500 gal/min of water at 80ft of total head.
- 3,500 rpm Centrifugal Pump,

b. 500 gal/min of water at 800 ft of head.
- Rotary Pump,

c. 500 gal/min of a viscous adhesive at 80ft of head.
- Rotary Pump.

d. 80 gal/min of water at 8,000 ft of head.
- Reciprocating Pump,

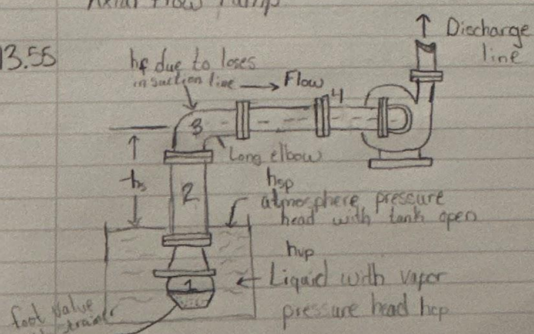
e. 80 gal/min of water at 800ft head.
- Rotary Pump,

f. 8,000 gal/min of water at 200ft of head.
- 1,750 rpm centrifugal Pump

g. 8,000 gal/min of water at 60ft of head.
- Mixed Flow Pump

h. 8,000 gal/min of water at 12ft of head.
- Axial flow Pump

13.55



Given: H_2O @ 80°F , P_{atm} = 101.8 kPa

$h_s = 2.0$ m $h_{vp} = 4.967$ m

D_v → DN 80 Schedule 40 steel pipe

$D_v = 0.0779$ m

D_H → DN 50 Schedule 40 Steel pipe

$D_H = 0.0525$ m 1.5 m = L_∞

$\gamma = 9.53\ kN/m^3$

$\nu = 3.60 \times 10^{-7}\ m^2/s$

$$Q = 300\ L/min \times \frac{1\ m^3}{1{,}000\ L} \times \frac{1\ min}{60\ s}$$

$Q = 0.005\ m^3/s$

$\varepsilon = 4.6 \times 10^{-5}$ m

$$h_{sp} = \frac{P_{atm}}{\gamma} = \frac{101.8\ kPa}{9.53\ kN/m^3} \times \left(\frac{kN/m^2}{1\ kPa}\right)$$

$h_{sp} = 10.682$ m

V_V = Vertical Velocity

V_H = Horizontal Velocity

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Technology Transfer Program

$f_{V_T} = 0.017$ $K = 75 f_{V_T} = 1.275$

$$h_f = f_V\left(\frac{L}{D}\right)_V \frac{V_V^2}{2g} + K\frac{V_V^2}{2g} + 20 f_{V_T}\frac{V_V^2}{2g} + f_H\left(\frac{L}{D}\right)_H \frac{V_H^2}{2g}$$

* Vertical DN 80 Schedule 40

$$V_V = \frac{Q}{\pi/4 (D_V)^2} = \frac{0.005 m^3/s}{\pi/4(0.0779 m)^2} = 1.049 m/s \qquad \frac{D_V}{\varepsilon} = \frac{0.0779 m}{4.6 \times 10^{-5} m} = 1{,}693.478$$

$$\text{Head } \frac{V_V^2}{2g} = \frac{(1.049 m/s)^2}{2(9.81 m/s^2)} = 0.0561 m$$

$f_V \approx 0.0192$

$$N_{R_V} = \frac{V_V D_V}{\nu} = \frac{(1.049 m/s)(0.0779 m)}{3.60 \times 10^{-7} m^2/s} = 226{,}991.944$$

* Horizontal DN 50 Schedule 40

$$V_H = \frac{Q}{\pi/4 (D_H)^2} = \frac{0.005 m^3/s}{\pi/4(0.0525 m)^2} = 2.310 m/s \qquad \frac{D_H}{\varepsilon} = \frac{0.0525 m}{4.6 \times 10^{-5} m} = 1{,}141.30$$

$$\text{Head } \frac{V_H^2}{2g} = \frac{(2.310 m/s)^2}{2(9.81 m/s^2)} = 0.272 m$$

$$N_{R_H} = \frac{V_H D_H}{\nu} = \frac{(2.310 m/s)(0.0525 m)}{3.60 \times 10^{-7} m^2/s} = 336{,}875$$

$f_H \approx 0.0201$

Loses

$h_1 = f_V\left(\frac{L}{D}\right)_V \frac{V_V^2}{2g} = (0.0192)\left(\frac{2.0 m}{0.0779 m}\right)(0.0561 m) = 0.0277 m$ - Pipe friction 1

$h_2 = K\frac{V_V^2}{2g} = (1.275)(0.0561 m) = 0.0715 m$ - foot value loss

$h_3 = 20 f_{V_T}\frac{V_V^2}{2g} = 20(0.017)(0.0561 m) = 0.01907 m$ - Long elbow

$h_4 = f_H\left(\frac{L}{D}\right)_H \frac{V_H^2}{2g} = (0.0201)\left(\frac{1.5 m}{0.0525 m}\right)(0.272 m) = 0.156 m$ - Pipe friction 2

$$h_f = h_1 + h_2 + h_3 + h_4 = 0.0277 m + 0.0715 m + 0.01907 m + 0.156 m = 0.274 m$$

$NPSH = h_{sp} - h_s - h_f - h_{vp}$

$10.682 m - 2.0 m - 0.274 m - 4.967 m$

$NPSH = 3.441 m$