Pretest 3 Fluids Ben Smithson

1. -For the first problem do both of the pipes exit into atm?
- For the second problem do we calculate the pressure in part 1 without the curve K_3 then with it in part 2.
- will we calculate the second flow rate in Prob 2?
- Is the K value necessary for problem 2 or just calculate based on Standards?

2. For the first question I would start with drawing the pipe system out then creating points of interest.
Next, I would calculate the flow rate of each pipes with energy losses including the pressure at the inlet $p = 400 kPa$
+ Joint 1, + Joint 2, $K = 6$

Using equation

$$\frac{P_1}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h_{L\,AB}$$

$$\frac{\Delta p}{\gamma} = h_{L\,AB1}$$

$$\frac{\Delta p}{\gamma} = f_1 \left(\frac{L_1}{D_1} + \frac{Le}{D_1} \cdot T_1 + \frac{Le}{D_1} \cdot T_2 + \frac{Le}{D_1} \cdot valve \right) \frac{V_1^2}{2g}$$

$$\frac{\Delta p}{\gamma} = f_1 \left(\frac{L_1}{D_1} + \frac{Le}{D_1} \cdot T_1 + \frac{Le}{D_1} \cdot T_2 + \frac{Le}{D_1} \cdot valve \right) \cdot \frac{1}{2g} \cdot \frac{16 Q^2}{\pi^2 D_1^4}$$

$$f = \frac{0.25}{\log\left(\frac{1}{3.7 D/\epsilon} + \frac{5.74}{Re^{0.9}} \right)^2}$$

Kvalue = 50

Calculate out the f value & Q using Δp and the given the energy losses.

- For problem 2. I will calculate the pressure using bernoulis for the straight pipes.

Next I will calculate the pressure in the second pipe set with the parallel split

given pipe length & 900 ft parallel

also given q_1 and standards Ts and elbows

Using equations

$$\frac{P_A}{\gamma} + \frac{V_A^2}{2g} + Z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + Z_B + h_{L\,AB}$$

$$\frac{\Delta p_1}{\gamma} = f_1 \left(\frac{L_1}{D_1}\right) \frac{1}{2g} \frac{16 Q_1^2}{D_1^4}$$

$$\frac{\Delta p_2}{\gamma} = f_2 \left(\frac{L_2}{D_2} + 2 \cdot \text{Tees}\ \frac{L_e}{D} + 2 \cdot \text{elbow}\ \frac{L_e}{D}\right) \frac{1}{2g} \frac{16 Q_2^2}{D_1^4}$$

integrate Q_2 & calculate pressures

then add pressures for second pipe & calculate pressure drop from first pipe.

3. Course objectives being used.
- compute pressure & forces in fluids
- Explain fluid dynamics in pipes and fittings
- Apply Bernoulli's equation to fluids
- compute friction losses in pipes & fittings (parallel)
- Identify forces in pipes such as pressure flow rate etc.

Objectives Indirectly

- Pumps (compute pumps power) Indirect because you can use flow rate & pressure to calculate a pumps power

- select a pump

If the pressures and flow is known for pipes then the correct pump can be selected.