Thermal Systems Design – Design Project 1
ME5810/6810
Fall 2008
Due October 19, 2008

A non-water chilled fluid system for a 5-story 50,000 sq-ft office building is to be designed. A sketch of required loops is shown below. The required flow rate from the chiller is 7 CFS. The air-handling units on each floor require 1.25 CFS each, except that floor 4 requires 2 CFS.

To meet this added load on the 4th floor, two design options are available: (1) close the valves on floors 1,2,3 and 5 until the desired flow rate on the 4th floor is achieved, or (2) keep all valves open, but place a second pump on the 4th floor to provide the desired flow rate. Using a multi-pipe simulation strategy, write a code using a friction factor loss representation. Find the pump power and sizes required for the two options. Find the size of the 3 different pipe diameters required. All vertical pipes and the return loop will one diameter, pipes on all floors except the 4th floor will be a single diameter, and pipes on the 4th floor will be one diameter. Size the pipes so that the velocities in the pipe do not exceed 10 ft/s.

Use schedule 40 pipe. Note that ~50' of piping is needed on each floor. Select the type of valve you would like to use.

Compare the outputs of the two options. Which design do you recommend? Why? Be sure to justify any design decisions you make.

Individual reports in the form of technical memos should be handed in. The memos should be 5-pages or less and fully describe the design process reasoning and results. Please add your code and any supplementary graphs as an appendix.

Fluid Density = 57.9 lbm/ft^3
Fluid Dynamic Viscosity = 0.001286 lbm/ft-s
Air-Handling Unit head loss $h_{fD} = 1.2Q^2$
Chiller head loss $h_{fD} = 0.04Q^2$

Floor

5   ▷◁   AHU   ▷◁

Pump   15'

4   (⊙) ▷◁   AHU   AHU   ▷◁

                                        15'

3   ▷◁   AHU   ▷◁

                                        15'

2   ▷◁   AHU   ▷◁

                                        15'

1   ▷◁   AHU   ▷◁

                                        100'

Pump 1   Chiller

(P)   [C]