HEAT EXCHANGER BASICS LAB WORKSHEET

Ch En 385 – Knotts

Overview

You will perform multiple experiments in this lab to determine how the system responds to changes in flowrate, heat transfer surface area, and geometry. You have control over the flowrate of each stream and the temperature of the hot stream. The latter is offered by mixing hot and cold water to the desired temperature and flowrate. You will do experiments on different types and sizes of heat exchangers. This requires moving some connections, but this will be done by the TA. Students will only be changing flowrates (and through the flowrates—temperature).

This lab will take two total weeks. You will take data the first week and start the analysis of the data. You will complete the analysis the second week.

Experimental Procedure

Start Up

1. Press and hold the On/Off button on the Temperature Readout display to turn the unit on.
2. Visually check the following. (The TA should have done these, but it is good safety practice to double check. See the TA Instructions for complete details.)
    a. Ensure the system is connected to the wall and the *smallest brazed-plate* exchanger.
    b. Ensure each rotameter valve is completely shut (to the right). *Do not overtighten these values*.
    c. Ensure the metal ball valves on the wall for IHW and ICW are open (the handle of the value is in line with the flow direction and not perpendicular).
    d. Ensure the plastic ball valves to the PCHWS and PCHWR are open (the handle of the value is in line with the flow direction and not perpendicular).
3. Open the valve on each rotameter until the flow stabilizes (about 2 turns).
4. Let the system come to steady state to flush each line.

Experiments

1. Set the unit (smallest brazed plate HX) to the following flowrates.
    a. Hot water: 3.0 gpm
    b. Cold water: 0 gpm
    c. Chilled water: max
        i. The chilled water from the heating plant is not always a consistent pressure.
        ii. You want to run the same chilled water rate for most later runs.
        iii. Open the valve all the way *and record the flowrate*.
2. Wait for the unit to reach steady state (1-2 minutes) and record the data in Table 1.
3. Change the flowrates to the specifications for Experiment #2 in Table 1.
    a. The condition labeled "(max)" means fully open the rotameter value.
    b. Make sure to record the flowrate for this condition.
4. Wait for the unit to reach steady state (1-2 minutes) and record the data in Table 1.
5. Have the TA change the system to the *large plate* exchanger.
6. Perform Experiments #3-#11 of Table 1 making sure to record the data.
7. Have the TA change the system to the *shell and tube* exchanger
8. Perform Experiments #12 and #13.

9. Have the TA change the system to run counterflow on the *shell and tube* exchanger.
10. Perform Experiment #14.

TABLE 1: EXPERIMENTAL DATA

Exp. #	Heat Exchanger	Water Flowrate (gal/min)			Temperatures (°C)			
		Hot Water	Cold Water	Chilled Water	T1	T2	T3	T4
1	Small Plate	3.0	0	(max)				
2	Small Plate	(max)	0	(max)				
3	Large Plate	3.0	0	(small plate max)				
4	Large Plate	3.0	0	(max)				
5	Large Plate	2.0	0	(max)				
6	Large Plate	1.0	0	(max)				
7	Large Plate	0.5	0	(max)				
8	Large Plate	0.5	1.5	(max)				
9	Large Plate	1.0	1.0	(max)				
10	Large Plate	1.5	0.5	(max)				
11	Large Plate	(max)	0	(max)				
12	S&T	3.0	0	(small plate max)				
13	S&T	(max)	0	(max)				
14	S&T counter	(max)	0	(max)				

Analysis