Table 1: Recorded values from Plate Heat Exchanger Lab.

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Type** | **100%** | **75%** | **50%** |
| Qe [W] | 1296.029 | 1465.676 | 1303.070 |
| Qa [W] | 1135.220 | 1314.349 | 1130.405 |
| Mdot Hot [kg/s] | 0.041 | 0.041 | 0.041 |
| Mdot Cold [kg/s] | 0.029 | 0.029 | 0.019 |
| Qf [W] | 160.809 | 151.327 | 172.665 |
| U [W/m2.K] | 3531.077 | 3382.922 | 2978.389 |
| Mean Temp Efficiency [%] | 44.48% | 45.86% | 48.16% |
| Vdot Hot [m3/min] | 4.148E-05 | 4.139E-05 | 4.175E-05 |
| Vdot Cold [m3/min] | 3.401E-05 | 2.900E-05 | 1.871E-05 |
| System Efficiency | 86.9% | 89.3% | 86.7% |

**1. Did the heat exchanger remove more or less heat from the hot stream as the flow rate of the cold water decreased?**

To determine if the heat exchanger removed more or less heat from the hot stream as the flow rate of the cold water decreased, we refer to the heat absorption equation from Dr. Kassegne’s Lab 5 Plate Heat Exchanger document [1].

$$Q= \dot{m\_{c}}c\_{p}∆T= \dot{m\_{c}}c\_{p}(T\_{4}-T\_{3})$$

The heat loss, *Q*, is a function of the mass flow rate of the cold water, $\dot{m\_{c}}$. Thus if the flow rate of the cold water decreases, the heat loss through the system will decrease resulting in a higher temperature of the hot water. If the cold water moves at a slower rate, the hot water will be able to increase the temperature of the cold water making the difference in temperature, *ΔT*, smaller which will also reduce the heat loss through the system.

**2. Did the system efficiency increase or decrease as the cold water flow rate decreased?**

The efficiency of the system is described as the heat absorbed by the system divided, $Q\_{absorbed},$ by the heat emitted from the system, $Q\_{emitted}$.

$$η= \frac{Q\_{absorbed}}{Q\_{emitted}}\*100\%$$

The values for the heat absorbed and the heat emitted move linearly with each other so the efficiency will stay around the same value. As the mass flow rate decreases, the heat absorbed decreases and the heat emitted decreases. Thus the ratio between the two values stayed fairly constant. The efficiencies for the 100%, 75%, and 50% flow of the cold water were recorded as 86.9%, 89.3%, 86.7% respectively. The values can be seen in Tab. 1.

**3. Were there any systematic or random errors that affected your measurements? Discuss in detail and suggest innovative ways to minimize such errors.**

During the experiment, we noticed the filter at the inlet of the cold water flow was filled with algae which may have infiltrated the system or impeded the flow of the cold water. It is recommended the filter be removed and cleaned, or if damaged then the filter should be replaced. Calibration of the thermocouples is recommended to ensure the most accurate readings possible for this experiment so the overall efficiencies are more accurate.

**[1]** Kassegne, S. "ME495 Lab - Tubular Heat Exchanger - Expt Number 4." Mechanical Engineering Department. San Diego State University. Fall 2011.