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| **Results Table** | | | | |
| ṁc (kg/s) | ṁh (kg/s) | Tho (°C) | NL (#) | L (m) |
| 50 | 59.657 | 500 | 46 | 1.8356 |
| 50 | 74.233 | 540 | 36 | 1.427 |
| 50 | 117.968 | 600 | 24 | 0.939 |
| 60 | 71.589 | 500 | 50 | 1.9827 |
| 60 | 94.91 | 550 | 36 | 1.4409 |
| 60 | 141.562 | 600 | 26 | 1.0163 |
| 70 | 87.816 | 510 | 50 | 1.9855 |
| 70 | 118.503 | 560 | 36 | 1.441 |
| 70 | 165.155 | 600 | 27 | 1.0808 |

Table 1: Results for ṁh , NL , L are shown for their respective ṁc , Tho

= Design Point

Figure 1: Gas outlet temperature is plotted against gas mass flow rate.

= Design Point

Figure 2: Number longitudinal tube rows is plotted against gas mass flow rate.

= Design Point

Figure 3: Exchanger length in the flow direction is plotted against gas mass flow rate.

**Design Point**

Upon inspection, it is found that altering only the water mass flow rate does not ultimately impact the efficiency of the heat exchanger, as ṁh has a linear dependence to ṁc which will cancel out the change when dividing q/qmax. It is found that the only input design change that alters the efficiency of the heat exchanger is the value of Tho, the gas outlet temperature. A design preference for water mass flow rate is chosen as 50kg/s as the smallest available flow rate. This will reduce the required length of the heat exchanger for any chosen Tho. A value of Tho is chosen to be 500K as it satisfies the ≥400K constraint and provides the largest available heat exchanger efficiency of about 48.78% while also minimizing the gas outlet temperature. This will help reduce potential danger in the exhausting (or whatever subsequent handling takes place after exiting the exchanger) of the hot gas. This design choice provides a lower ṁh as well, as per the linear correlation mentioned, which should allow for greater factors of safety in handling the hot gas while delivering it to the exchanger and pathing away from it. The corresponding length of the heat exchanger for these design choices returns as 1.8356m which is less than its higher flow rate counterparts for the same Tho. While all calculated lengths fit within the 2 m constraint, this option will minimize volume of the exchanger for the design choice of Tho= 500K. The number of tubes in the longitudinal direction is highest at lower Tho values, and as such may increase the cost of the heat exchanger. But assuming equal pump motor efficiencies across different mass flow rates of ṁc and ṁh , less power should be required to run the exchanger as per the lower flow rates which would be more economical over long term usage.

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| **Tho** | **Efficiency** |
| 500 | 0.4878 |
| 540 | 0.3924 |
| 550 | 0.3659 |
| 560 | 0.3415 |
| 600 | 0.2439 |

Table 2: Heat exchanger efficiency is shown for varying values of Tho.