Details of Final Mechanical Design

The final design of the mechanical system is very similar to the original design. It is a combination of ruler shaped heat conduction rod with a light pocket milled for the face of the thermoelectric. The overall dimensions are 6.94 inches long 2.75 inches wide and .5 inches thick. These dimensions were chosen because they were the closest standard dimensions to the ones generated by our analysis. Our team also used an insulated cover on section of the heat conduction rod exposed to the environment. This not only protected the user from the heat, but helped minimize losses on the exposed section. The rod is joined to the heat sink through 4 socket head cap screws, using springs to maintain pressure on the thermoelectric. The springs were not part of the original design, but after the first experiment it was clear that something was needed based on how loose the screws had become through the heating cycle. The heat sink is a seven extruded fin design with a matching pocket milled for the cold side of the thermo electric. The overall dimensions of the base are 3.15 inches by 4 inches. The height from the bottom of the base to the top of the fins is 2.88 inches with a base thickness of .38 inches. The base surface of the heat sink is insulated from the housing surface, but slightly thermally coupled by the two screws that hold the heat sink in place on the housing. The housing is a boot shaped design with the overall dimensions of 10 inches by 5.18 inches by 3.27 inches. The “toe” of the boot fits into the air intake of the stove with the long section turning upward. The wall of the housing has one cutout for the interface between the temperature control devices, the heat sink being on the inside of the housing and the end of rod matching up on the outside. The other cutout in the side of the housing is for allowing air to escape when the bypass is adjusted. The bypass is our design for controlling air flow. This allows for the fan to continuously run at its optimal point regardless of the air requirements of the fire. This also allows us to maintain maximum flow over the heat sink in times of low air requirement. This proved to be critical in maintaining the temperature difference across the thermoelectric. The thermal system developed is designed to achieve a 200°C temperature difference and pass 110 watts of heat across the thermal electric. The design actually achieves a steady temperature difference of about 150°C from what was measured. Further analysis is needed to determine the actual wattage of heat being passed through the system.