Thermoforming Dual Heater System

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Abstract: A vacuum thermoforming machine works by heating a clamped polymer sheet and then engaging the tooling to form the desired shape when the plastic is at the proper temperature. The current vacuum thermoforming machine in the Trine University Plastics Lab possesses a single top-side heater. With the current setup, thicker materials will be scorched on the material’s top side and while the bottom side is not heated enough. In order for thicker materials to be used by the machine and heated effectively, a second bottom-side heater is needed. Since an off the shelf solution is not feasible, the second heater must be designed and fabricated. Before fabrication of the secondary thermoforming heater, several analyses were conducted to ensure that the heater would function within the necessary operating parameters. Using thermal simulation software, the designed heater enclosure box was tested to ensure that the correct thermal flow was provided as needed. Material properties were then applied to the CAD files and finite element analysis software was used to ensure that the new heating enclosure and track system would be structurally sound. Although variations of the heating enclosure setup were taken into account as part of these analyses, the results favored mirroring the existing heater layout with some adjustments. Instead of sixteen individual horizontal coils like in the top heater, three coils with three bends each were used. Testing showed that the same watt density could be achieved with only three coils using this design. The new heater was also made thinner in order to allow for more space for the mold. The heater tray was insulated in order to protect the mold which rests underneath and also for safety purposes. By providing Trine University with a second heater, the group hopes to expand the capabilities and learning possibilities that the plastics lab provides.