Automated Polyethylene Flange Machining

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Project Background

Poly Tech is a company that specializes in aftermarket solutions made of polyethylene, for agriculture equipment. All of their solutions are intended to be bought and serviced by the owners of the equipment. These solutions aim to solve some problem that the equipment is prone to have.

Upon receiving the machining table, it was non-functional and unusable. To address this issue, we were tasked with refurbishing and improving the machine's performance. The table was initially designed to create grooves on sheets of polyethylene, which was a vital component for our agricultural needs. With our work, we improved the accuracy, user-friendliness, and safety of the machine, which greatly increased the production output for Poly Tech.

Goals

Automate machining process

- Reduce the amount of human input required to operate machine
- Make machine physically easier to operate

Structurally enhance machine

- Add leg supports to reduce the risk of collapse
- Redesign and implement a new backstop mechanism
- Implement new work surface to reduce deflection and increase accuracy of the cuts

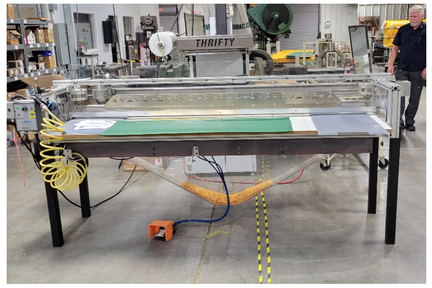
Development

Mechanical Issues

- Legs buckling inward
- Flimsy Backstop
- Rough and uneven work surface

Mechanical Solutions

- Leg supports
- Pnuematic cylinder powered backstop
- Smoother aluminum work surface

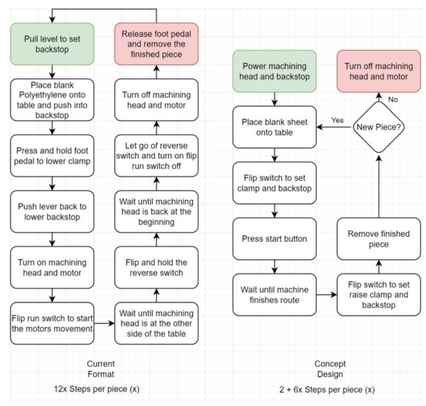


Electrical issues

- Pneumatic foot pedal that didn't work as intended
- Convoluted process to operate machine

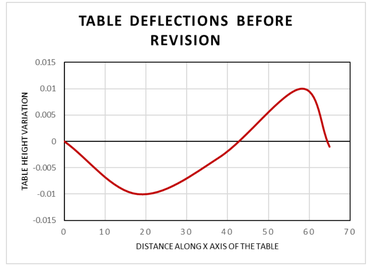
Electrical Solutions

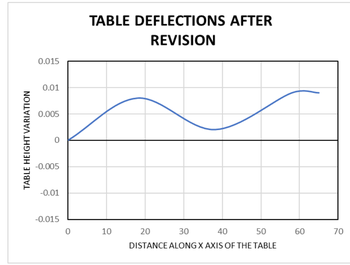
- Electrical foot pedal with toggle capabilities
- Microcontroller based control panel to automate the machining process



Testing

Before and after redesigning the machine we created a map of table deflections. These measurements were taken across the cutting axis while the clamping motion is engaged and free from the workpiece





Codes and Standards

- Control of Hazardous Energy (Lockout/Tagout)
  - OSHA Standard 29 CFR 1910.147
- Mechanical Power Transmission Apparatus
  - OSHA Standard 29 CFR 1910.219
- General Electrical Requirements
  - OSHA Standard 29 CFR 1910.303
- General Requirements for All Machines
  - OSHA Standard 29 CFR 1910.212
- Wiring Methods, Components and Equipment for General Use
  - OSHA Standard 29 CFR 1910.305

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Sponsor/Client: Poly Tech Industries