Manufactured Door Frame One-Way Gate Installation System

Local Door Manufacturer

Western Carolina University
School of Engineering + Technology

Original Objectives

- Eliminate the need for plugging the fill hole during the foam injection process by creating a one-way gate component
- Develop automated/semi-automated/manual processes to install one-way gate component
- Modify the injection process without increasing cycle time

Requirements

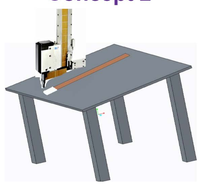
- The material cost per door must be less than or equal to $0.08
- The operation should be reduced from two-person process to a one-person operation
- Device must seal off injection site, keeping foam contained within door frame with minimal leakage
- Device must be of correct size to not impede function of foaming nozzle or door features
- Device must not alter current door geometry
- Assembly process must allow for more than 3ppm (2000+ per 12hr shift)
- Staple must be inserted the appropriate distance away from the injection sight

Concepts

Concept 1

- Support arm and tool balancer to hold pneumatic stapler
- Manual gate positioning by operator
- Multiple gates per cycle

Concept 2



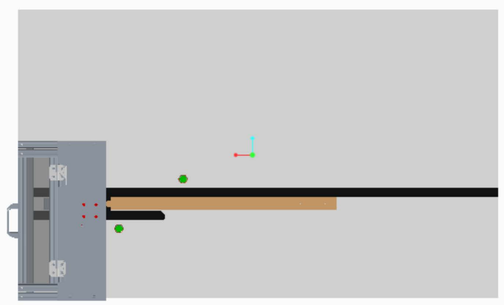
- Automatic stapler
- Manual gate positioning by operator
- One gate per cycle

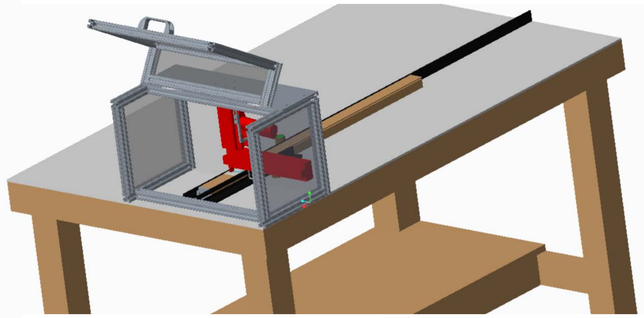
Problem Statement

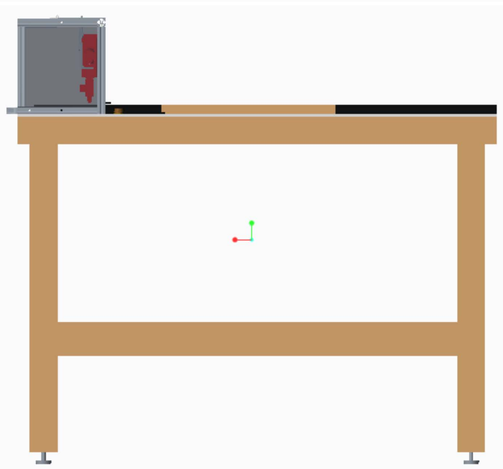
During the foaming process of fiberglass doors, a plug is hammered into every door immediately after polyurethane (PU) foam is injected into the door cavity. This prevents the foam from escaping out of the fill hole as it expands. The current process requires two employees; one to inject the foam and another that is solely responsible for plugging fill holes. The goal of this project is to modify the construction of the door frame to eliminate the need for a plug. Any modifications to the port must be compatible with automated door manufacturing processes.

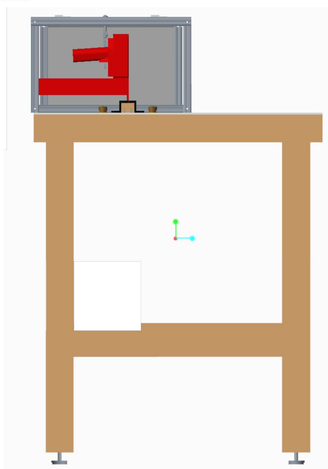
Final Design/Results *

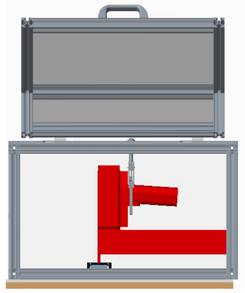
- Tabletop workstation with shelving underneath for storage of necessary materials
- Pneumatics system consisting of trigger mechanism, door safety switch, dual finger operation switches, and main air supply for stapler
- 80/20 enclosure guarding with finger notch for operator safety
- Guard rails to aid proper positioning of the door frame
- Adjustable backstop for added customization and versatility

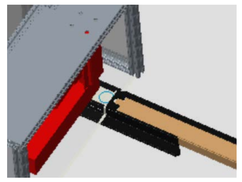












* On March 16, 2020 classes and labs were closed to students due to the COVID-19 Pandemic. Without access to fabrication and testing equipment, Objectives and Deliverables were modified accordingly.

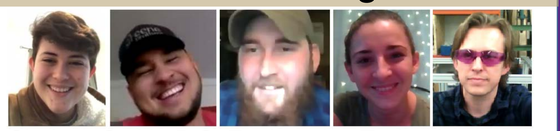
Modified Objectives*

- The team was able to accomplish the majority of the original objectives, however due to unforeseen circumstances the final fabrication and assembly of some features was no longer possible
- The team originally planned to test and verify that the solution will function as expected and meet the sponsor's requirements. Losing access to campus resources will not allow us to complete this testing
- The team has modified the original testing plan to provide
- The team has created an assembly guide to provide instruction for future fabrication and construction

Summary

- Completed 3D model with greatest level of accuracy possible without access to the physical project
- 8020 enclosure has been purchased and assembled
- Fully constructed table workstation is complete and ready for 8020 enclosure to be mounted
- Blueprints have been created for custom parts that have not yet been manufactured
- Assembly instructions created for the remainder of the table, enclosure, pneumatic system & lighting features

Team & Acknowledgements



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