



ADVANCED SUPERABRASIVES
Manufacturers of Diamond & CBN Grinding Wheels

Abrasive Wheel Polisher



School of Engineering + Technology

Original Objectives

- Evaluate current process of manually polishing wheels
- Create an automatic way to polish the Abrasive Wheels.
- System must polish various sizes of the wheels diameter, thickness and different type of materials.
- Build a functional prototype to provide a smooth transition into current production line.
- Be tested for removal of defects added polish and without damages.
- Successfully deliver a functional prototype to sponsor.

Requirements

Req #	Requirement	Description	Test	Status
1.1	Clean wheels with varying inner diameters	Wheel sizes vary from a 3/8in – 6in inner diameter	Demonstration	Accounted for in design Unable to test due to Covid-19
1.2	Clean wheels with varying outer diameters	Wheel sizes vary from up to 4in – 8in outer diameter	Demonstration	Accounted for in design Unable to test due to Covid-19
2.1	Clean wheels made from aluminum	The wheels that must be cleaned are made of aluminum	Demonstration	Accounted for in design Unable to test due to Covid-19
2.2	Clean wheels made from steel	The wheels that must be cleaned are made of Steel	Demonstration	Accounted for in design Unable to test due to Covid-19
3	Process simultaneously	Multiple wheels must be processed at the same time	Demonstration	Accounted for in design Unable to test due to Covid-19
4	Must not erode resin off wheel	The process must not remove the resin that is applied to the outer side of the wheel	Demonstration	Accounted for in design Unable to test due to Covid-19
5	Must remove bad surface finish	Removes rust, residue, flash, and fixes discoloration	Demonstration	Accounted for in design Unable to test due to Covid-19
6	Must be automated or semi-automated	Must relieve two workers from the manual polishing station to work on other steps in the process	Demonstration	Accounted for in design Unable to test due to Covid-19
7	The wheels must look aesthetically pleasing	The polish should give the wheels a new finished look that pleases the customers	Demonstration	Accounted for in design Unable to test due to Covid-19
8	The process must stay within existing time frame	Each wheel should take between 2-6 minutes for a complete polish	Demonstration	Accounted for in design
9.1	Must be compatible with a single phase 240-volt electrical system	They use a single phase 240-volt system in the facility	Analysis	Accounted for in design
9.2	Must be compatible with a three phase 240-volt electrical system	They use a three phase 240-volt system in the facility	Analysis	Accounted for in design
9.3	Must be compatible with a pneumatic system	The facility operates with a pneumatic system	Analysis	Accounted for in design
10	Machine must not exceed approximate size of 7ft by 7ft by 9ft	Floor space within the facility is limited	Measurement	Accounted for in design

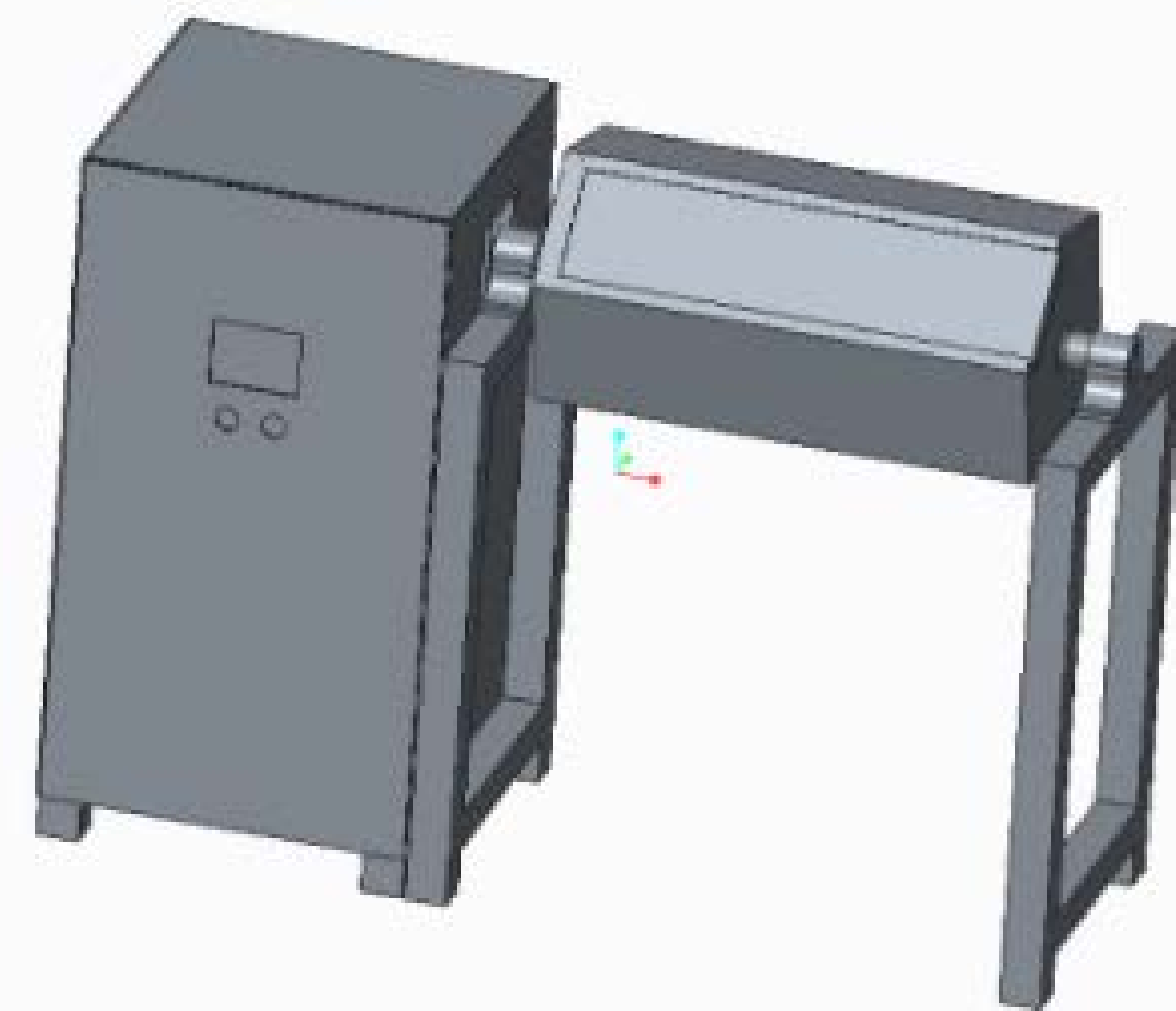
Concepts

Requirements (weight)	Alternatives			
	Dishwasher	Sandblaster	Turning Table	Drag Media
Clean multiple wheels (Yes,No)	Y	Y	N	Y
Clean multiple material (Yes,No)	N	Y	Y	Y
Process simultaneously (Yes,No)	Y	Y	N	Y
Must not erode resin off wheel (Yes,No)	N	N	Y	?
must remove bad surface finish (Yes,No)	N	Y	Y	Y
Has to be automated or semi-automated (Yes,No)	Y	Y	Y	Y
Must look aesthetically pleasing(Yes,No)	N	Y	Y	Y
The process must stay within existing time frame (Yes,No)	Y	Y	Y	Y
Comments:	uses chemicals for finish			Different materials of media are available
Risks (Likelihood/Impact)				
Human exposure to chemicals (L-M-H)	H	L	L	L
Abrasive wheel is not aesthetically pleasing (L-M-H)	H	L	L	L
Resin is removed off of wheel (L-M-H)	H	M	L	M
Unable to process wheels simultaneously (L-M-H)	L	L	H	L
Unable to process multiple wheel sizes (L-M-H)	L	M	L	L
Unable to process wheels of differing materials (L-M-H)	H	M	L	M
Doesnt remove bad surface finish (L-M-H)	H	L	L	L
Comments:				
Costs (low to high)	Medium	medium	High	medium

Problem Statement

- High performance Abrasive Wheels are one of a kind technology that is only produced in Mars Hill, NC. The company, Advanced Superabrasives, Inc. (ASI), is a privately-owned US based manufacturer of premium high-performance Diamond and CBN Wheels. ASI is supported greatly by its customers and businesses since founded in 1993. The high-performance tool is used in many industries such as automotive, woodworking, aerospace, ceramics, and metalworking. ASI is an ecologically friendly facility that strive to provide quality, precise, cost efficient products to its global customer base.
- Unfortunately, the finishing process is being manually done by two employees and this process isn't very cost efficient. ASI has been producing quality polished wheels out in the world and have to hold up to that reputation, but manual cleaning is time consuming. The idea is to manufacture an automated or semi-automated cleaning system that will wash, remove cosmetic defects or polish these abrasive wheels without 100% involvement by employees. The polishing system must consider the various sizes of the wheels diameter, thickness and different type of material (alloys, steel, aluminum powder, Bakelite). The impact of the project will increase their efficiency on production and time. More products will be able to be made without tying up employees with this tedious polishing process. This in turn will provide a smooth transition from constructing to polishing to inspecting to packaging to shipping. Reducing the polishing stage will speed up the process.

Final Design



Dimensions :

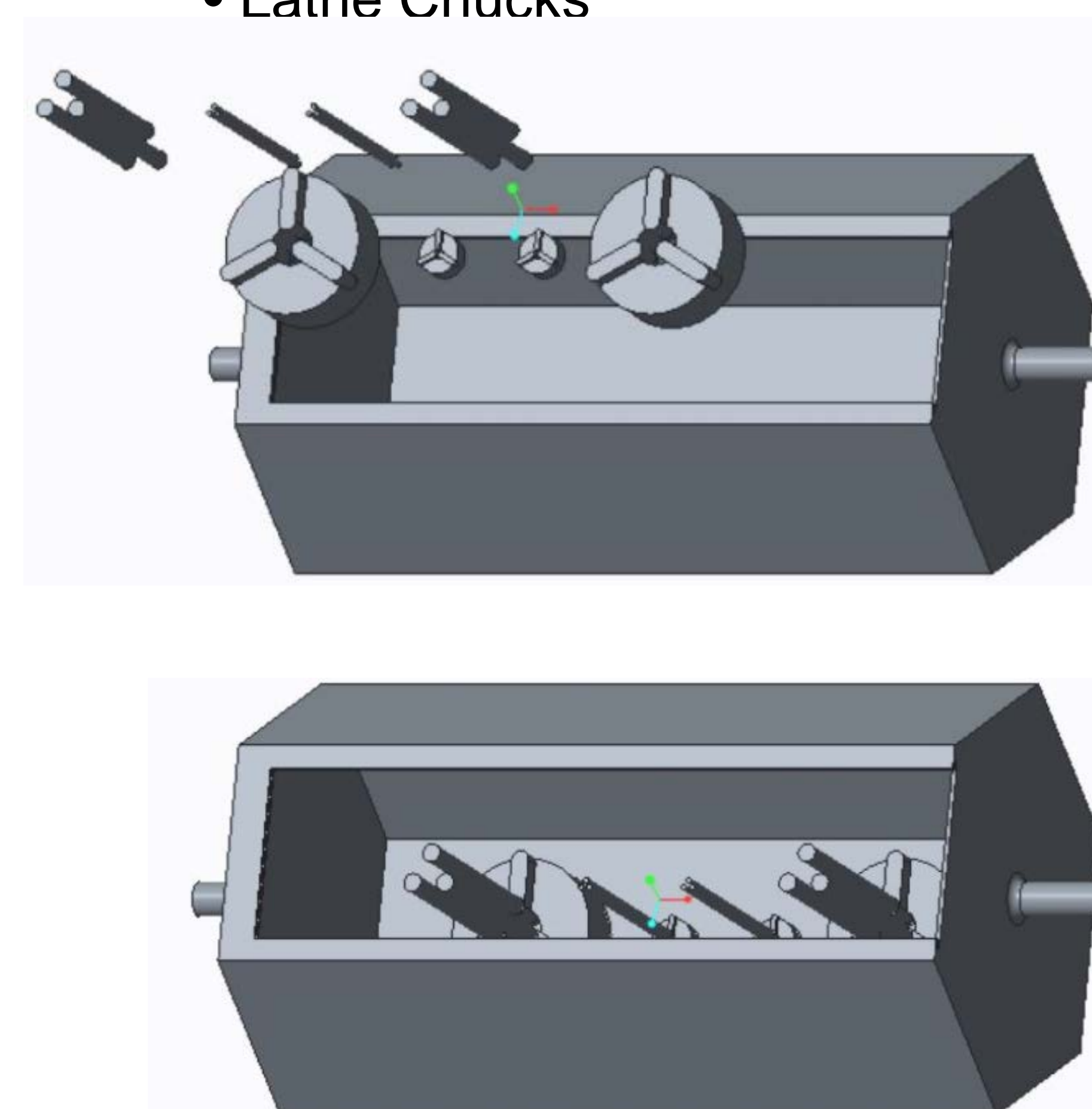
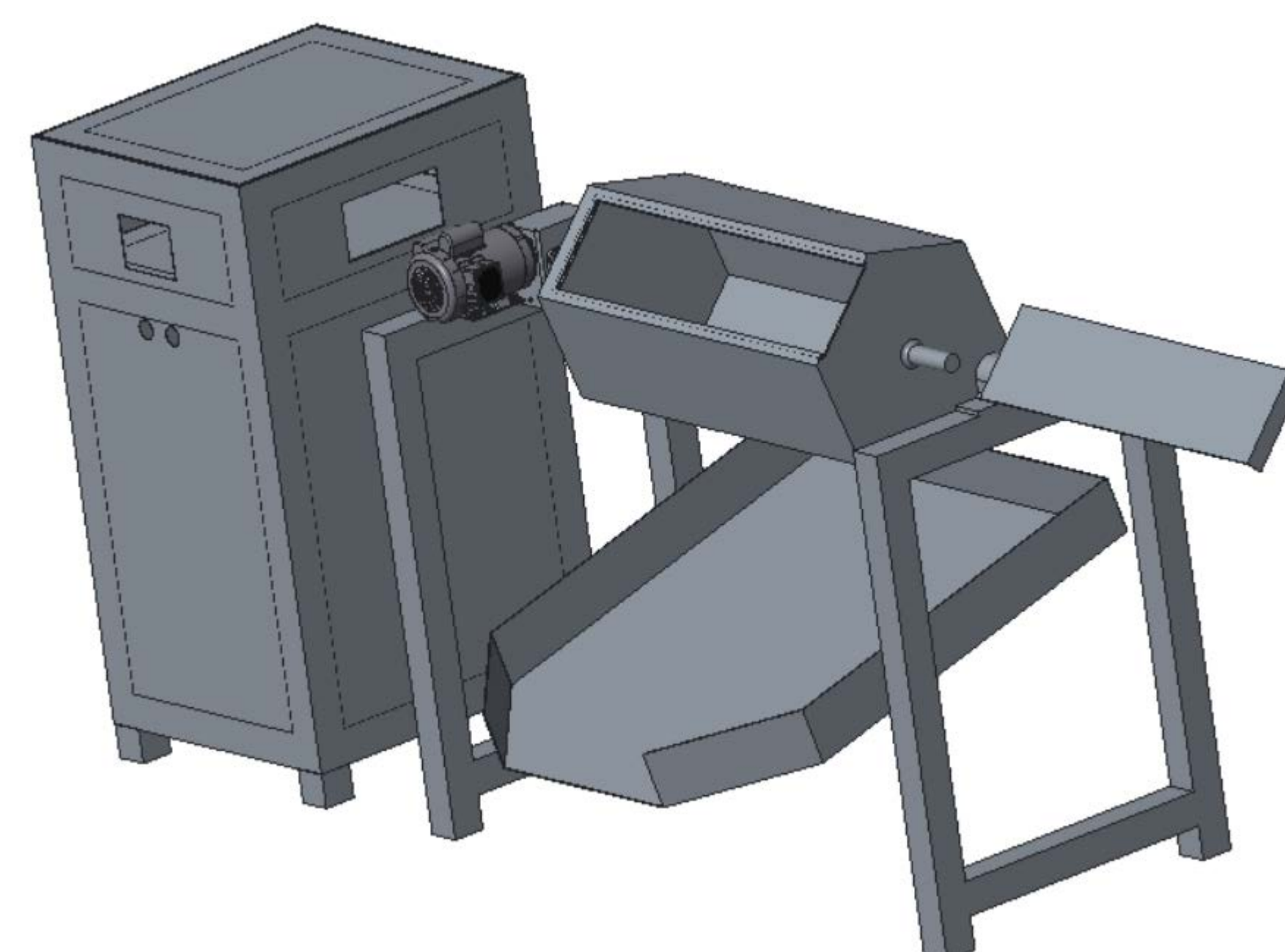
- 7ft x 2.625ft x 5ft

Function:

- Will have the ability to polish multiple wheels of varying sizes using drag media

Components :

- Motor
- Gearbox
- HMI
- Push Button and Emergency Stop
- PLC with VFD
- Latch
- Proximity Sensor
- Lathe Chucks



Modified Objectives*

- Functional working prototype**
 - Fabrication of the prototype has been halted due to access to campus labs and fabrication spaces being cancelled for the remainder of the semester. In lieu of completing fabrication and assembly, the team proposes to develop a detailed manual containing all relevant information, documentation, and instruction necessary to outsource this work in the future. This manual will include:
 - CAD and/or CAM models for custom part fabrication
 - A purchase order for any parts/materials that have yet to be purchased, so that these items may be purchased once work resumes
 - Basic flow chart for the logic needed for programming/coding
 - Detailed assembly instructions with the aid of pictures, photos, drawings, etc.
- Test plan with data collected and analysis**
 - Testing is no longer an option, because of restricted access to the sponsor's facility and campus resources. In lieu of data collection or analysis, the team proposes to research on the method chosen and present a short report of our findings.
- Testing Report**
 - The team had originally planned on testing and verifying that the solution functions as expected and meets the sponsor's requirements. Losing access to campus resources will not allow us to complete our testing. Instead of testing and presenting the results, the team proposed to modify our original test plan from Stage 3, adding new instruction for the test to be conducted in the future by someone other than the team. This instruction will be clearly laid out and easy to follow.

Summary

What will be provided to sponsor:

- Complete final design of Abrasive Wheel Polisher
- Creo parts/assemblies of mechanical components
- Electronic schematics
- Program/code
- BOM of all components

What will be provided to sponsor due to Covid-19:

- A report on testing data findings in lieu of test plan
- A more in-depth testing plan
- Detailed assembly instructions
- Inventory documentation and purchase orders
- Basic flow chart for programming

Team & Acknowledgements

Team:

Adam Sluder – Engineering Technology
 Luke Sanderford – Mechanical Engineering
 Devaniel Dale – Engineering Technology
 Dhyaa Felemban – Electrical Engineering

Mentor: Neleson Granda-Marulanda

Sponsor: Brian Jones

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* 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.