WPI

Addendum to Process Improvement Project
at Saint-Gobain Norton Abrasives

Submitted to the faculty of Worcester Polytechnic Institute

Submitted by:
Trung Tran Trong

Project Advisor: Sharon Johnson, PhD
Project Co-Advisor: Robert Daniello, PhD
Project Sponsor: Saint-Gobain Norton Abrasives

Introduction

One of Saint-Gobain's processes in manufacturing superabrasive grinding wheels is the removal of the inner arbor. While separate from the processes addressed in the overall project, this operation is part of the manufacturing process and there is an opportunity for process improvement. This process is currently done manually and has a cycle time of approximately five minutes, according to conversations with operators. This process is done by the operator holding the wheel standing while hammering out the arbor, and is a potential area for improvement in both ergonomics and reduction of cycle time. This subproject provides a design solution for the arbor removal process.

Customer needs

- Accommodates all wheel configurations
- Reduces cycle time
- Ergonomic and safe
- Non-damaging to WIP
- Cost-effective

Functional requirements

- Press frame inner width at least 40 inches
- Ram to be able to push arbors out for wheels from thickness 2-22 inches
- Rollers rubberized to prevent damage to WIP
- Minimum custom equipment to reduce costs
- Built from current available frame at the plant
- Does not fail under stress applied in normal working conditions

Methodology and design

This project first involved researching the requirements and constraints for the design of the frame for the press. The minimum and maximum dimensions of the WIP that would be used on the press were given by the operator, while certain ergonomic requirements were given by the plant manager and supervisors. To ensure effectiveness of the design, it was crucial to consult with the operators who would be using the design. With this information, the next task was to research available industrial parts that can be used in the design of the press frame.

To facilitate the movement of the WIP, I referenced available roller conveyors on Global Industrial, finding a set of appropriate conveyors given the requirements. Since the largest WIP for the press is 38 inches in diameter, the frame will be a maximum width of 40 inches to give additional room for the WIP to slide in. Using two 12-inch-wide conveyors will provide a maximum central gap of 8 inches for the largest of arbors to fall through. To minimize potential damage to the WIP, the conveyor rollers should be fitted with rubber covers.

To accommodate for the different wheel configurations, the table must be able to be adjusted for different wheel diameters and the press must be able to be adjusted for wheel thicknesses. To adjust for diameter, the conveyors will be set on wheels, fixed in rails, while to accommodate for thickness, the press nose piece can be removed and replaced with heads of different length. Initially, the proposed design for adjusting the height of the press involved mounting the press on adjustable rails, but after reviewing the design, the simpler solution of replaceable nose pieces was chosen instead. Similarly, the initial design to accommodate for different wheel diameters involved mounting conveyors on adjustable rails, but a design that allows for the conveyors and their legs to move was chosen instead due to its reduced complexity.

Once the overall design for the table was set, the press frame had to be adjusted to fit the new dimensions. The current available press frame (Figure 1) at the plant has an inner width of 28 inches. To fit the design requirements, the frame should be cut and welded with extensions to a total width of 40 inches.

The deliverable for this project is a bill of materials and overall design for the press and frame. Keeping custom parts to a minimum, where there are necessary parts to manufacture, those parts are included as drawings.

Figure 1. Available press to be modified

Deliverables

Table 1. Bill of Materials

ITEM NO.	PART NO.	DESCRIPTION	QTY	IMAGE
1	Omni Metalcraft P/N RSHS1.4-12-3-5-LL	Omni Metalcraft STEEL 5' LONG STRAIGHT SECTION ROLLER CONVEYOR	2	
2	Omni Metalcraft P/N LSHT"BF"-30.25-42.25 TOL-12W	PERMANENT LEG SUPPORT FOR Omni Metalcraft SKATE WHEEL OR 1-3/8" DIAMETER ROLLER CONVEYORS	4	
3	VinylGuard® P/N 31-CV-1375B	VinylGuard® Heat Shrink-to-Fit Conveyor Roller Cover	1	
4	Hamilton® P/N R-WH-6FSB	Hamilton® Workhorse Forged Rigid 6 x 2 Forged Ball 2000 Lb. Caster	8	
5	NOSE-10	10" Nose Piece	1	Figure 2
6	NOSE-18	18" Nose Piece	1	Figure 3

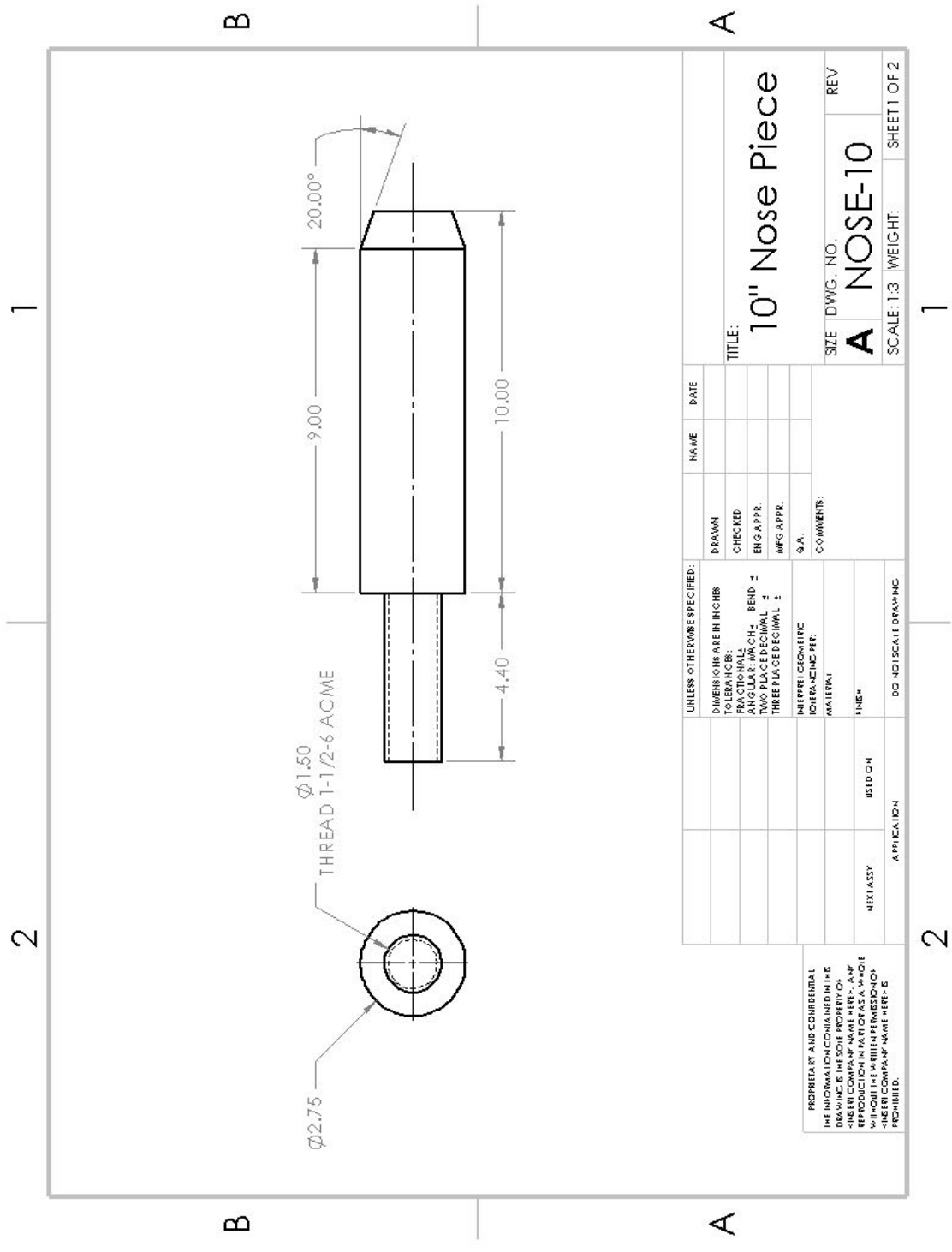

Figure 2. 10" Nose Piece drawing

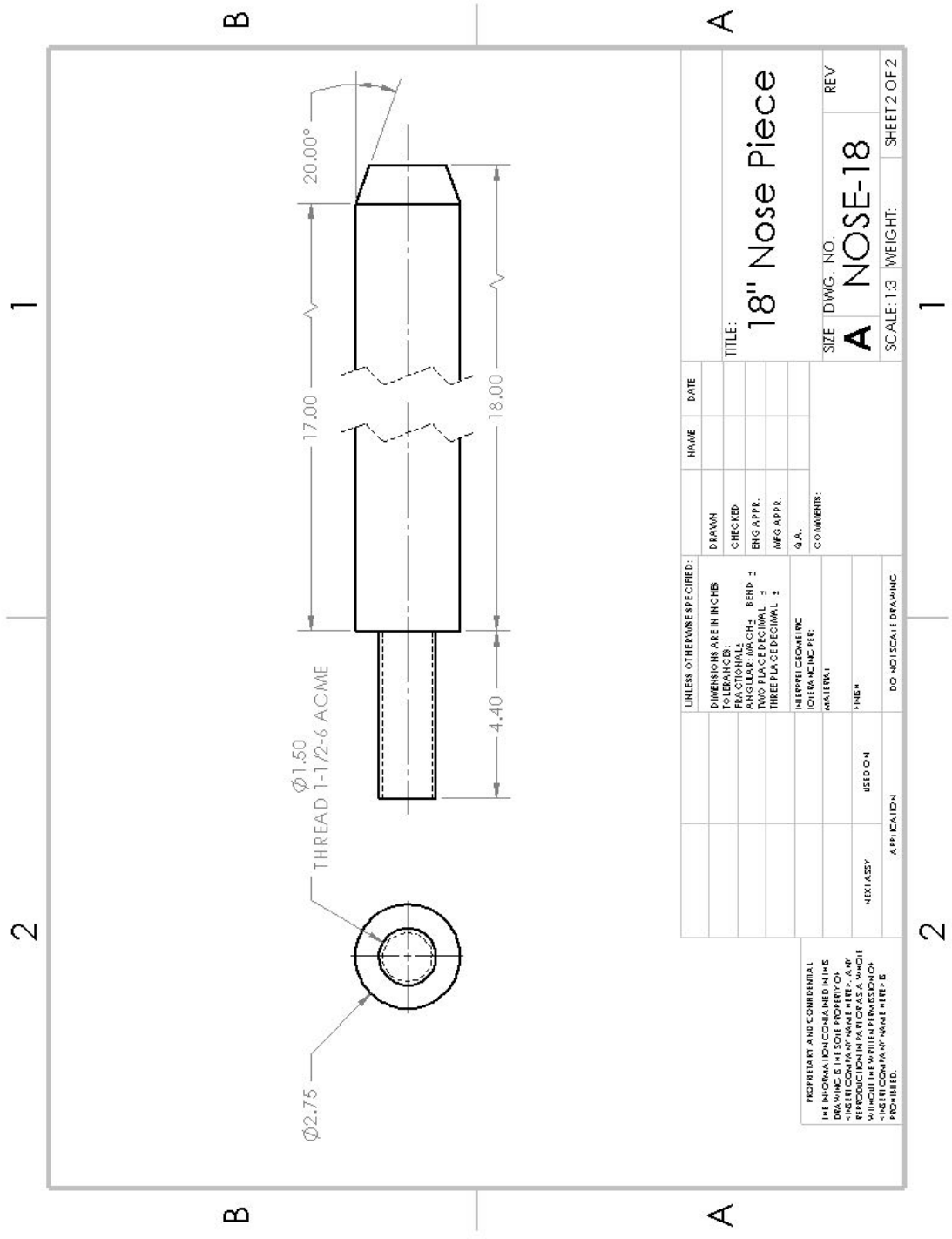

Figure 3. 18" Nose Piece drawing

Conclusions

The implementation of this design will improve safety and cycle time at the arbor removal process. Operators would not have to manually lift the wheel to remove the arbor, minimizing the risk of the wheel slipping and injuring the operator. It is expected that additional automation of this process would reduce the process cycle time from 5 minutes to 3 minutes, thereby increasing throughput for these superabrasive grinding wheels.

Further recommendations

Following implementation of this design, there are additional opportunities for further improvement, such as tailored cart design. With specific carts designed for this press, incoming WIP can be moved from the cart to the press seamlessly, without the requirement for potentially lifting the wheel from one area to another.