

Metal Shear Blade Replacement System

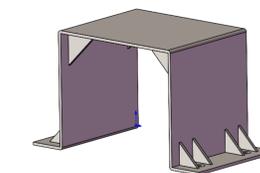
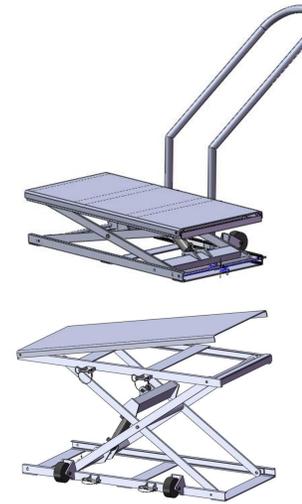
Project Description

Western Metals Recycling's metal shear blades are maintained or changed approximately every 2 weeks. This process is currently labor intensive and unsafe. The purpose of this project was to design and build a system or procedure to increase the speed and safety of the process, while reducing the amount of effort needed. The design requirements are as follows

- \$5000 Budget
- Run on electrical, pneumatic, or hydraulic power
- Maintain operator safety
- Function within space constraints of shear
- Remove and replace shear blades
- Operators should not be required to lift more than 50 lbs
- Device must be able to function in temperatures from -20 F to 110 F and Any weather condition



Design Description



- This project consists of three different systems, the scissor table, crane arm/base, and the pusher puller.
- All components are built using steel to withstand the forces of blade moving and replacement

The systems of project design and their functions:

- The scissor table is moved into place in the shear throat, used to lift and lower blades to working heights safely
- The crane arm is used to move blades to and from shear mouth
- The pusher puller is used to remove the blades by placing the collet inside the blades; force is then applied to the center line of the pusher puller to remove blades



Performance Review

- Most of the tests performed on this device were done using field tests at WMR



- Test not performed in the field were done using calculations with known forces from loading conditions
- The performance of required lifting force was done by determining the maximum load required by the technician during a blade change.

Parameter	Targets	Threshold	Actual Performance
Time to complete blade change (hours)	3.5	7	4
Manual Force required by Technician (lbf)	50	100	60
Force to tip while holding blade (lbf)	100	25	52.27
Operator distance from blade during operation (ft)	1	3	1 - 1.5
Lateral motion for blade alignment (in)	3	0	30+
Rotational motion for blade alignment (deg)	5	0	5
Static height in between phases (ft)	3.5	2	4-1
Number of steps to complete flip	2	5	4
Number of mechanical inputs to complete process	3	7	5
Number of steps to reconfigure for pulling collars	2	7	NA

Conclusion

This project was able to produce a working prototype of the system to WMR that met the needed requirements. These results are shown in the Performance section. The follow came as results of this project

- Working system capable of assisting with shear blade replacement
 - All 3 systems working, Scissor Table, Crane Base and Arm, and the Pusher Puller
- Lessons Learned
 - Clear definition of desired results allows for a clearer design path to a solution
 - Understanding the customer's desires for the project is critical to a good design for the customer
- Recommendations for future work
 - Hydraulic device to push the top blades out without the need of an electric jackhammer
 - Decreasing weight of design by building device for single blade removal instead of both blades
 - Adding hydraulic cylinder to crane arm to allow for less manual effort in the blade changing process

