

# Linamar Weld Evaluation Process Improvement

Linamar



## PROBLEM STATEMENT

At the beginning Linamar was using destructive methods to evaluate welds on battery trays produced by an automated welding production line. Each aluminum battery tray took up to 22 hours to fully evaluate every weld. The original process was lengthy and consisted of the trays being cut on a waterjet, trimmed down by hand, cast in cylindrical resin pucks, sanded, and then inspected under a microscope. The main objective of the project was to reduce the turn-around time of the process and provide a safer less extensive process to evaluate the welds.



Complete battery tray, part that is being inspected

## REQUIREMENTS

- Save money on a 7 cent/second budget for the process
- Improve or eliminate a current process to save time and money
- Ensure the new or improved process is safe for the technicians and comply with OSHA and ISO standards
- Ensure the new or improved process is ergonomic to any users

## CONCEPTS

- First sample mounting concept



Concept 1 disposable PLA cups to fix samples to using UV curing resin

- Early Sample Clamp Prototypes



Sample clamp proof of concept bottom view with 140-120 sample



Sample clamp prototype V2 bottom view with 140-120 sample



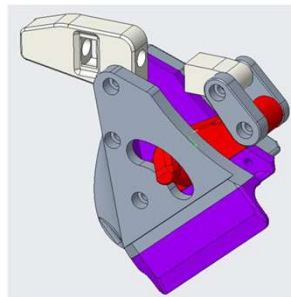
Sample clamp proof of concept top view



Sample clamp prototype V2 top view

## FINAL DESIGN, APPROACH, PLAN

- The final product was achieved by many consistent improvements from previous iterations designs
- Designs were developed using a system of feed back from the end users (Metlab Techs and Engineers)



Final CAD model : The bottom view of the final CAD model. The image shows the adjustable feature and the locking mechanism that hold the sample in place



Assembled Sample Clamp 1 : The image shows the assembled clamp with the adjustable feature and finger guards. The interchangeable grips is also present. This allows comfort no matter the size of the hand.

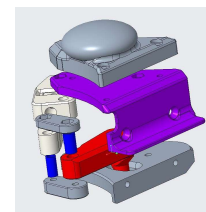
- The clamp has an adjustability feature so welding technicians can sand samples that are different in shape and size. (1)
- The last feature that was added to the final design was the finger guards. This will reduce the risk of injury when sanding the samples. (2)
- The final product also has a grip that can be interchangeable according to the welding technicians' needs (3)

## RESULTS

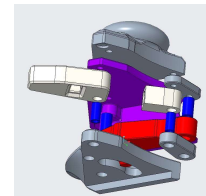
- Estimated money saved on consumable sample mounting acrylic: \$1000 a week
- Estimated time saved on cutting, mounting, and remarking: 40 hours a week
- Estimated injury reduction: 100% (Medical Costs Avoided)
- Estimated life span of each sample clamp: 2000 samples sanded between rebuilds
- Estimated cost of initial build: \$6.87
- Estimated cost of rebuild: \$2.50

## FEATURES

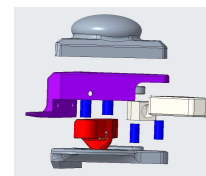
- Full stainless hardware
- Locking 4 bar linkage design
- Adjustable to accept 99% of process samples
- Quick and easy to adjust with no tools needed
- Comfortable and safe grip design
- Will work for samples outside of project scope
- Easy to replace any worn or broken components



Sample clamp exploded view 1



Sample clamp exploded view 2



Sample clamp exploded view 3



Sample clamp with a 140-120 sample



Sample clamp with a steel gear sample



Sample clamp with a small aluminum sample

## SUMMARY AND CONCLUSIONS

Linamar was previously sanding samples by hand which later rose many injuries. The scope of the project changed, and the team focused on safety and durability. The team provided sample clamps that provide the following

- Adjustable feature that allow to hold any size sample and shape
- Finger guards that reduces the risk of injury. It also allows for comfort when sanding the samples
- Interchangeable grips. This feature is used for ergonomic purposes. Many technicians did not like how the clamps felt when sanding. The grips can be changed to accommodate the technicians grip standard and comfort.

Overall, the device did meet all the technicians' requirements. The devices are now used in the metallurgical lab for safety and to eliminate the resin puck sample mounting process.

## FUTURE WORK

The team delivered all the files and instructions to Linamar so that they can reproduce and modify the sample clamps as needed in-house. However, they may decide to outsource that job to the school. Also, there are several other points in the process the team identified that had room for improvement, such as the sample etching process.

## TEAM & ACKNOWLEDGEMENTS

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- [Dr. Alsayed](#) (Faculty Mentor)
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