Redesign of Turbocharger Assembly Process

BYU CAPSTONE

Project Objective:

Improve the S60 VNT rebuild process in order to improve operator safety, reduce injuries and improve the overall throughput.

Project Background:

DDRW salvages S60 VNT variable vane turbocharger parts. The salvaged levers, vanes, and ring are reassembled and TIG welded by a robot welder.

New Design

Shims

The previous design involved 3 shims; the new design has only 2 shims which helps reduce cycle time. The pull tabs make handling the shims easier.

Lever Locating Plate

Redesigned how levers are constrained to minimize required insertion force.

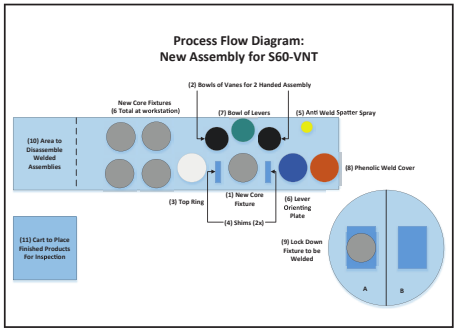
Locking Vane Insertion Base

Wider clearances allow for faster vane insertion with minimal insertion force. After insertion, the fixture locks vanes into the proper orientation for welding. The fixture is designed to prevent the operator from inserting a vane oriented incorrectly.

Portable Assembly Fixtures

Assembly can be done off of the welding table which allows for batch processing. The assembled fixtures are easily transferred to and located on the welding table. DDRW plans to make six of these portable assembly fixtures to allow for batch assembly which would increase throughput.

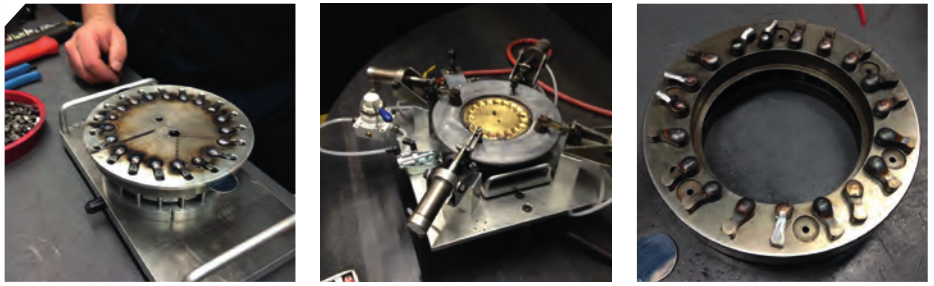
New Process



Improvements:

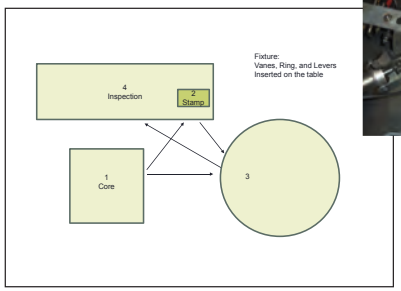
- Improved cycle time
- Decreased back and finger strain
- Assembly off table allows for batch processing

New Fixture



Old Fixture

Old Process



Problems:

- Vanes insertion required too much force which caused finger fatigue
- Assembly process performed on welding table which caused back strain
- Assembly time (194 seconds) was slower than robot welding time (94 seconds)

Testing

In February the team tested the fixtures with the robot welder at DDRW. These pictures demonstrate the fixture being assembled on the assembly table, moved to the welding table, and a welded turbo assembly. Cycle time testing averaged 102 seconds, which is 92 seconds faster than the current cycle time.

Accomplished:

Cut cycle time in half to 102 seconds
Decreased force and operator fatigue
Improved assembly accuracy to 100%

Detroit Diesel Remanufacturing West

2013-2014 Sponsor

TURBOTECH

Team Members from left to right: Matthew Bowman, Chris Phelon, Mike Salisbury, Shaun Heldt, Coach: Larry Moore.