Elimination of Lubricant in Stanadyne Gen V+ GDI SPP Component Press

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Original Objectives

1. Determine root cause of lubricant requirement.
2. Develop solution to eliminate use of lubricant for the operation.
3. Quantify improvement of production
4. Demonstrate repeatability of results.

Requirements

Req #	Requirement	Description	Test	Requirement Type	Affected Requirement
1 ✓OK	Manufacturing Process must stay the same	The machinery and tools within the manufacturing process cannot be changed or removed	Demonstration	Functional	4
2 ✓OK	Net cost	The cost of the end solution must not be greater than the current cost of operations	Analysis	Functional	4
3 ✓OK	The piston must press fit the specified depth	The press fit operation must meet Stanadyne's requirements	Measurement	Functional	4
4 ✓OK	Repeatability process yield	The end solution must be repeatable (99% yield)	Demonstration	Functional	3,1 ,2

Concepts

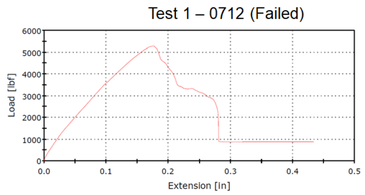
Initial concepts:

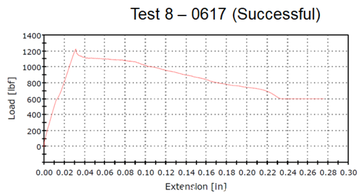
- Laser Etching,
- Tolerance Refit
- Thermal Expansion
- Friction Reduction
- Press Alignment
- Best Practices

Problem Statement

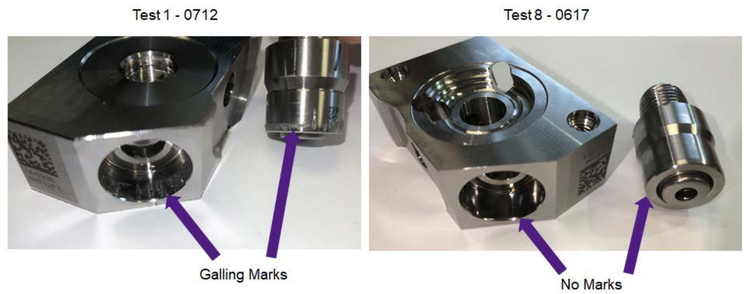
Stanadyne currently has an automated assembly process on their Gen V+ Gasoline Direct Injection Single Piston Pump line in which two components are pressed together. A laser weld compatible lubricant is applied to one of the mating surfaces to allow for a successful press operation. The use of lubricant was not intended during the design process and elimination will increase first-pass yield and reduce variation/scrap at the station.

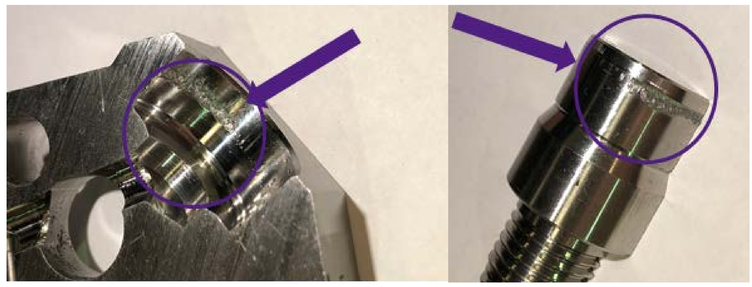
Final Design/Results *





Serial Number	Pressing Discharge Fitting Force	Pressing Discharge Fitting Position	Pressing Discharge Fitting Final Force
(Test 1) 14-929660712F1	24302.57031	83.50180054	28620.35156
(Test 8) 14-919460617F1	3510.4021	83.80979919	29282.92188





Upon receiving part samples from Stanadyne that had been cut by a diamond saw, galling was visually evident on both mating surfaces. The photographs to the left illustrate the galling on both the housing and valve.

Testing samples on the Instron machine further verified our hypothesis that galling is why lubricant is needed for the press operation to be successful. A significantly different plot signature occurs when a failed part tested on the Instron machine.

* 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.

Modified Objectives*

- What had to be modified due to COVID-19?

The team's final round of testing was halted, and the report had to be written with the progress made at the time.

- How did the team operate in the new environment?

Smoothly, most of the project was an analysis of data. The important primary round of testing was already conducted, which could not have happened during the outside of school operations.

- What was the impact on the overall project?

An overall slow-down, but the meetings became less important and thus, happened less frequently.

Summary

- Failed parts had failed to reach a critical depth and were scraped
- Galling was identified as the cause of failure in parts.
- . Alternative solutions to lubricant were devised and analyzed.

Team & Acknowledgements

Team:

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