

CASE STUDY

LARGE ENGINE PLANT

Retooling and retrofitting an existing line to manufacture a new model.

PROJECT SUMMARY

A large engine plant was preparing an existing assembly line to manufacture a new model of engine. This required a pre-existing block honing machine to be retooled and retrofitted. In addition to the needed block honing machine software and hardware modifications, project goals included increasing automation and decreasing operator involvement in the machining process by automating several of the hydraulic operations. The plant purchased a hydraulic fixturing system and power unit to assist with the positioning and securing of the product in one of the stations and they needed help integrating it into the station.

CHALLENGE

Prior to this project, the block honing machine was having serious issues which were causing frequent downtime. Other integrators had tried but were unable to fix the problems. Recommended by the plant's Siemens distributor representative, Patti Engineering was able to resolve the problems to get the honing machine back up and running. When changes were needed to manufacture the new engine model, Patti Engineering was the first integrator called in to help.

SOLUTION

Controls Hardware Components and Work

The primary operating components in the existing block honing machine were a Fail-Safe S7-1500 programmed in TIA Portal, Version 14. The system had a set of S120 drives that drove three servo-driven movement axes. There was also a Comfort Panel HMI for operator interaction, SICK laser scanner safety components, and Keyence LVDT sensors.

As part of the machine upgrade project, a hydraulic power unit, consisting of a constant-volume pump and motor and a bank of control valves, was added to allow for automation of a previously manual operation performed by the operator. This hydraulic fixturing system raised and lowered the block from the fixture, engaged and disengaged clamps to secure parts for the milling operation, and raised and lowered additional work supports for the milling operation.

To make the hydraulic fixturing system work, Patti Engineering added Siemens motor control components, including a Siemens soft starter, thermal overload circuit breaker, and isolating contactor. These components drove a three-phase 480VAC induction motor attached to the hydraulic power unit.



Additional controls rack components were added to accommodate new sensors and outputs needed to integrate the hydraulic controls components. LVDT sensors were also added to increase visibility for specific areas of the part on the fixture locations.

Significant engineering work went into component selection and validation to ensure that the power demand of the system was met, electrical protection standards were maintained, and the future expandability of the controls system could be kept open.

Controls Software Work

In software engineering, much time was spent adapting the program to accommodate more automated hardware. The previous system frequently required operator input via the HMI to progress through the machine process. Patti Engineering's work involved streamlining that process to remove the operator from as much of the process as possible. Modifications were made to both the PLC program and the HMI to accommodate the new machine functionality. The PLC program included programming done in ladder format and structured text format, both formats requiring modification.

The new engine model was significantly different from the previous product variant that ran on the machine. As a result, one of the axes was no longer required to function, however, it was not to be physically removed from the system. Programmatically, this axis was isolated from the system and muted to not function or cause problems for the machine at large. Modifications were made to the safety program as well to ensure that the hydraulic control components operated in a safe manner for operators and maintenance technicians.

In addition to the required machine modifications, some program improvements and tweaks were made to assist future activities. These included improving network comments and tagging list comments to be more helpful, general improvement of some logic flow, and cleaning out unneeded components from the PLC and HMI programs.

Digital Electrical Drawings Provided

Prior to this project, the customer had no digital copy of the electrical drawings. In addition to the hardware controls engineering done for this project, Patti Engineering's scope also included modifying and updating electrical drawings. During the digitalization process, several errors existing from the original authors were corrected. At project close, Patti Engineering provided completely updated and digitized prints.

RESULTS

Once all of the new hardware was installed and the software was updated, Patti Engineering was able to complete the validation of the changes with the customer. Integration of additional automation met the plant's goals of manufacturing the new model with less operator involvement. The plant has already expressed interest in subsequent modifications to the machine to increase automation in the future.

OVERALL BENEFITS

- Future Expandability
- Improved Safety
- Upgraded Automation
- Decreased Operator Involvement
- Improved Networking Capabilities
- Accurate Digital Documentation

Founded in 1991, Patti Engineering, Inc. is a CSIA Certified Integrator offering high-caliber engineering and software development services. Patti Engineering is an expert in our partners' technologies. Our partners include:





