

Semi-Auto Leak Detector

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Abstract

MTH Pumps is a company that manufactures industrial pumps. The facility in Plano, IL, is involved in constructing pumps for other industries such as boiler feeds, water services, chillers / temperature controllers and refrigeration. The castings and covers of such pumps must go through a testing process to determine whether the parts might have a crack that will result in leaks. The new design will focus on improving the setup time of the testing process by making the setup semi-automated. Aside from reducing the set-time, the cycle time between tests will also be reduced by the new design. Finally, the new design will increase the success rate of leak detection by relying on pressure sensors instead of sight to determine leaks or cracks in the castings or covers.

Introduction

Our senior design project focused on the T31 pump model. The T31 pump model is made from two bronze castings that are fastened together. One half is the motor cover, with the other half being the motor bracket. The current process for the inspection utilizes a machine that consists of a large metal plate suspended above a tub of water. There are eight individual part slots that lay across the plate where the castings are placed. Then any drain or inlet port the casting has is manually threaded. There are two posts that sit opposite of each part slot that a clamp and screw mechanism are slotted into and manually tightened down to secure the castings to the plate. After this, the plate is dropped into the water. A small hole in each of the individual part slots sits along the fluid track and supplies pressurized air into the closed system for about twenty seconds. The operator then raises the plate looks for bubbles that would a defect along the fluid track where air could be escaping. The current process is very time consuming taking 15 to 20 minutes to test only one half of a pump at a time, with defective castings getting through the process. MTH wants a new process with goals of eliminating the manual labor of the process and making it automated, while producing more consistent results.

Methods and Materials

Our new process had to be semi-automated and be able to decrease cycle time by over 50%. To do this, we changed the manual system to a hydraulic and pneumatic system. Eight hydraulic clamps hold down two castings, while pressurized air is supplied to the castings air track. To do this, the two castings are pressed down onto a custom aluminum plate, with an o-ring in place to prevent leakage. Four pressure transducers are placed strategically on the castings, which are used to determine how much pressure is lost over a period of time.



Results and Virtual Build

The outcomes of our project are to replace the manual system at MTH and to increase productivity. The updated system is expected to test two castings in less than 2 minutes, including charge time, settling, and work handling. This would save MTH \$5,833 just in labor for testing the annual demand of the castings. Because of the time shortage, we were not able to test the clamps or pneumatic system to determine an accurate cycle time, and thus 2 minutes is an estimate. All components have been ordered; however, there some machining is still required to complete the system. MTH can machine all of the components in house, reducing additional costs to manufacture. Once fully manufactured, the system will be ready to assemble and test.

Discussion

The employees at MTH Pumps are using an inefficient system to test the castings of the water pumps. The set-up time for this system takes an MTH employee over 15 minutes to tighten all the clamps and to plug all the holes. When the test is run, there is no standard or pass/fail rate to follow. It is all up to the discretion of the employee running the machine to decide whether it is a part that passes. This new process we created will give MTH a more efficient and time saving way to check the castings. This will give MTH a standard to know which castings pass. This will give MTH Pumps better quality products and make clients happier with their products.

Conclusions

It is recommended that MTH decrease the manual set up and incorporate automated features to reduce the set-up and overall cycle time of the test. Furthermore, by eliminating the visual inspection from the original test and including pressure sensors will increase the number of ideal castings and covers distributed by MTH Pumps. Finally, for future consideration the company can make this semi-automated process fully automated by including a robot to increase the overall efficiency.

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