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Sample Processing Update
Peening Pumps Up Injector Pressure

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Herb Tobben creates solutions to customer problems at ZERO's Sample Processing facility.

An automotive OEM supplier for a diesel engine manufacturer asked ZERO to help make their fuel injector nozzles more durable. These injectors shoot a mist of fuel directly into the motor's combustion chamber.

The automated system that installs the injector into the engines applies a side load that can crack or break off the tip of the nozzle. If a nozzle fractures, it can destroy the engine, some of which are valued at tens of thousands of dollars.

Sample processing demonstrated that peening the tips of the nozzles eliminated failures, so the company began manually bead blasting the tips of two different sizes of nozzle in a ZERO BNP 55 cabinet. This was a relatively slow process, and one that did not allow them to document the results.

The company wanted to increase production from manually processing 60 parts per hour to automatically peening more than 600 parts or more per hour. They hoped to get a machine that could process both styles of nozzle with minimum changeover time, while achieving consistent results.

This looks like a safe bet for automation, but we must clear some hurdles before recommending a process and equipment.

First, the need to peen a small area on a small part eliminates tumble blasting and other all-over methods.

With tumbling ruled out, that goal of 600 parts per hour takes human operators out of the mix. The operator would have to remove the nozzles from the blast fixtures and put them on a rack, then pull more parts from another rack and place them into the fixtures. Imagine trying to manually handle 10 small parts per minute, or one every six seconds, for hours on end. It's a recipe for repetitive-motion injury.

The Solution

This calls for a robot.

When you need a robot, you also need an automated blast system that can precisely position the fixtures so the robot can pick and place the parts.

Collaborating closely with the customer, a robotics supplier, and the Distributor, ZERO supplied a modified BNP A-200 containing three sets of five rotating satellites fitted to a precision-indexing turntable.

Working to tolerances of a few thousandths of an inch, ZERO technicians made sure the satellites returned to the exact position time and again. Each satellite carries a magnetic fixture that both masks and holds the part during blasting, yet allows the robotic arm to pluck the parts with little resistance.

Five No. 6 automatic guns deliver a 10-second blast with Number 8 glass beads - selected because the beads are bigger than the minute pinholes that ring the tip of the injector nozzle.

In operation, the robot pulls five nozzles from a bin, and inserts them into the satellite fixtures. The turntable automatically indexes. At any given moment, five injectors are being blasted, five are being blown clean with air, and five are positioned at the load/unload station.

Thanks to the non-stop loading and unloading provided by the robot, the system has blown away the original production objective. The customer has hit 900 parts per hour, and is shooting for 1,000.

The customer's engineers report that the injector nozzles, which had failed their in-house break test at 2500 to 3500 Newtons, now routinely achieve 5500 to 7000.

This story actually begins several years ago, when one of the customer's engineers visited ZERO for sample processing on another project. As we concluded our presentation, he pulled a handful of nozzles from his pocket and asked if we could help make them stronger. A little masking tape, followed by a trip through a manual blast cabinet left the nozzles significantly stronger. The customer bought a standard cabinet, and put the wheels in motion to purchase the automated system. ○