

Gearing Up for Quality: Eaton Corporation



Eaton Corporation's Truck Components Operations Headquarters in Galesburg, Michigan

KEY FACTS

ORGANIZATION

Eaton Corporation

OVERVIEW

- Diversified power management company
- Sells products in more than 150 countries
- Sales of \$15.4 billion in 2008
- Approximately 75,000 employees

PRODUCTS USED

Minitab® Statistical Software

RESULTS

- Parts and processes consolidated
- Need for alternate electronic control units (ECUs) eliminated
- Gear forging costs reduced by 10 percent
- Costs for ECUs in transmissions reduced by 12 percent

One quality improvement project that uses Minitab® Statistical Software can have a big impact across an entire company. Consider Eaton Corporation, which manufactures electrical systems for power management; hydraulics for industrial and mobile equipment; fuel, hydraulics, and pneumatic systems for commercial and military use; and truck and automotive drivetrain and powertrain systems. A small project at one Eaton Corporation facility turned into three projects, which ultimately benefited several divisions—and the entire company's bottom line.

Challenge

The project started with a challenge to increase output at Eaton's truck components plant in Kings Mountain, North Carolina without any capital investment. While looking for ways to improve processes and efficiency, the Six Sigma Black Belt working on the project saw an opportunity to reduce the number of changeovers and decrease time spent setting up new machines between production runs.

The plant was using two similar steel gears produced at Eaton's forging operation in South Bend, Indiana. One gear had holes pierced into it during the forging process to facilitate the flow of oil during heat treatment; the other did not have holes. Each time the Kings Mountain facility switched between these two similar parts during production, the plant had to reconfigure its machines. Consolidating two different forgings into one would reduce the number of setups required for production, leaving only one common part number to keep in inventory.

Team members at Eaton's forging operation determined that they would also benefit if they could eliminate the gear with pierced holes. The piercing/punching operation increased production costs and was a frequent source of breakdown. Removing the piercing step from the production process would allow the South Bend plant to ship parts more quickly, and would extend tool and die life.

Learn how Minitab software can help you improve quality at www.minitab.com.

How Minitab Helped

To determine if they could stop making one of these gears, the team focused on "lead range," the variation between gear teeth created during heat treatment. They used Minitab to analyze data from the forging operation and determined that there was no difference in the average lead range error or in the variation of the lead range data between the two forgings.

The team concluded that the gear with holes could be eliminated. In addition to enabling Eaton to use a common part number, this decreased waste in two ways. It removed the need to make and maintain the piercing tool used to punch the holes. It also eliminated the downtime caused by changing or adjusting the tool. Ultimately, this decision reduced gear forging costs by approximately 10 percent.

The team suggested to Eaton's Truck Components Operations Headquarters in Galesburg, Michigan, that other parts also might be able to be consolidated.

A team at Eaton's Heavy Duty Truck Transmission plant in Shelbyville, Tennessee soon found another case where two similar gears were being used in transmissions, one with and one without holes. To prove that there was no difference in part performance between them, the team again evaluated the gears' lead range. Twenty-five samples of each were measured before and after heat treatment, and the differences were analyzed with Minitab. In addition

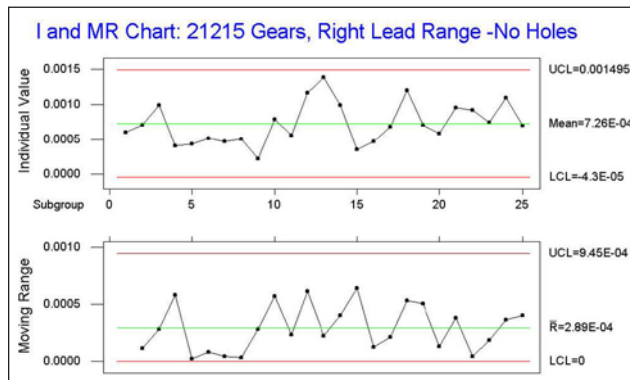
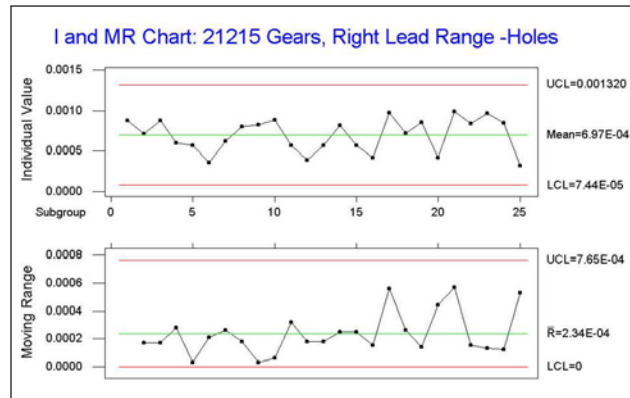
to testing for stability, the team ran a two-sample t-test to evaluate the averages and a test for equal variances. Based on these analyses, the team was able to recommend with total confidence that the gears with holes be eliminated, a change that reduced forging costs for these transmission gears by 10 percent.

But this project also benefited Eaton's Automated Products Division. This division's transmissions included a speed sensor that worked in conjunction with the gears produced in Shelbyville. The gears with holes caused signal fluctuations that affected the sensors, so two electronic control units (ECUs) had been manufactured to allow the sensor to work with both gear types. Eliminating the gears with holes in turn allowed the Automated Products Division to eliminate the special ECU, thus saving money needed to build, stock, and handle two different ECUs. The savings were estimated at approximately 12 percent.

Results

Based on the improvements realized from these three projects, Eaton achieved a 10 percent cost reduction for a high volume gear manufactured in North Carolina and forged in Indiana. They also realized a 10 percent cost reduction for a family of gear forgings manufactured in Tennessee and forged in Indiana, as well as a 12 percent cost reduction for electrical control units (ECUs) used in certain seven-speed transmissions by the Automated Products Division in Michigan. Eaton continues to rely on the power of Minitab Statistical Software to analyze and get the maximum value from their quality improvement data.

These projects were originally profiled in the July 2002 issue of Scientific Computing and Instrumentation.



Minitab's Individuals (I) and Moving Range (MR) charts were used to illustrate the stability of the Right and Left Lead Ranges on both gears.