

# Shop Floor SPC Cuts Rejects at Tufts Grinding

*by Karin Groening, Technical Writer, Zontec Inc and*

*Carl Laib, Plant Manager, Tufts Grinding*

Imagine cutting your in-house rejections by more than 67% in 18 months and making customer rejections almost nonexistent. A fantasy? Not really. Tufts Grinding did just that by applying statistical process control (SPC) methods on the shop floor. Along with cutting rejections, SPC has helped Tufts increase productivity, improve service, and reduce turnaround time.

Tufts Grinding is a small family owned steel processing company on Chicago's south side. They use the centerless grinding process to size steel bars, which are later induction hardened and chrome plated for use as piston rods in hydraulic and pneumatic cylinders. They also grind stainless steel and non-ferrous bars, such as aluminum, for the automotive and electric motor shafting industries.

The grinding process uses a centerless grinding machine, which consists of a table that supports the bar and two wheels that grind and guide it. Operators first determine machine settings based on customer requirements and the material they'll use for the run. Then they feed the bar into a gap between the wheels. One of the wheels is abrasive and scrapes metal from the bar. The other acts as a brake and adds a forward spinning motion to the bar. To meet narrow tolerances, the bars are fed through the machines several times until they are shaved to the required size.

This is a highly competitive industry where success depends on how accurately a company can grind bars to a specific size and smoothness. Tufts succeeds by ensuring their bars vary no more than 0.0005" from the target value and have a surface finish less than 20Ra. (Ra is a measure of smoothness; the lower the number, the smoother the surface.) Meeting these high quality standards requires constant attention to details on the shop floor. At Tufts, this responsibility falls on those closest to the work, the operators.

The primary job of Tufts operators is to produce a quality product in a timely fashion. It isn't enough to run the grinders, the operator must understand the customer's requirements and know the material he'll be working with so he can set the machine correctly. He is also responsible for inspections, machine adjustments, preventive maintenance, packaging, and recording job information.

To help operators meet the company's quality goals, Tufts began an SPC program in 1991. Their first step was to show operators how SPC worked. This was done in a formal classroom setting where operators learned to take readings and create control charts manually. They also learned how to use the charts to monitor production, how to interpret the charts and how to react to their findings. With all of their normal tasks, however, operators had little time for collecting and recording data and creating control charts. Tufts needed a way to apply SPC methods to improve the grinding process without adding to the operator's workload.

Their solution was to automate their SPC program. To do this, Tufts selected Zontec's SPC TimeSaver Advanced System and LaserMike's Z-Mike laser micrometers. Under

this program, as the bar passes through the grinder its size is checked 150 times per second by the laser micrometers. This data feeds directly into a computer which analyzes the data and makes automatic size adjustments at the grinder in 0.0001" increments. At the same time, the data also enters the SPC TimeSaver system which processes the data and displays it instantly on an X-bar and R chart at the operator's workstation.

The X-bar and R chart shows the operator how the process is running, if there are any trends, and if it is stable or out of control. If a more detailed analysis is needed, the operator can press a few keys at the same workstation to view the same data in histograms and capability charts. Using this information, the operator can make manual machine adjustments when they are needed.

Tufts uses SPC TimeSaver's real-time multiple function capability to monitor the production of four different grinding machines working on different jobs simultaneously and independently. They've set up video monitors to cycle through the charts, displaying the results of all the processes at different locations throughout the plant. This keeps everyone informed of process conditions everywhere in the plant. It gives supervisors an accurate real-time assessment of how the entire plant is running and helps them quickly find and address problems with a particular machine or job.

Along with decreasing the operator's workload, automating SPC let Tufts manage large amounts of SPC data without human error in recording data and running SPC calculations. Automating some of the machine adjustments helped improve their ability

to compensate for grinding wheel wear, which in turn has increased their ability to hold and stabilize the product size.

Tufts found that SPC is most effective when it's applied on-line in real-time. The faster process information is collected, processed, and charted, the faster any problems can be solved. Solving problems quickly and controlling process variation enabled Tufts to cut down the amount of scrap and reworks, which in turn lead to an increase in productivity and a decrease in job turnaround time. Tufts also found that because it helps operators find and control problems in their part of the production process, putting SPC on the shop floor got operators more involved in the company. This has lead to a marked increase in operator confidence and improved customer service.