

How-To Make Lab-Quality Inspection An Integral Part Of Your Shop Floor Workflow



Laboratory-grade inspection machines don't like dirt, heat, humidity, chips, swarf, oily parts and operators who treat them with less than tender loving care. That's why they live in climate-controlled labs and not on shop floors where parts and profits are made.

More and more often today manufacturers are asking themselves whether or not that last infinitesimal increment of precision really is worth the cost and in a growing number of cases the answer is "No". And so the trend toward shop floor gauging of high-precision parts was born.

It really got started in the fuel injector industry. Here a typical requirement is to measure both size and true roundness on Plunger and Body components having a 0.6 micron roundness tolerance on the OD and ID respectfully. A lab-grade machine can do that easily, but it typically can take an hour or more to get the results.

During that hour the manufacturer can either shut down the process and lose the production, or continue making parts that may well have to be scrapped. Caught between a rock and a very hard place, one injector manufacturer decided to explore an alternative solution that put the gauge on the shop floor next to the production machines.

Based on their experience with the rugged in-process gauges used on their grinders, the manufacturer approached Marposs for a solution.

This photograph is an example of a multiple-cycle, scanning gauge that is used in match grinding applications. In a typical application, the part with the critical I.D. feature is first measured by the gauge. The gauge data from the I.D. measurement is used to calculate the required dimension of the part with the matching O.D., taking into account the clearance parameters. After grinding the part with the O.D., both parts are placed into the gauge to verify that the match clearance is correct.

Marposs responded with an M39S gauging system employing standard LVDT technology to scan over the OD or through the ID while the part was rotated on a precision spindle. To handle the tight tolerance, Marposs installed additional transducers to monitor and then compensate for mechanical errors.

By using robust standard components Marposs was able to produce a sub-micron capable system that can live and work on the shop floor. Using contact technology developed for in-process gauges, the M39S is able to handle oily parts and even parts with metal residue from the grinding process with no loss of precision.

Gauge data are analyzed by a Marposs E9066 computer that also serves as the gauging system control. The output gives the operator a graphic indication of both size and true roundness in real time—all within the machine cycle. The system is fast enough to provide 100 percent inspection of production parts and stable enough to achieve a GR&R of less than 20-percent on the shop floor.

Today, successors to that original M39S system have become a virtual standard in the injector industry. The technology has also been applied in many other areas over a variety of industries.

Sleeves and spools used in automotive automatic transmissions are another application of the M39S shop floor gauging system along with brake caliper pistons. These types of parts are particularly challenging because the finished ID's and OD's, with extreme surface finishes, must be gauged without leaving witness marks. In these



M39S Scanning System
— Standard Version ID Single Station

cases, low gram pressure contact or pneumatic technologies can be applied.

A more recent application of the technology is to measure the size and geometry of the bore in smooth-bore transmission gears. Here the requirement is to measure the straightness and roundness of the bore along with the checking the “bell mouth” condition at each end.

M39S technology also makes it possible to measure interrupted ID and OD surfaces, opening a whole range of potential applications in the aerospace and hydraulic valve industries.

And, in what may well be the ultimate application, feedback from an M39S measuring a part ID is being fed to a robot that sends data to a Marposs match grinding system that finishes the OD of a mating part. That part is then gauged on a second M39S to verify a perfect match.



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