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Medical for machines making parts for the pharmaceutical industry

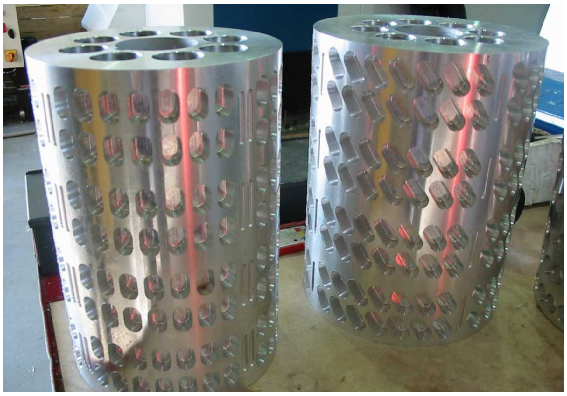
Monitoring machine capability with Renishaw's QC10 ballbar has proved crucial to TJW, a successful machining sub-contractor who specialise in the pharmaceutical and aerospace industries. TJW regards itself as a 'one-stop shop' with a complete range of services. It is able to provide fast change-over between a wide variation of batch sizes and component types, with Renishaw machine tool probe systems minimising set-up times.

TJW uses the QC10 ballbar on its CNC machining centres to keep tight process control and meet quality requirements. One of its large contracts relies on being able to prove machine capability, not just produce parts within tolerance. It has a number of HAAS machines, which are checked regularly with the ballbar, by both TJW machine operators and HAAS engineers, who use it as part of the annual service. The HAAS engineers provide ballbar test results as proof of machine accuracy after servicing work is done.

TJW, based in Cam, Gloucestershire, first heard of the ballbar through a West of England Aerospace Forum manufacturing initiative, which promotes process improvement and provides funding for training to aerospace and defence SMEs in South West England. Ben Bartholomew, Technical Director, went to see demonstrations of the ballbar in action at Renishaw's own machine shop, and took the decision to use it in their own shop. "We needed to understand our machines' capability and control it, rather than waste time tweaking programs on machines we weren't always certain could do the job."

TJW started out in 1983 doing wire erosion work, then bought a milling machine to do erosion tools and finally started selling its machining service. The company has grown its floor space nine times and now has 13 CNC machines and 15 wire / spark erosion machines. Being able to offer multiple processes and therefore a complete service has been key to their success.

QC10 ballbar - quick test of multiple machine variables The ballbar check takes about 10 minutes of machine time, which suits TJW well.

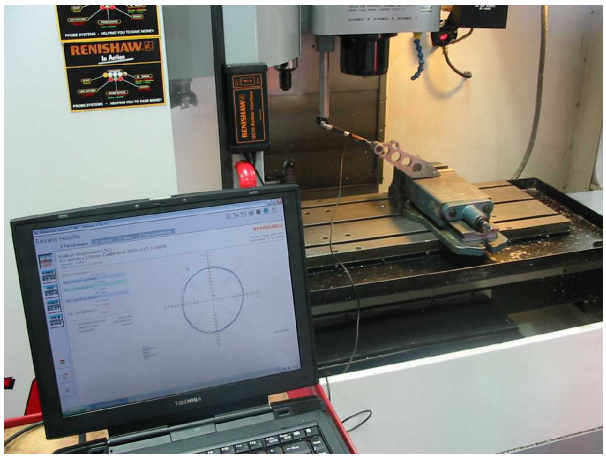


Typical components for the pharmaceutical industry

QC10 ballbar checking X-Z positioning performance of one of TJW's HAAS machines. Spindle probes and non-contact tool setting systems transform setting time and consistency

With plenty of work, machines are in constant use - the quicker the machine is cutting metal again, the better. Tests are done by running a short CNC program on the machine to describe an interpolated circle, the ballbar continuously measures the radius of the machine movement. Any variation in the circle's radius is recorded by the ballbar software, on a PC, which then analyses the data to diagnose the exact extent and nature of any machine errors. Twenty-one different machine variables can be checked, including backlash, squareness, and scale mismatch, the software then makes suggestions to correct these errors.

Ben Bartholomew explains - “Simple adjustments, such as backlash, we do ourselves on the machine control. Otherwise, if we see a problem developing that will involve maintenance, we can look ahead and book it in around jobs before it starts affecting performance, reducing the amount of unplanned maintenance.”

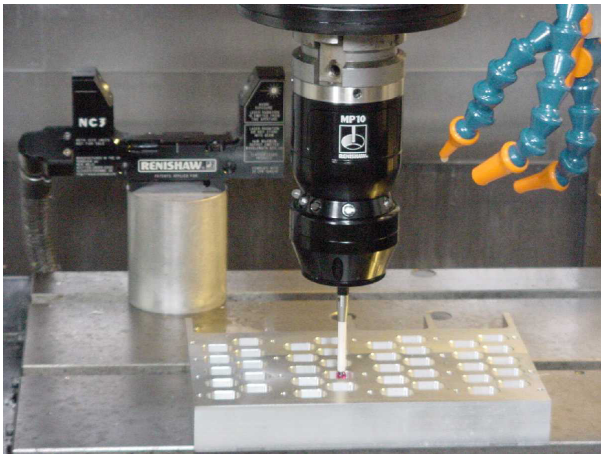


Ballbar test results being analysed to ensure that machine capability is maintained

He continues “The other big advantage is that now we know every machine’s capability. I can plan jobs onto machines which I know can do them, really cutting down the set-up and proving-out that we previously needed to do. The QC10 ballbar enables us to monitor and maintain that capability and, having done the initial benchmarking, we’re now building up a history of our machines with the software’s history function. Machining centres are checked every 2 months in the X-Y plane, where most positioning occurs, and every 6 months in X-Z, as a number of our jobs require accurate interpolation involving the Z-axis. We also test every CNC lathe to control their performance.” TJW has one job in particular that demonstrates how the QC10 ballbar has improved confidence in machine positioning; a circular plastic part that is too big for any of their lathes. This is cut on a machining centre using circular interpolation - the corrections made with ballbar data ensure this can be achieved within tolerance.

Scrap reduced and productivity increased

Originally TJW’s operators set cutting tools manually, often on top of the job with setting blocks and cigarette papers. This resulted in long set times and inaccuracies in tool measurements. TJW decided to fit Renishaw TS27R tool setting probes to its vertical machining centres. Immediately it benefited from the fully automatic checking of tool length and diameter, with higher accuracy and consistency. Bartholomew adds,



Spindle probe setting a pharmaceutical part, non-contact tool setter in the background

“We have saved over two minutes per tool on setting operations, the scrap rate is down and productivity has increased, all of which is passed on to the customer and makes us more competitive.”

The added benefit of broken tool detection with the probe means that any broken cutters can be identified in-cycle, by detecting significant changes in tool length, eliminating any subsequent damage to components. Seven machines now have probe systems fitted, including two NC3 non-contact laser tool setters. “Cycle time on the HAAS machines fitted with NC3s is particularly fast, a matter of seconds for tool setting and at rapid feed rates for broken tool detection”, comments Mr Bartholomew. TJW is also planning to make use of the NC3 system’s ability to check profiles on form cutters to ensure that the correct tools are used.

Renishaw MP10 spindle probes are also fitted to three of the machines, replacing wobble bars and the clocking of jobs or the vices used to hold the job, which were time consuming and prone to inaccuracies. TJW has found that with the probes used to set jobs, it can achieve greater part accuracy on a more consistent basis. Setting time is dramatically reduced, which allows them much more flexibility to change between jobs, and reduces costs through shorter overall run-times. The repeatability of the process has virtually eliminated scrap due to setting, partly because they also use the probe to identify key features and ensure no mistakes are made, including running the wrong part program for the job on the machine.

Ben Bartholomew is planning to expand TJW’s use of the MP10 probes with dedicated inspection routines for finished components, and to provide the data necessary to re-machine any features that are out of tolerance.

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- **Styli for CMM and machine tool probe applications.**

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