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Renishaw's inspection tools optimise VMC precision for Haas

Haas Automation Inc. used to fine-tune every one of its VF vertical machining centres through a mechanical fore-and-aft loading test, with results entered into the CNC as a compensation value. Recently however, the company began to supplement this test with backlash compensation using Renishaw's QC10 Ballbar System. By measuring position errors throughout a complete circle, the Ballbar isolates effects often missed by the mechanical test, including the influence of friction, and problems in the motor/ballscrew connection.

Haas supplies a Ballbar circularity test plot with each new VMC shipped. Unique to the individual machine, the plot shows the trace of a 300 mm diameter circle in the X-Y plane, made at 25 or 50 ipm, depending on machine size. Through the precise match between an ideal circle and the Ballbar map of the machine's true movement, the customer sees graphic proof of the contouring accuracy of the machine. The test is frequently re-performed by Haas UK once the machine is installed at a customers' premises. Andrew Ward, Haas UK Engineering Director commented: "The Ballbar check is a straightforward test. We are happy to show the customer that his machine is just as accurate after it has travelled the 6,000 miles from California". He added. "We have also found the Renishaw Ballbar System invaluable as a diagnostic tool, if and when a problem does occur".

The other tool used throughout the development and manufacturing cycle of every Haas machine is Renishaw's ML10 Laser Calibration System. "Laser and Ballbar inspection begins with new machine prototypes," says Haas Inc.'s Service Manager, John Roth. "When an error is found in a prototype, the problem is traced back to the machine that produced it." He cites the company's new VF-6 vertical machining centre as an example.

Roth used the Ballbar to test the multi-axis movement of the VF-6 prototype in all three planes, X-Y, Y-Z and X-Z. This was followed by straightness and displacement measurements taken using the laser.

QC10 ballbar testing positioning performance on a HAAS VMC

The QC10 ballbar test is controlled with software on a PC, the data gathered will then be analysed with Ballbar diagnostic software off-line

“For a precision machine tool, it is necessary to assemble the parts and put them under true operating loads before we can be confident we have found every problem” he says. On the VF-6 prototype, laser straightness measurements revealed a 0.001" bow in the machine’s saddle. Roth returned to the milling centre responsible and through closer inspection with the Renishaw laser, he discovered the straightness error causing the bow. By compensating the CNC using the laser measurements the milling centre’s straightness was corrected, and the saddle bow was eliminated from the VF-6 production version.

John Roth added. “Before we use a machine in our shop to produce a component for a Haas machine, we first determine that the machine is accurate enough for the job, instead of waiting for post-process inspection to find a problem. When we are about to machine a part with a very tight tolerance, we use the Renishaw Ballbar and/or the Laser Calibration System to confirm that the machine tool is positioning accurately enough to hold that tolerance.”

“The other option,” Roth concluded, “is to risk wasting time and money, and risk scrapping a very expensive piece of material.”

Following the ballbar test, adjustments can be made and the machine re-tested to provide a bench-mark for on-going historical analysis of the positioning performance, allowing predictive maintenance