Engineered Solution Decreases Machining Center Woes

Tight tolerances are essential in high-speed machining, and if the toolholder doesn't fit the spindle precisely, decreased productivity and reduced tool life are inevitable.

Recently, JM Performance Products, Inc. (JMPP; Fairport Harbor, OH), a manufacturing innovator of CNC mill spindle optimization products since 1966, worked with Morgan Meredith, Inc. (Cedar Rapids, IA), a family-owned business specializing in customized wood retail display products, on improving the productivity of a new wood router machining center that makes parts for retail product displays out of sheet plywood.

The CNC router system was designed to run at a high-speed spindle machining standard of 18K RPM for speed, accuracy and repeatability. For years, however, Morgan Meredith's President, Morgan Karns, had experienced problems with the taper series toolholders in the tool holding spindle.

The conventional retention knob's small end of the taper kept pushing the tool holder out of the spindle by a small amount. Morgan originally thought that swelling was the issue, but a bulge in the back of the toolholder due to deformation was revealed as the actual cause.

Notably, 1" brown fretting rings appeared around tool holders and on the front edge of the spindle. The machining system's high-speed rotation caused friction, which resulted in the iron oxide rust corrosion rings. This corrosive friction also produced an intense 'screaming' effect from the machines which required workers to use protective ear plugs. Most importantly, these corrosive elements continually wore out the spindle socket and toolholders–which required frequent and costly tool changing.

A long chain of process parameters were also affected due to toolholder deformation including: z-axis drift/height drift cutter changing, elevated spindle temperatures which caused the previously mentioned fretting on the contact surfaces, and skidding/sliding effects. All of these issues related to a single source problem–toolholder deformation in direct connection to the conventional retention knobs.

Karns, enlisted JMPP to analyze their high-speed milling center production dilemma and engineer a solution. JMPP's Technical Team immediately performed toolholder tests with JMPP's Taper Shank Test Fixture. This conclusive test revealed that the toolholder was out of tolerance and, thus, a special configuration solution was recommended to optimize the fit to overcome the toolholder expansion/distortion issues.

The solution was JMPP's patented High Torque retention knob, which works by making the retention knob as long as possible to fit the toolholder. It also includes a precision pilot, increases the undercut length and designs the threads to be balanced. When properly installed with a retention knob socket and torque wrench, this patented design prevents toolholder deformation.

Additionally, a calculated torque value for installation is provided to ensure the knob is installed to manufacturers specifications. This is vital in applications where the RPM of the tool is high, thus ensuring that the toolholder will not pull out of the machine.

According to Karns, "The results were immediate in machining with a 3/8" diameter carbide bit into solid acrylic. The machine and toolholders show incredible improvement in taper contact quality, as the tool holder has close to 100% contact."

Key Morgan Meredith production improvements using JMPP's High Torque Retention Knobs led Karns to conclude: "We'll be using the High Torque retention knobs exclusively moving forward, as they've solved a host of problems we've been trying to overcome for years."