



HIGH SPEED MACHINING NEEDS A HIGH TORQUE RETENTION KNOB

Medical component manufacturers are running titanium and stainless at unheard-of speeds with less replacement of expensive tools by using unique retention knob.

High speed machining in excess of 20,000 RPMs is often utilized when machining medical components out of exotic alloys and harder metals like titanium and stainless steel.

At these rates of speed, vibration and chatter can occur as a result of factors such as the balance or concentricity of the toolholder as well as improper seating within the spindle.

When this occurs, material removal rates are dramatically reduced and the expensive carbide tools utilized must be replaced more frequently. In addition, vibration and chatter can lead to poor surface finishes that require secondary bench operations and even damage the workpiece.

All this serves to slow down machining cycle times, the measure of the time it takes to complete each part from start to finish.

For an industry in which cycle times are directly related to operational costs and, by extension the bids offered prospective customers, finding new ways to

decrease machining time can lead to a significant competitive edge.

According to Janos Garaczi, President of Delta Machine Company, LLC., a company that specializes in titanium machining for the aerospace and the medical industries, this meant addressing issues with the interface of toolholder and spindle on new high-RPM / high-torque equipment he installed.

For this, Garaczi utilized unique High Torque retention knobs along with dual-contact spindles designed to keep the toolholder rigidly in place during high speed machining.

In doing so, Garaczi says the combination of equipment and machining expertise has decreased cycle times as much as 40-50%, allowing Delta Machine to often outbid the competition for projects involving titanium.

"At the end of the day, we are able to run [titanium and stainless steel] much faster than most machine shops," says Garaczi.



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A more aggressive approach

Based in Gardena, Calif., Delta Machine Company, LLC., specializes in high volume production of precision machining of complex, tight tolerance parts out of titanium, stainless steel, aluminum, plastics and other exotic alloys.

Garaczi is in a unique position, having started with the company as a machinist and eventually working his way to president and owner. As such, he remains responsible for much of the programming, set-ups and also purchasing. As part of his duties, Garaczi decided to invest recently in new high-end horizontal machining centers to add to his "lights out" operation.

Because the equipment involved a high torque, high speed spindle, Garaczi says the CNC manufacturer recommended investing in a unique retention knob for use with harder materials like titanium. Standard, off-the-shelf retention knobs could be used, but were at some risk of shearing off or breaking due to the high torque involved.

"They recommended we use these specific High Torque retention knobs because there were scenarios where the high torque could tear off the retention knob and destroy the spindle," says Garaczi, adding that a replacement spindle can run \$40,000 or more to replace.

High Torque retention knobs

To find a solution, Garaczi did some research and found JM Performance Products, Inc. (JMPP). Invented by the company's founder, John Stoneback, the High Torque retention knob is longer by design to reach deeper into the threaded bore of the toolholder.

As a result, all thread engagement occurs in a region of the toolholder where there is a thicker cross-section of material. It also includes a precision pilot to increase rigidity, and is balanced by design.

"For this type of aggressive machining, if you have a really strong retention knob, it's going to further increase the rigidity of your set-up," says Garaczi.

Although the High Torque retention knobs cost a little more than standard options, Garaczi says he would not take the risk of using another alternative.

"In the aerospace and medical industries, price is a factor, but the customer is more interested in top quality parts delivered on time," says Garaczi.

Seating in the toolholder

To further maximize the rigidity and minimize vibration, Garaczi specifies machines that have dual contact spindles. In this approach, both the toolholder shank (taper) and the flange are used to eliminate pull-back in the spindle.

However, most machining operations do not use dual contact and instead rely on the interface between only the taper and spindle. Retention knobs attached to the threaded end of the toolholder are used to engage with the drawbar, which exerts a pull force that holds it firmly in the spindle.

The problem is poorly designed, traditional retention knobs, at less than \$30 a part, create a bulge in the taper when tightened that prevents proper seating in the spindle. Once this expansion occurs, the toolholder will not pull fully into the spindle and so cannot make contact with upwards of 70% of its surface.



By installing the High Torque retention knob with the correct torque, spindle contact with the taper is improved to close to 100% every time, significantly reducing vibration and chatter.

Tool life

Perhaps more than some other industries, medical component manufacturing can take a toll on the carbide cutting tools used when machining exotic alloys and hard metals. The result is that cutting tools must be changed out more frequently as they dull or break.

By increasing the rigidity of the toolholder at higher RPMs, the High Torque retention knob can increase tool life.

According to Garaczi, with titanium most shops run about 50" per minute, with tool life typically reaching 1.5-2 hours before replacement.

With higher-end multi-flute end mills and technical carbide inserts, these costs can add up quickly while also costing time for frequent changeovers.

"With the High Torque retention knob, we are running 100" per minute in titanium and our tools last about 5 hours before we have to change them, which is pretty

incredible," says Garaczi.

The other advantage was a better surface finish, which eliminated additional benching operations that add to the cycle times.

"Usually at the feed rates and speeds that we run titanium, the typical finish expected is 125 [rms]," says Garaczi. "The retention knob helps achieve a 50 rms finish at more than 100" per minute, which often exceeds what the customer requires."

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About JM Performance Products, Inc.

JM Performance Products, Inc. is the leading manufacturer of retention knobs, High Torque retention knobs, Spindle cleaners, and drawbar gages.

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