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Delta Machine Co.: High Torque Retention Provides Stability for Machining Exotic Metals

October 31, 2018 by [James Lorincz](#) - Contributing Editor

Titanium, stainless steel, aluminum and other super-alloys and exotic materials are on the rise for use in component manufacturing in growth industries such as aerospace, medical, and automotive.

According to John Stoneback, president, [JM Performance Products Inc.](#) (JMPP; Fairport Harbor, OH), “This creates a unique set of production machining challenges considering the high speeds (typically in excess of 20,000 rpm) that are often required. At these rates, vibration and chatter can occur, leading to poor surface finishes that require secondary bench operations or result in damage to workpieces. Additional factors, such as the lack of balance/concentricity of the toolholder, as well as improper seating within the spindle can reduce material removal rates and increase the time it takes to complete each part.”

“Typical CNC milling centers are running 20-40% slower than they should be,” Stoneback continued. “Bridging this gap of missed productivity can conservatively help job shop operations achieve a 10-20% competitive advantage per hour via faster setups, better feed rates and more rigid tools, reducing tooling cost by 20-50% or more.”

[Delta Machine Co.](#) LLC (Gardena, CA), which specializes in titanium machining for the aerospace and medical industries, addressed these issues by implementing JMPP’s patented High Torque retention knobs. Since 1980, Delta has specialized in high-volume production of complex, tight-tolerance parts from titanium, stainless steel and other exotic materials. President Janos Garaczi made investments in new

high-speed, high-torque CNC machining, including four horizontal, three five-axis, and two vertical machines. Significantly higher drawbar pressure exerted on the JMPP retention knobs eliminates any issues with the interface between the toolholder and spindle.

With a focus on titanium (80%), stainless steel (15%) and aluminum (5%), Garaczi wanted to get through roughing as quickly as possible, especially of titanium. It was critical to maximize machining efficiencies to enable 24/7 production for key customer projects. They included:

Boeing 737 MAX: Advanced technology of the narrow-body aircraft series included a switch from composites to titanium on key portions of the design. Production of the series quickly set an industry record for the fastest introduction ever of a new jet transport. Timely production and delivery by Delta were essential.

Tesla: Type 17-4PH is a martensitic, precipitation-hardening stainless steel that provides an outstanding combination of high strength, good corrosion resistance and good mechanical properties at temperatures up to 600° F (316° C). Delta predominantly used this material for intricate Tesla product applications that required high strength and a modest level of corrosion resistance.

Chevrolet: Highly polished, lightweight, corrosion-resistant, premium 316L stainless steel was used by Delta in production of exhaust valves.



High Torque retention knobs from JM Performance Products, along with dual-contact spindles and a combination of high-speed and conventional toolpath approach, have reduced cycle times as much as 40–50% for machining exotic materials like titanium, stainless steel and aluminum for Delta Machine’s aerospace, medical and automotive customers.



JMPP's High Torque knob is longer and reaches deeper into the cross section of the holder's threaded bore. As a result, all thread engagement occurs in a region of the toolholder where the cross-section is thicker to resist deformation, increasing rigidity and tool life.

Although standard, off-the-shelf retention knobs could be used on Delta's new machines, Garaczi wanted to avoid scenarios where the machine's high torque could shear off or break the retention knob and destroy the spindle. Replacement spindles cost upwards of \$40,000 or more, not including the cost of downtime.

"For the aggressive types of machining we do, if you have a really strong retention knob, it's going to increase the rigidity of your setup," Garaczi said. To further maximize the rigidity and minimize vibration, Garaczi specified that Delta's machines have dual-contact spindles. In this configuration, both the toolholder shank (taper) and the flange are used to eliminate pull-back in the spindle.

To address these issues, Garaczi investigated a recommendation from one of his machine suppliers that he convert to a specific High Torque retention knob from JM Performance Products, a manufacturer of CNC mill spindle optimization products. "The combination of the unique High Torque retention knobs, along with dual-contact spindles and a combination of high-speed and conventional toolpath approaches, has decreased cycle times as much as 40-50%. This also allows us to often outbid the competition for projects involving titanium," Garaczi said.

Component manufacturers for industries like aerospace, medical and automotive machine a lot of exotic alloys and hard metals that can take a toll on carbide cutting tools. The result is that the tools must be changed out more frequently as they dull or break. The cost of tool replacement, not to mention loss of production time due to frequent changeover, can escalate costs as well.

By using High Torque retention knobs, Delta was able to resolve improper seating of the toolholder in the spindle. Since tight tolerances are essential in high-speed machining, if the toolholder doesn't fit the spindle precisely, reduced productivity and tool life are inevitable.

JMPP's design includes a knob that is longer and reaches deeper into the cross section of the holder's threaded bore. As a result, all thread engagement occurs in a region of the toolholder where the cross-section is thicker to resist deformation. A precision pilot also increases rigidity.

By increasing the rigidity of the toolholder at higher rpms, the knob can increase tool life. Installing High Torque knobs in Delta's new high-rpm, high-torque equipment resolved a key design flaw inherent in CNC V-flange tooling by eliminating the toolholder expansion responsible for costly CNC milling and boring issues. By increasing contact of the holder and the spindle at the gage line, a wide range of CNC milling issues are overcome, including vibration and chatter, poor tolerances, non-repeatability, poor finishes, shortened tool life, excessive spindle wear and tear, run-out and shallow depths of cuts.

By implementing over 800 of the High Torque retention knobs, cutting tools on Delta's machines work better and faster. "At the end of the day, we are able to run titanium and stainless steel much faster than most machine shops. These shops [typically] run about 50 ipm [1.3 m/min] with tool life typically reaching 1.5-2 hours before replacement. With the high-torque retention knob, we are running 150 ipm [3.8 m/min] in titanium and our tools last about five hours before we have to change them, which is pretty incredible." Garaczi also noted "the accuracy with the reduced runout (using the right toolholder and machine) which can interpolate 2" [50.8 mm] or any size bores with 0.0001" [0.003 mm] accuracy, with the ability to repeat it in titanium."



JMPP's High Torque retention knobs help Delta Machine achieve finishes of 50 rms at more than 100 ipm (3.8 m/min), exceeding typical 125 rms results and customer requirements for quality and delivery.

Another key advantage that Delta achieved was better surface finish, which eliminated additional benching operations that add cycle time. “At the feed rates and speeds that we run titanium, the typical finish expected is 125 [rms]. The High Torque retention knob helps achieve a 50 rms finish at more than 100 ipm, which often exceeds what the customer requires,” said Garaczi. “In the aerospace and medical industries, price is a factor, but the customer is more interested in top quality parts delivered on time.”

JMPP’s High Torque knobs work with all existing V-flange toolholders, including BT, DIN, ISO, and CAT toolholders from 30 to 60 taper. The solution provides V-flange toolholders with the rigidity and concentricity necessary for high-speed machining of titanium, aluminum and other exotic metals/alloys, without having to turn to HSK or CAPTO tooling systems that can be two to three times more expensive, according to the company.

For more information from JM Performance Products Inc., go to www.jmperformanceproducts.com, or phone 440-357-1234.

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