A few years ago, Boeing (Seattle, WA) contacted one of their tooling manufacturers, Briney Tooling Systems (Bad Axe, MI), a supplier of CNC tool holders and shrink fit tooling systems in North America, reporting that they had performed testing that revealed a flaw in the V-flange tooling they were using. Requesting a solution, Briney reached out to JM Performance Products, Inc. (JMPP: Fairport Harbor, OH / formerly J&M Machine) to help them handle the problem. In turn, within the following week, JMPP began an intrinsic investigation and designed a gage that mirrors the interior grind of a CNC spindle. This gage measures movement or growth of the toolholder taper down to 7.5 millionths inch in diameter.

The JMPP team identified that the flaw as toolholder expansion. Using their gage to perform extensive testing, the team proved that toolholder expansion is caused by the installation of a standard retention knob into a V-Flange holder.

Briney had reported expansion of their holders with as little as 13 ft./lbs. of torque during retention knob installation. This expansion creates a bulge in the holder at the small end, causing the holder to make contact with the small end instead of the large end. This reverses the way the toolholder is designed to fit the spindle, allowing the holder to move randomly within the spindle. This movement results in a loss of contact between the spindle and the toolholder and causes a laundry list of issues: vibration and chatter, excessive run-out, poor finishes, shortened tool life, high power consumption, excessive spindle wear, need to slow down, and the need to reduce the depth of cuts.

Using the taper shank test fixture, the JMPP team redesigned the knobs, finally reaching a design that eliminated toolholder expansion. Their high torque retention knobs are designed to thread deeper into the bore of the holder where there is a thicker cross-section of material to resist deformation.

Boeing's primary complaint was associated with the vibration and chatter — it was causing tolerance and finish issues on costly parts. The introduction of the high torque knobs eliminated the chatter issues. Once the knobs were made available to the general milling population, the JMPP team began to get feedback from customers that served to emphasize how rampant and detrimental a problem toolholder expansion represented to the manufacturing community.

Schuster Mechanical Profile

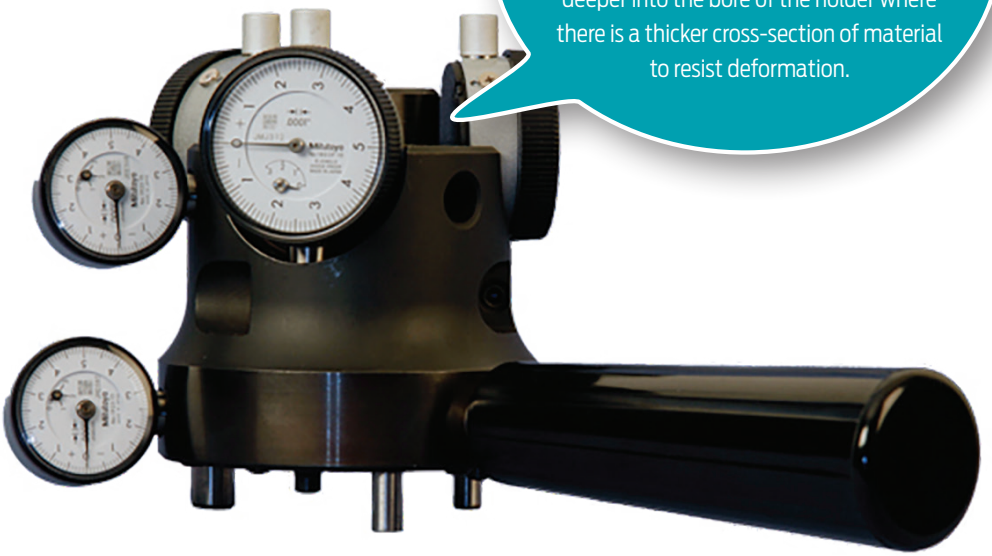
Nearly every component manufactured for use in the automotive industry has CNC manufacturing involved in its production. Perhaps it's time for automotive manufacturers to take a giant step backward and get down to the basics of manufacturing issues that exist on the production floor, which cost the industry billions of dollars per year and go largely unrecognized.

Schuster Mechanical, LLC (Detroit, MI), a CNC job shop focused on auto test equipment, was investigating new CNC machine investments which included TRAK 2op and TRAK LMP. The TRAK 2op is the first portable (2.5 x 4-ft footprint) VMC to focus on Second Operations Work, featuring an 8-station tool changer, and 10,000 RPM spindle. The TRAK LMP VMC is a low volume/high mix production system that incorporates technologies to markedly reduce the changeover times that plague high-mix, low-volume shops.

Owner Robert Schuster wanted to proactively ensure that his spindle cartridge would last as long as possible to maximize the dependability and productivity of the new machining centers. Schuster engaged with JMPP's sales engineering personnel at an industry trade show, who showed him how their knob's threads ran deeper into the holder—causing less distortion at the small end of the taper. Schuster was immediately impressed that his holders were not damaged by the expansion caused by the standard knobs and could still be used in production with the High Torque knobs—with no spindle damage occurring.

Initially, Schuster was considering implementing an HSK toolholder system, but found that it was an expensive system that had too many limitations to justify conversion from V-Flange. The HSK design features a cup-shaped holder that doesn't provide a long reach, the socket is shallow, and the walls are thin. The High Torque knobs maintain spindle/taper contact, with the benefit of the more affordable V-Flange CAT/BT holder system. Subsequently, Schuster determined BT30 knobs (JM31109HT) would be a more cost-effective solution to extend the life of the new VMC machines.

Sandvik Profile



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Increasingly, the automotive industry is using more carbide tools primarily because they can cut both aluminum and hard materials such as titanium, carbon, and exotic alloys at high speeds. Carbide tooling is expensive and also fragile, so it's imperative to watch for microfractures which yield poor surface finishes. If a microfracture occurs, the whole tip may disappear and the inserts can be rendered useless.

Recently, Sandvik, a high-tech and global engineering Group with about 42,000 employees, lent out one of their engineering representatives to test the best retention knobs for Caterpillar with a $1,200 solid carbide tool. The specification included: a toolholder, retention knob, tightening spec, proper placement, and then lock it down. The test's goal was to get the custom carbide tool to run without shattering.

A variety of standard retention knobs did not work. When tested with JMPP's High Torque knobs tightened to their provided torque specifications, it worked every time with no tool shatter. The fact is, a carbide tip cannot vibrate when it makes contact, or it shatters. Essentially, carbide must smoothly enter into the pocket and maintain its position in the pocket or it breaks. Carbide can last a long time with the right chip load and RPM. It could last weeks, but let it vibrate and it could be minutes.

Ultimately, by making a simple change — moving to the high torque retention knobs, CNC manufacturers across the board can eliminate the vast majority of issues, improve their milling operations, and get the best results while saving money. Moreover, this solution creates a real opportunity for U.S. tool shops to grow along with their automotive OEM and Tier One customers in creating progressive tooling cost containment solutions. . DW

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