JM Performance Products, Inc.

High torque retention knobs help reign in tooling budget

Edited by **Mike Santora** • Associate Editor

Tooling is a vital process in the productio automobiles, as every single part of a new car re a unique tool. What if an invisible problem inh to CNC manufacturing existed? One of the m initiatives at the forefront of today's automo manufacturing community is to answer the challenging tooling cost containment questio find progressive solutions therein.

Boeing profile

Automotive industry manufact

their suppliers — on-time delivery, accu want perfect parts, but they want them they can control. Automotive industry s maintain production volume and qualit through cost containment.

The big automotive companies hold the relative to quality while expecting them fluctuating demand, and still produce p every component manufactured for use manufacturing involved in its productio

Perhaps it's time for automotive mar backward and get down to the basics o production floor, which cost the industr unrecognized.

Tooling is a vital and often overlooke automobiles, as every single part of a ne an invisible problem inherent to CNC m flaw in the tooling was robbing manufa accurately, and interfering with the proc of the major initiatives at the forefront community is to answer these challeng and find progressive solutions therein.

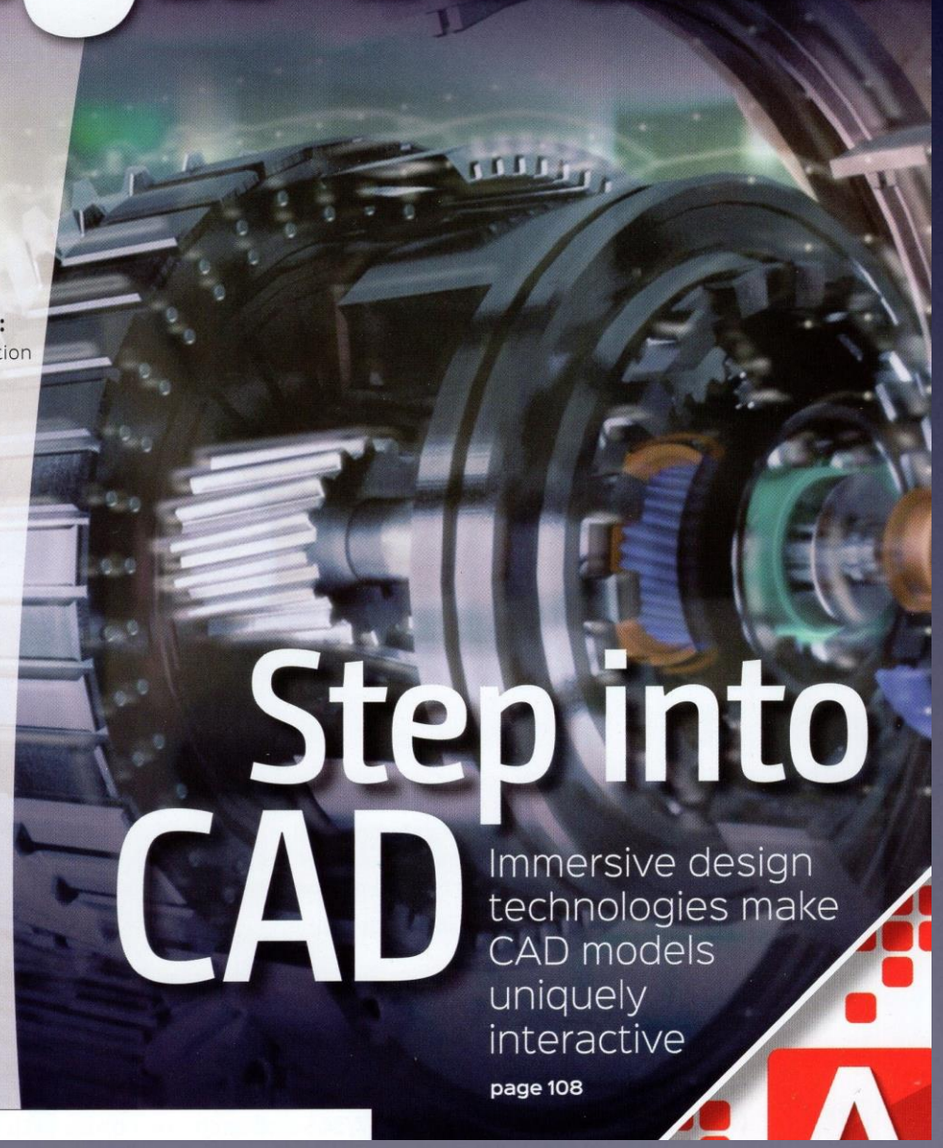
Design World
www.designworldonline.com
une 2019

nside:

MOTION CONTROL:
VFDs with integrated motion and machine controls
p. 96

LINEAR MOTION:
Up your conveyor game
p. 102

ADDITIVE TECHNOLOGY:
Pneumatics ensures safe post processing of metal 3D printed models
p. 72



Step into CAD

Immersive design technologies make CAD models uniquely interactive

page 108

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.

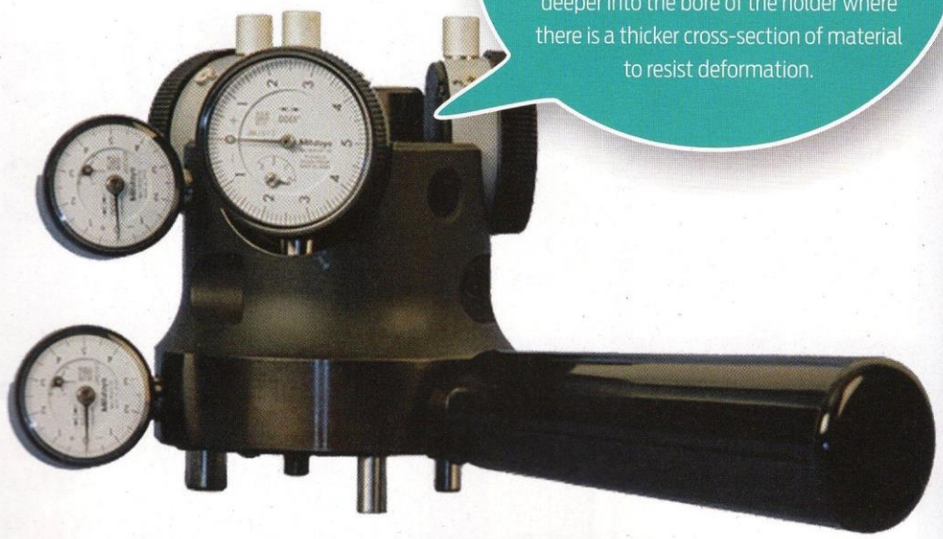
Schuster Mechanical, LLC (Detroit, MI), a CNC job shop focused on auto test equipment, was investigating new CNC machine investments which included TRAK 2op and TRAK LMP. The TRAK 2op is the first portable (2.5 x 4-ft footprint) VMC to focus on Second Operations Work, featuring an 8-station tool changer, 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

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.



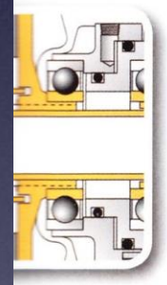
Increasingly, the automotive industry is using more carbide tools primarily because they can cut both aluminum and hard materials such as titanium, carbon, and exotic alloys at high speeds. Carbide tooling is expensive and also fragile, so it's imperative to watch for microfractures which yield poor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

Design World

w.designworldonline.com
2017

IDE:

LINEAR CONTROL:
Equivalent dynamic load and L10 life ratings for linear-motion setups
PAGE 56



MOTION CONTROL:
Designing with pneumatic clutches and brakes
PAGE 64

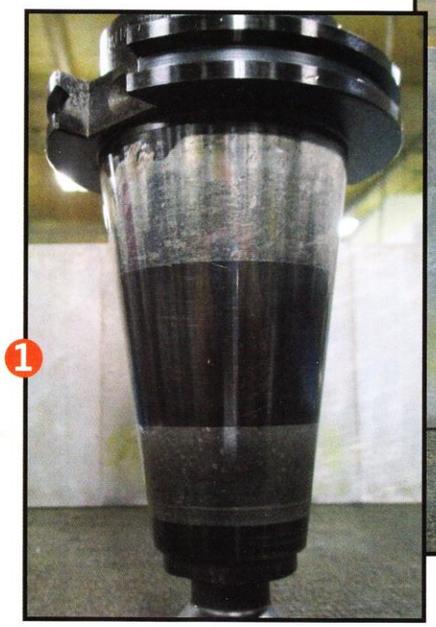
ELECTRONICS
LEDs light up industrial enclosures
PAGE 86

Medical software development—

where safety meets security

76

Edited by: Mike Santora • Associate Editor



These images show HEC's after use of standard versus high torque retention knobs. The first image shows taper deformation which prevents a toolholder from properly mating with the CNC machine's spindle. The second image reflects JMPP's high torque retention knobs' design

High torque retention knobs fix toolholder deformation

The easiest way to achieve the highest level of performance from CNC mills and tooling is to eliminate toolholder expansion. Toolholder expansion occurs when a standard retention knob is installed into a toolholder. Pressure exerted by thread engagement, coupled with the elastic properties of the steel used to manufacture the toolholders, creates a bulge at the small end of the holder. Once expansion occurs, the holder will not pull all the way into the spindle, and the toolholder can't make contact with upwards of 70% of the spindle surface.

Because this bulge stops the toolholder from making full contact with the taper of the spindle, a wide range of CNC milling issues surface: vibration and chatter, poor tolerances, non-repeatability and others.

Hansen Engineering Company selected JM Performance Products' High Torque knobs to overcome these issues. HEC engineering personnel initially met with JMPP's technical team at a WESTEC show in Los Angeles, where they were given a demonstration on the benefits of how the High-Torque retention knobs would work with their 50 taper V-flange toolholders. The High-Torque retention knob design features a knob that is longer and reaches deeper into the holder's threaded bore. As a result, all thread engagement occurs in a region of the toolholder where there is a thicker cross-section of material to resist deformation.

HEC initially bought 25 High Torque knobs and properly installed them, following calculated torque specs and using a retention knob socket and torque wrench. Immediately, they noticed a 5% spindle load decrease using a 3.0-in. hi-feed insert mill running titanium. HEC also installed them on an aluminum forging job they were running

The high-torque retention knob design has a knob that is longer and reaches deeper into the holder's threaded bore. As a result, all thread engagement occurs in a region of the toolholder where there is a thicker cross-section of material to resist deformation.

that had consistently produced chatter problems. Among the tools tested for this job were a 1-1/4 in. diameter knuckle rougher and 2.0-in. diameter finisher.

Key design elements include: Longer than traditional retention knobs, with a precision pilot to increase rigidity, a relief below the flange forces threads into a deeper cross section of the toolholder. The knobs are hard turned to ensure precision fit and are balanced by design with threads cut to start and finish 180° from each other. The High Torque knobs will work in existing toolholders. DW

JM Performance Products | jmperformanceproducts.com

MACHINING CENTERS

Manufacturing ENGINEERING

AdvancedManufacturing.org | June 2019

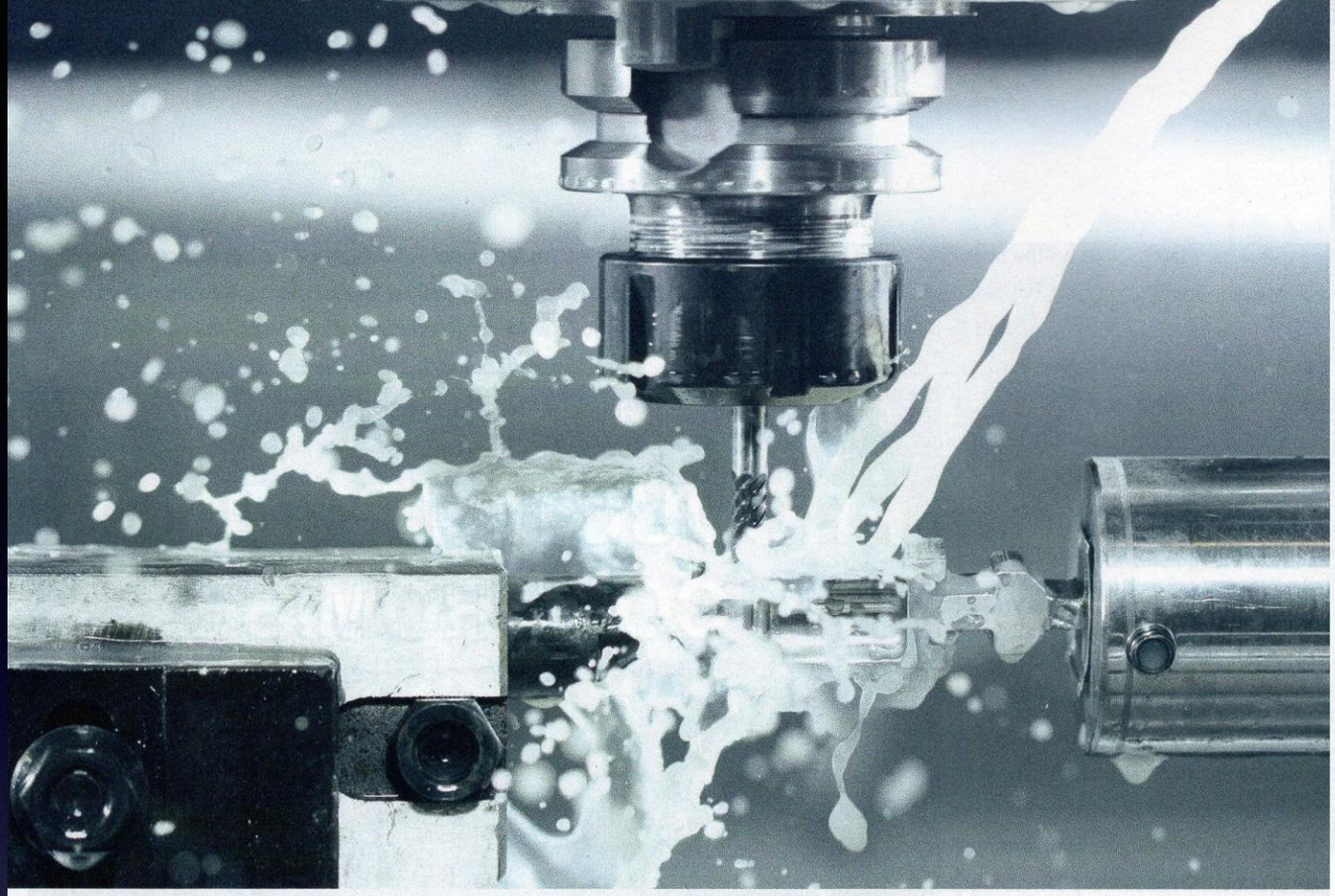
GRINDING STRATEGIES GO FROM GOOD TO GREAT

VMC Technology Stretches Applications, Productivity

Keeping Machines Honest with Advanced Calibration, Optimization

Geometry, Parameters and Strong Toolholders Vanquish Drilling Problems

A publication of SME



JM Performance Products modified Brother's spec for its BT retention knobs and incorporated all of Brother's dimensional and radius requirements along with JMPP's patented High To design features and higher tensile strength material for high-machining. (All images provided by JM Performance Products

BROTHER INDUSTRIES LTD.

High-Torque Knob Secures High-Speed Milling

High-speed, small footprint milling machines have challenged traditional spindle retention knob technology to achieve the design safety required in today's advanced shops. "As the trajectory of today's new milling technology trends toward machines producing extremely high speeds/high rpms within a smaller overall footprint, potential safety issues can't be ignored," said John Stoneback, JM Performance Products Inc. (JMPP), Fairport Harbor, Ohio.

"The bottom line is, everyone is looking to get more production per square inch and increase efficiency via heavy-duty, multi-axis machines doing precision milling using less space," said Stoneback. "The daunting obligation and responsibility for both industry and machine builders is to keep machine operation as safe as possible, while achieving the consensus goal of optimizing milling productivity," he said.

Stoneback noted that the retention knob is the main interface between the machine and the spindle and, when exposed to severe conditions, failure of a standard retention knob can result in a tool breaking loose during a cutting operation. A tool, ho or knob breaking loose from the spindle at such high speeds rpms produces a projectile that can damage the spindle, too holder, workpiece, workholding device and personnel. "Loos tools moving fast could present the potential for a lot of dam to the machine and workpiece. Indirect costs and liability ca run the gamut, from damaged facilities or equipment to serio injuries to personnel," he said.

Recognizing the potential for machine spindle interface fa that these small-footprint/high-rpm machines represent, JM Performance Products, a developer of CNC mill spindle optir tion products, created its patented High Torque retention kn

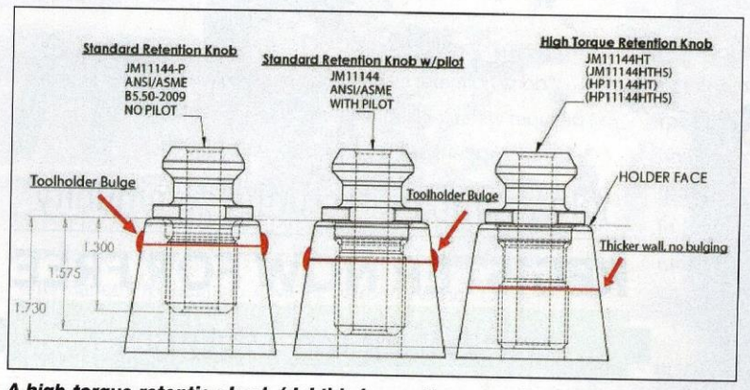
"In addition to solving the critical 'loose tool' factor and preventing toolholder deformation, the design delivers inhere safety benefits that are vital to addressing the velocity-driven safety dilemma," said Stoneback. "The fact is that most stan retention knobs are still being designed and manufactured to standards put in place over 40 years ago while the evolution of the tooling and the mills has been progressive. Even though it is a vital component in milling using V-flange tooling, the retention knob has been largely overlooked in this evolution—including safety factors," he said.

According to JMPP, its testing has proven that standard design retention knobs often expand the toolholder, leading to excessive vibration, chatter and mill harmonics. The company stated that in addition to affecting finishes, tolerances and tooling life, this vibration and chatter, caused by a lack of concentricity, can be damaging to the spindle and the draw bar of the mill.

"With the advent of today's very fast, very powerful small-footprint machines, this damage can directly result in the high-risk, red-flag safety dangers associated with a tool breaking loose during a cutting operation," said Stoneback. "In essence, it's a disaster waiting to happen."

Brother Industries Ltd., Nagoya, Japan, a leading multinational manufacturer of CNC drilling and tapping centers for automotive, aerospace and medical applications, identified the need to modify the standard used to manufacture its retention knobs, including the material tensile strength to make them stronger to meet the machine's manufacturing demands.

Material strength of knobs is a key factor in retention knob failure. To ensure their durability and strength, JMPP proactively migrated its 30-taper and 40-taper retention knobs from the traditional B8620H material to 9310H material. The 9310H material offers 40 percent higher tensile strength than the 8620H material. In reviewing the cross-sectional strength of the knobs, JMPP also identified a design flaw. To correct this flaw, JMPP is modifying the size of the coolant holes in many of its 30- and 40-taper knobs to increase this cross-sectional strength.



A high-torque retention knob (right) is longer than a traditional retention knob, but shares the same head dimensions.

In reality, any industry that depends on high-speed precision milling, whether for roughing exotic materials to complex geometries

JMPP's High Torque longer and reaches the cross section of threaded bore. As a thread engagement region of the toolhol the cross-section is order to resist defor increasing rigidity an

or for micro parts, is going to face these tooling safety iss Brother's modified spec for its BT 30 retention knobs, JM responded by introducing a knob with a coolant hole and without a coolant hole. These knobs incorporated all of B dimensional and radius requirements along with JMPP's design features and higher tensile strength material.

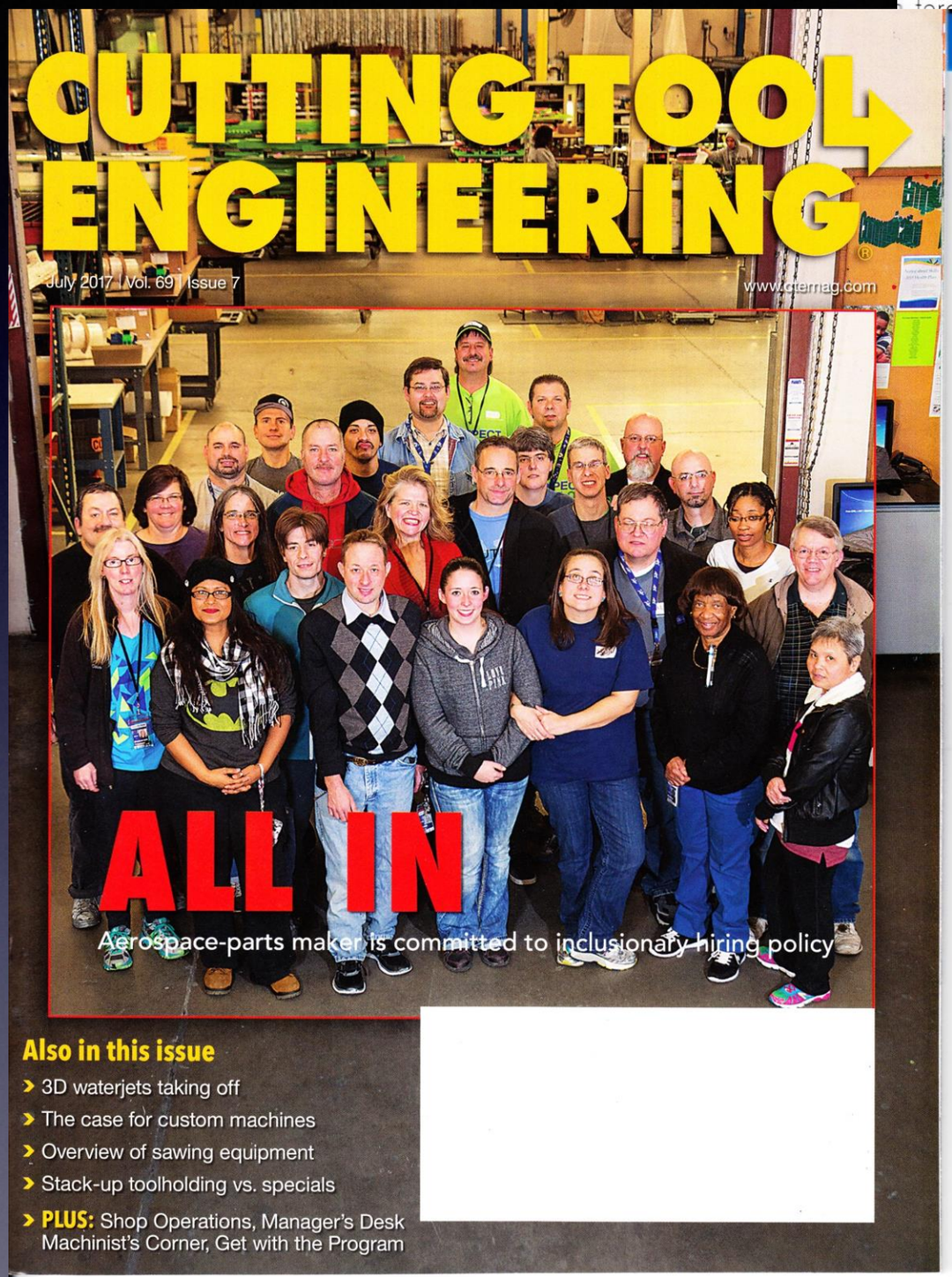
In addition, JMPP laser marks its parts, providing d each knob. The laser marked "date-in-service" feature a unique serial number for traceability of how long the been in service.

"This ensures safety of retention knobs, which are a consumable part," said Stoneback. "A typical retention k good for one to three years on a machine, depending on long the machine runs per day. The operator can simply unique identifier serial number to show how long a knob in service and when a tool change should be Inspection of retention knobs during tool chan reveal signs of diminished draw bar force. Wit replacements costing $20,000 to $80,000, ma is critical," said Stoneback.

Currently, JMPP has provided more than the modified High Torque retention knobs to for demanding high-rpm machines, in additio more than 10,000 standard JMPP High Torqu already in use.

All JMPP retention knobs are manufactur material sourced in the U.S. and made from 8620H or Grade 9310H fine grain steel. H13 is also available. Knobs are shot peened to relieve stres turned for superior fit and finish, and balanced by desig meet all five world standards: ANSI, JMTBA, ISO or DIN according to the company.

For more information from JM Performance Products go to www.jmperformanceproducts.com, or phone 440-3



A HIGH-TORQUE CONVERSION

END USER	SOLUTION PROVIDER
Hansen Engineering Co. (310) 534-3870 www.hansenengineering.com	**JM Performance Products Inc.** (800) 322-7750 www.jmperformanceproducts.com

CHALLENGE	Increase productivity and decrease machine downtime.
SOLUTION	Install high-torque retention knobs in toolholders.

Eliminating toolholder expansion provides an easy and cost-effective way to achieve high levels of performance from CNC machines and cutting tools. Expansion can occur when a standard retention knob is installed in a toolholder. Pressure exerted by thread engagement, coupled with the elastic properties of the steel used to make the toolholder, creates a bulge at the small end of the holder.

Once expansion occurs, the holder will not pull entirely into the machine spindle. As a result, the holder can't make contact with as much as 70 percent of the spindle surface. This lack of complete contact can lead to vibration and chatter, nonrepeatability, shorter tool life, excessive spindle wear, tool runout and out-of-tolerance parts.

Hansen Engineering Co. is well aware of these problems. The Harbor City, Calif., job shop produces multiple-axis parts and major structural assemblies for the aerospace industry in two buildings on its 43,000-sq.-ft. campus. The majority of HEC's CNC machines have 10,000-rpm to 15,000-rpm spindles.

Over time, heavy-duty machining jobs began to present issues. Toolholders were getting stuck in the

Hansen Engineering

Far Left: With a standard retention knob, taper deformation on the toolholder prevents it from properly mating with a CNC machine tool's spindle. Left: The high-torque retention knob from JM Performance Products enables a toolholder to have close to 100 percent contact with the spindle.

spindle because of deformation, evidenced by wear marks at the top and bottom of the holders. Fretting appeared on contact surfaces and increasingly long cycle times developed. These problems led to more production shutdowns to allow the machines to cool off for significant periods of time. In addition, chatter and the resulting poor surfaces were recurring when roughing titanium, stainless steel and aluminum.

Seeking a solution, HEC engineering personnel attended a trade show where they saw JM Performance Products, Fairport Harbor, Ohio, demonstrate the benefits of JMPP's high-torque retention knobs. These knobs are longer and reach deeper into the holder's threaded bore than a standard knob, JMPP reports. Relief located below the flange forces threads—which are cut to start and finish 180° from each other—into a deeper cross-section 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 to resist deformation.

Intrigued by their potential, HEC initially purchased 25 high-torque retention knobs. They properly installed the knobs in some of their existing toolholders by following calculated torque specifications and using a retention-knob socket and torque wrench. The parts manufacturer immediately saw a 5 percent decrease in the spindle load when cutting titanium with a 3" (76.2mm) high-feed, indexable-insert milling tool.

HEC also used the retention knobs for an aluminum forging job that had chatter problems. Among the tools tested for the job were a 1¼"-dia. (31.75mm) knuckle rougher and a 2"-dia. (50.8mm) finisher.

"The results were positive, as the chatter was eliminated and it produced the best finish we have ever seen on these parts," said Curtis Sampson, shop lead man at HEC. "After that, we bought 50 more knobs and immediately noticed improvements. We've been increasing their use over time ever since."

Since installing the high-torque knobs on the toolholders used on 14 CNC machines, requiring about 120 knobs per machine, HEC has realized roughly a 15 percent increase in productivity and a decrease in machine downtime.

In addition, the retention knobs reduced the decibel level in HEC's shop. "Our machines used to make a loud noise when changing tools, and JMPP's high-torque retention knobs solved that problem," said Jose Campos, toolcrib buyer for HEC. "They also eliminated fretting of the toolholder shank."

Because the high-torque retention knobs lower the spindle load, machines experience less wear and te HEC's power meter indicates a significant reducti in power consumption, and tool life improved wh roughing titanium and stainless steel with tooling semblies that have the knobs. In addition, HEC n realizes savings by being able both to increase t speeds and feeds and to shorten cycle times.

OVERCOMING TOOLHOLDER DEFORMATION

How JM Performance Products' high-torque retention knobs helped Hansen Engineering Co. increase productivity. By John Stoneback

Hansen Engineering Co. (HEC) is a Harbor City, California, aerospace engineering shop, with most of its modern, high-speed enclosed CNC machines operating from 10,000rpm to 15,000rpm – cutting large blocks of titanium, stainless steel, and aluminum. Toolholders were getting stuck in the spindle due to deformation, fretting on contact surfaces, and increasing cycles. Persistent problems lead to shutdowns to allow the machines time to cool off. Additionally, poor finish and chatter problems were recurring when roughing aluminum, titanium, and stainless steel.

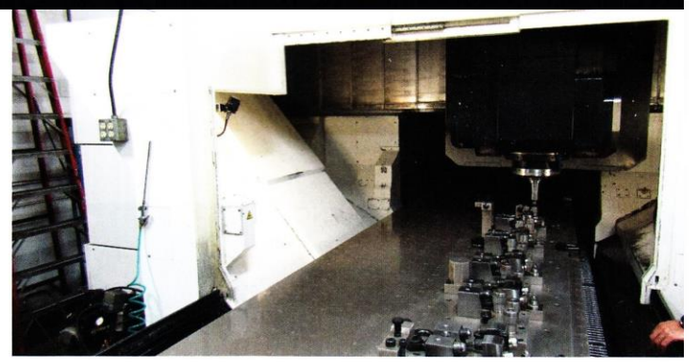
Eliminating toolholder expansion – a condition that occurs when a standard retention knob is installed into a toolholder – can boost performance in CNC milling. Pressure exerted by thread engagement, coupled with elastic properties of toolholder steel, creates a bulge at the small end of the holder. Once expansion occurs, the holder will not pull all the way into the spindle, will fail to contact more than 70% of the spindle surface. The bulge stops the toolholder from making full contact with the spindle taper, causing vibration, chatter, poor tolerances, non-repeatability, poor finish, shortened tool life, excessive spindle wear, run-out, and shallow depths of cuts. Eliminating the bulge reduces downtime, extends tool life, and increases speed and feed rates.

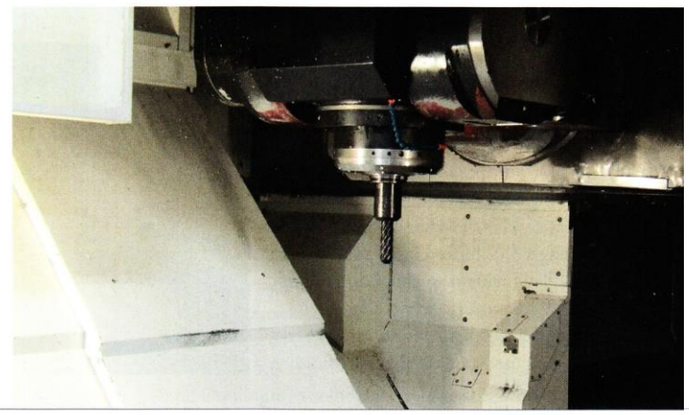
JM Performance Products Inc. (JMPP) of Fairport Harbor, Ohio, a manufacturer of CNC mill spindle optimization products since 2009, recognized a bulge-related

After-use images of standard vs. high-torque retention knobs. The first image shows taper deformation which prevents a toolholder from properly mating with the CNC machine's spindle. The second image reflects high-torque retention knobs' design elements that improve taper contact close to 100%.

DESIGN ELEMENTS

JM Performance Products' high-torque retention knobs are longer than traditional retention knobs with a precision pilot to increase rigidity, a relief below the flange forces threads into a deeper cross section of the toolholder. The knobs are shot-peened to relieve stress, hard turned to ensure precision fit, and balanced with threads cut to start and finish 180° from each other. The high-torque knobs meet ANSI, JMTBA, ISO or DIN, and JIS standards, and will work in existing toolholders. They are manufactured from hot rolled, 8620H or 9310H fine grain steel sourced in the United States. H13 tool steel is also available.

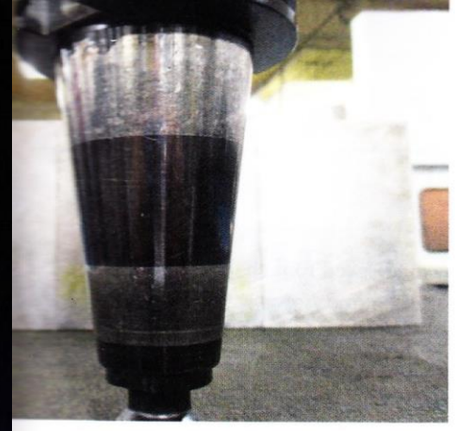




design flaw in V-flange tooling was responsible for CNC boring and milling problems. A high-torque retention knob for use in existing toolholders eliminated the bulge.

HEC engineering personnel met with JMPP's technical team for a demonstration on how the high-torque retention knobs would benefit their 50 taper V-flange toolholders. JMPP's high-torque retention knobs are longer and reach deeper into the holder's threaded bore. Thread engagement occurs in a thicker cross-section of the toolholder where material is better able to resist deformation. Eliminating V-flange tooling flaws allowed HEC to increase machine speeds, offering savings of 10% to 15%.

HEC installed 25 high-torque knobs, abiding by calculated torque specs and using a retention knob socket and torque wrench. Immediately, HEC machinists noticed a 5% spindle load decrease using a 3.0" hi-feed insert mill running titanium. HEC also installed them on an aluminum forging job they were running that had consistently produced chatter problems. Among the tools tested for this job were a 1-1/4" diameter knuckle rougher and 2.0" diameter finisher.



HEC Shop Lead Man Curtis Sampson says, "The chatter was eliminated, and it produced the best finish we have ever seen on these parts. After that, we bought 50 more pieces and immediately noticed improvements all around the table – we've been increasing their use over time ever since."

By converting 14 CNC machines with approximately 120 JMPP high-torque retention knobs per machine, HEC increased productivity 15% and decreased downtime.

HEC Buyer - Tool Crib Jose Campos says, "Productivity has continued to increase by approximately 15%. The same rate applies for downtime as there is less change-out of tool cutters across the board." Campos notes that in 2015 a HEC machine with spindle running at 10,000rpm and 350ipm feed on aluminum parts used 170 high-torque retention knobs. In 2016 the company used 300 high-torque knobs. The progressive conversion to JMPP's high-torque retention knobs allowed HEC to overcome long-standing productivity issues for its entire fleet of high-speed CNC mills.

Campos says improvements on HEC's Mazak 5-axis CNC machining center, featuring 160" length with dual shuttle tables and a tool-changer designed to run one table full of parts while the other is being loaded. "Our Mazak machines used to make a loud noise when changing tools, and JMPP's high-torque retention knobs solved that problem," Campos says. "The machines are much quieter now when roughing titanium and stainless steel. They also eliminated fretting of the toolholder shank."

The retention knobs have shown lower spindle loads, which is better for the machine, and when roughing titanium and stainless steel with the knobs, HEC used less power while improving tool life. **A**

Hansen Engineering Co.
www.hansenengineering.com

JM Performance Products Inc.
www.jmperformanceproducts.com

About the author: John Stoneback, JMPP's president, can be reached at 440.357.1234 or jstoneback@jmppinc.com.

Modern Machine Shop

mmsonline.com

2017 TOP S
BENCHMA
Business Str
Machining Te
Shopfloor Pr
Workforce D

AUGUST 2017
A property of Gardner Business Media

Overcoming Toolholder Deformation with High-Torque Retention Knobs

When a toolholder expands, it cannot make full contact with a machine tool's spindle, causing vibration, chatter, poor tolerances, non-repeatability, poor finishes, shortened tool life, excessive spindle wear and tear, runout, and shallow depths of cut, among other problems. Hansen Engineering Co. (Harbor City, California) remedied its production issues by converting to high-torque retention knobs from JM Performance Products Inc. (Fairport Harbor, Ohio). This reportedly increased the aerospace engineering shop's productivity by 15 percent and decreased downtime.

Hansen Engineering Co. used a standard retention knob in the toolholder on the left. Taper deformation prevents the toolholder from properly mating with the CNC machine's spindle, however. In contrast, the photo on the right shows use of JM Performance Products' high-torque retention knobs in the toolholder. A longer design enables the knob to reach deeper into the holder's threaded bore, improving taper-contact quality.

HANSEN ENGINEERING CO.

PROBLEM Toolholder expansion reduced spindle contact causing a variety of production issues

SOLUTION High-torque retention knobs from JM Performance Products Inc.

RESULTS Increased productivity, reduced downtime

Established in 1962, HEC is an approved Air Transport Association supplier of precision-machined multi-axis parts and major structural assemblies. The shop specializes in complex MDI

Two buildings on HEC's 43,000-square-foot-facility campus boast a wide array of major CNC equipment including high-speed, five-axis machining centers, horizontal machining centers with dual tombstones, three-axis machining centers, and a machining center with dual-shuttle tables.

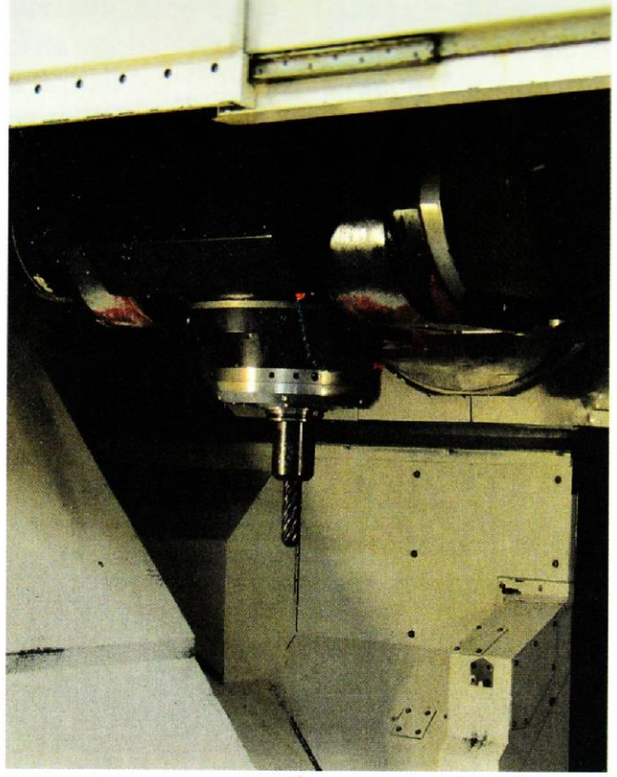
job that had consistently produced chatter problems. Among the tools tested for this job were a 1.25-inch-diameter knuckle rougher and 2-inch-diameter finisher.

"Again, the results were positive, as the chatter was eliminated, and it produced the best finish we have ever seen on these parts," says Curtis Sampson, shop leadman. "After that, we bought 50 more pieces and immediately noticed improvements all around the table. We've been increasing their use over time ever since."

According to JMPP President John Stoneback, "By significantly increasing the speed of machines via eliminating the problems that were designed into V-flange tooling, conservative estimate savings of 10 to 15 percent can be achieved. The high-torque knobs transform V-flange tooling into the most cost effective, reliable and precise tooling system available."

Since these initial tests, HEC has progressively converted to high-torque retention knobs in its 14 CNC machines, requiring approximately 120 per machine. Jose Campos, tool crib buyer, says the 15 percent increase in productivity has led to the same rate of decreased downtime due to less change-out of tool cutters across the board.

Mr. Campos praises the knobs' performance



Seeking a solution to their production issues, HEC engineering personnel initially met with JMPP's Technical Team at the Westec trade show in Los Angeles, California, where they were given a demonstration on how the high-torque retention knobs would work with their 50-taper V-flange toolholders.

of material to resist deformation.

HEC engineering personnel met with JMP a manufacturer of CNC mill spindle-optimizati products, to learn how its high-torque retenti knobs could work with the shop's 50-tap V-flange toolholders. Intrigued by their potenti HEC initially bought 25 knobs and prope installed them following calculated torque spe ifications using a retention-knob socket a torque wrench. Immediately, the shop noticed 5 percent spindle-load decrease using a 3-in high-feed insert mill running titanium. The co pany also installed them on an aluminum forgi

CONSUMABLES

PRODUCT NEWS FOR METALWORKING, MACHINE TOOLS AND AFTERMARKET PARTS

www.consumablesmagazine.net JULY/AUGUST 2017 A **TREND** PUBLICATION

DISCS/BELTS/PADS/WHEELS

Versatile quick-change disc system

The CombiClick disc system has a cooling and quick-mounting system backing pad to deliver lower workpiece temperatures, improve surface contact and provide longer disc life. The discs in the CombiClick kit provide solutions for rough grinding, fine grinding, surface conditioning, pre-polish and polishing to a mirror finish.

Pferd Inc., Milwaukee, 262/255–3200, www.pferdusa.com.

[*continued on* **page 4**]

HAND TOOLS/PORTABLE TOOLS

Flexible hose added to cordless grease gun

The Flexzilla 20-volt cordless grease gun kit features a 42-in. Flexzilla grease hose made of a hybrid material that stays flexible in temperatures from subzero to 140 degrees Fahrenheit. Flexzilla grease guns also have a RapidReload to change cartridges quickly. The kit includes two heavy-duty 20-volt MAX lithium-ion batteries and a one-hour quick charger.

Legacy Manufacturing Co., Marion, Iowa, 800/645-8258, www.legacymfg.com.

WELDING

Capable, durable turntable

The Aircrafter T250 turntable has a detachable clutch to rotate the turntable freely, a closed-frame design, a simple push knob to adjust table angle and an illuminated control panel with a digital display. It can be easily bolted to any flat surface, and its gas fitting accepts common hoses.

MK Products Inc., Irvine, California, 949/863-1234, www.mkproducts.com.

ELECTRIC POWER

Convenient charging on the job site

The M18 and M12 vehicle chargers plug into 12-volt DC outlets and accept all M18 and M12 battery packs. The chargers feature Milwaukee's Redlink Intelligence, communicating directly with the battery packs to monitor cell voltage, temperature and charge status to optimize the performance and overall life of the packs.

Milwaukee Electric Tool Corp, Brookfield, Wisconsin, 800/729-3878, www.milwaukeetool.com.

ABRASIVES

Wheels are ideal for metal and stainless steel

Pearl Abrasive Co. unveiled its new SlimCut Plus Cut & Grind Combo wheels. The aluminum oxide thin cut-off wheels are designed for metal and stainless steel and ideal for cutting, notching, deburring and light grinding. SlimCut Combo wheels are also contamination-free.

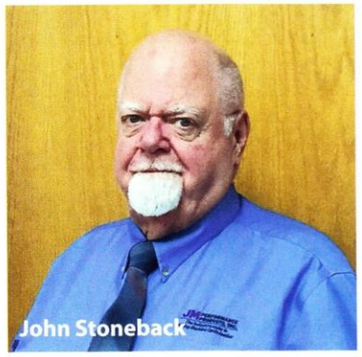
Pearl Abrasive Co., Norcross, Georgia, 800/969-5561, www.pearlabrasive.com.

TIGHTEN UP

Preventing toolholder deformation can increase productivity, says JP Performance Products President John Stoneback

Q: WHAT IS TOOLHOLDER DEFORMATION?

John Stoneback: A workhorse in today's high-speed CNC machining centers, the retention knob and its relationship with V-flange toolholders can cause critical productivity issues for manufacturers due to toolholder expansion. Once expansion occurs, the holder will not pull all the way into the spindle and the toolholder typically cannot make contact with more than 70 percent of the spindle surface.


John Stoneback

Insufficient holding by toolholders is far more typical in machining center processes than most shops realize—whether you are running one mill or hundreds. Loose tools present myriad issues industrywide in terms of production, time and tooling. Key productivity variables include chatter and vibration, excessive runout, lengthy finishing and polishing times, long setup times, rigidity issues, poor tolerances, lack of repeatability, shortened tool life, slow speeds and feeds, and shallow depth of cuts.

At the core of this quandary is what happens to the toolholders when they are tightened. Overtightening the retention knob can produce a bulge in the narrow end of the holder. This often results in the toolholder losing the shape that matches the cone of the spindle—rendering it free and seating insecurely in the machine. 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.

Q: HOW CAN HIGH-TORQUE TOLERANCE SOLVE THIS PROBLEM?

Stoneback: Whereas the retention knob is an unmistakably critical component of the machining process, conventional retention knobs, when installed in a toolholder, may deform the precision taper because of the elastic nature of a toolholder's thin walls. This taper deformation prevents a toolholder from properly mating with the spindle of a CNC machine.

JM Performance Products Inc., a manufacturer of CNC mill spindle optimization products since 1966, has been spearheading the charge to overcome this manufacturing bind with its high-torque or lower-deformation retention knobs. An essential element of the patented design is a knob that is longer and reaches deeper into the holder's threaded bore. As a result, all thread engagement occurs in a region of the toolholder where the diameter is large and where there is more material to resist deformation.

Q: WHAT ARE THE KEY DESIGN ELEMENTS OF A HIGH-TORQUE KNOB?

Stoneback: Essential design elements of JMPP's patented high-torque retention knob include the following:

- Longer than traditional retention knobs
- Precision pilot increases rigidity
- Relief below the flange forces threads into a deeper cross section of the toolholder
- Hard turned to ensure precision fit and balance for high-speed operations
- Head dimensions that match existing toolholders.

When properly installed with a retention knob socket and torque wrench, this design prevents toolholder deformation. The accumulated synergistic effect of these design elements eliminates the expansion or distortion of the small end of the tool holder, allowing CNC routers to run faster.

Q: HOW CAN SWITCHING KNOBS STIMULATE RESHORING IN THE UNITED STATES?

Stoneback: Over 750,000 CNC mills have been put into service in the past 15 years in the United States. The fact is, many toolholders will expand when a traditional retention knob is installed. As more end users begin to understand the retention knob's critical role as the interface between the toolholder and machine spindle, they will progressively move toward converting to the high-torque retention knob.

Typical CNC milling centers are running 20 percent to 40 percent slower than they should. If you are able to significantly increase the speed of machines by eliminating the deficiencies of conventional retention knobs, conservative estimate savings of 10 percent to 15 percent can be achieved.

Many larger manufacturing entities and market applications—automotive, aerospace, medical, etc.—have been implementing JMPP's patented high-torque retention knobs and have seen tremendous productivity results. Many machine operators are not aware they can achieve significant increases in tool life, production rates and revenue by simply minimizing the expansion/deformation that happens at the small end of the taper when it is over-torqued. These are goals that are easily in reach and present U.S. machine tool die/milling manufacturers with a unique opportunity to promote reshoring. C

JM Performance Products Inc., Fairport Harbor, Ohio, 440/357-1234, www.jmperformanceproducts.com.

GEARSolutions

Your Resource for Machines, Services, and Tooling for the Gear Industry

ISSUE FOCUS

Lubrication | Broaching

INDUSTRIAL GEAR LUBRICANTS

FACE FORMULATION CHALLENGES

COMPANY PROFILE

GENERAL BROACH COMPANY

MARCH 201
gearsolutions.com

STREAMLINING SAFETY FOR HIGH-SPEED/ SMALL-FOOTPRINT MILLING MACHINES

High Torque retention knobs provide a myriad of safety benefits between machine and spindle for High RPM Mills. (Courtesy: JM Performance Products)

High torque retention knobs are a vital anchor for safety between machine and spindle for high-RPM mills.

By JOHN STONEBACK

Safety in design is critical to CNC milling operations end products as well as to the machine's profitability. As the trajectory of today's new milling technology trends toward machines producing extremely high speeds/high-RPM within a smaller overall foot print, potential safety issues can't be ignored. Loose tools moving fast could present the potential for a lot of damage to the machine and work piece.

Indirect costs can run the gamut from damaged facilities to equipment. Currently, there are no defined guidelines to address the potential hazards that small footprint/high-RPM machines being introduced into the marketplace may present.

Everyone is looking to get more production per square inch and increase efficiency via heavy duty, multi-axis machines doing precision milling and using less space. The daunting obligation and responsibility for both industry and machine builders is to keep machine operation as safe as possible, while achieving the consensus goal of optimizing mill productivity.

HIGH TORQUE / MILLING SAFETY EVOLUTION

Without proper tools, milling machines can be a potentially dangerous threat at the forefront of this evolving safety climate. The retention knob is the main interface between the machine and the spindle and when exposed to severe conditions, failure of a standard retention knob can result in a tool breaking loose during a cutting operation. A tool, holder, or knob breaking loose from the spindle at such high speeds and RPMs produces a projectile that can damage the spindle, tool, holder, work piece, and work holding apparatus.

Recognizing the potential for machine spindle interface failure that these small footprint/high RPM machines represent, Fairport Harbor, Ohio's JM Performance Products, Inc., a leading manufacturing innovator of CNC mill spindle optimization products since 2009, is leading the way of this safety evolution via its patented High Torque retention knobs. In addition to solving the critical "loose-tool" factor and preventing toolholder deformation, the patented design delivers inherent safety benefits that are vital to progressively addressing this velocity-driven safety dilemma.

Most standard retention knobs are still being designed and manufactured to the standards put in place over 40 years ago—while the evolution of the tooling and the mills has been progressive and responsive. Even though it is a vital component in milling using V-Flange tooling, the retention knob has been largely overlooked in this evolution, including safety factors.

Extensive testing by JMPP has proven that standard design retention knobs often expand the toolholder, leading to excessive vibration, chatter, and mill harmonics. In addition to affecting finishes, tolerances, and tooling life, this vibration and chatter, caused by a lack of concentricity, can be damaging to the spindle and the draw bar of the mill. With the advent of today's very fast, very powerful, small footprint machines, this damage can directly result in the high-risk, red-flag safety dangers associated with a tool breaking loose during a cutting operation. In essence, it's a disaster waiting to happen because if anything breaks loose, it would essentially be like a missile coming off the machine.

> **Most standard retention knobs are still being designed and manufactured to the standards put in place over 40 years ago.**

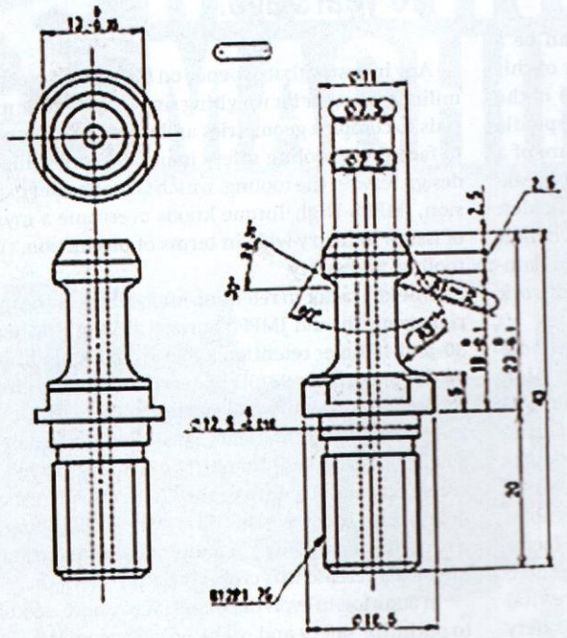
Any industry that depends on high-speed precision milling, whether for roughing simple and exotic materials to complex geometries and micro parts, is going to face these tooling safety issues. By correcting the design flaw in the tooling, which is tool holder expansion, JMPP's High Torque knobs overcome a myriad of issues industry-wide in terms of production, time, tooling, and safety.

One key factor in retention knob failure is the material strength–and JMPP is proactively migrating its 30- and 40-taper retention knobs from the traditional 8620H material to 9310H material, in order to ensure the knobs' durability and strength. The 9310H material offers 40 percent higher tensile strength than the 8620H material. Additionally, JMPP has reviewed the cross-sectional strength of the knobs and identified a design flaw. To correct this flaw, JMPP is modifying the size of the coolant holes in many of its 30- and 40-taper knobs to increase this cross-sectional strength.

In addition to evolving material strength on knobs to optimize safety and overall production, JMPP also laser marks its parts, providing dating on each knob. The laser marked date-in-service feature, which includes a unique serial number for traceability, shows how long the knob has been in service.

This ensures safety as retention knobs are a perishable, consumable part — a typical retention knob is good for one to three years on a machine, depending

High Torque retention knobs are longer than a traditional retention knob but share the same head dimensions. (Courtesy: JM Performance Products)



JMPP provided a customized engineering solution with their High Torque retention knobs based on Brother's unique modification specs. (Courtesy: JM Performance Products)

the unique identifier serial number to show how long a knob has been in service and when a tool change should be made. Inspection of retention knobs during tool changes can reveal signs of diminished draw bar force. With spindle replacements costing $20,000 to upwards of $80,000, maintenance is critical.

RESPONSIVE HIGH-TORQUE/HIGH-RPM ENGINEERING

Brother Industries, Ltd. (Brother: Nagoya, Japan), is a leading multinational manufacturer of CNC drilling and tapping centers for the automobile, aerospace, and medical industries. Brother identified the need to modify the standard used to manufacture their retention knobs, including the material tensile strength, to make them stronger to meet the machine's manufacturing demands.

Using Brother's modified spec for its BT30 retention knobs, JMPP quickly responded by introducing the JM25084ACHTHS (with coolant hole) and JM25084AHTHS (without coolant hole). These knobs incorporated all of Brother's dimensional and radius requirements along with JMPP's High Torque patented design features and higher tensile material.

JMPP's engineering team is the only retention knob manufacturer of record to progressively respond to Brother's unique modification challenge with a customized solution, based on Brother's revised specs and material, and incorporating Brother's High Torque standard tolerances and design features.

After engineering modified the design which makes the knobs stronger for high-RPM machines, used in the manufacture of small diameter parts, JMPP directed customers to use the JM25084AHTHS and JM25084aCHTHS instead of the current JM31109A, JM31109AHT, and JM31109AHT. Brother provided a print that notes changes to the knob on four dimensions and a material change not covered in MAS-P30T-2(30 degrees).

JMPP has provided more than 10,000 of the modified High Torque retention knobs to customers for their uniquely demanding high-RPM machines, in addition to more than 10,000 more of their standard High Torque knobs already in use.

MEETING SAFETY ISSUES HEAD-ON

The Brother example is part of a continuing trend of manufacturers being progressive in trying to push capacity while also thinking about safety. JMPP is also focusing on bringing safety issues to the forefront with leading manufacturers like Kitamura and its ultra-compact (6' wide x 9'7" deep) MyCenter 30 taper horizontal machine, which offers the world's fastest rapid/cutting rates of 2,362 RPM on all axes. Given its crazy speeds and size of tooling, JMPP views this as the ideal example of the trending combination that would benefit from its High Torque retention knobs, specifically their High Torque/High Speed JM32621HTHS.

Since everyone is "squeezing size" as they strive to produce larger envelope parts on smaller machines, certain safety considerations must be addressed in this equation. Almost every kind of hazard can be found in a machine shop, and JMPP strives to be proactive in its approach to design, manufacturing, and key issues such as how to safely increase speed rates that are facing the industry.

The industry must recognize the potential for machine spindle interface problems that these small-footprint/high-RPM machines represent. JMPP's high torque retention knobs have design elements that will meet those issues head-on.