➤ BY ALAN ROOKS, EDITORIAL DIRECTOR

Cool Turning

CNC units that do more, run cooler and offer more control.

Like many other machine tools, turning centers are getting bigger, faster and more precise. CTE examined five new turning centers and found units that can operate as near-milling machines, tightly control thermal growth and meet the needs of specific industry applications.

HAAS AUTOMATION INC., Oxnard, Calif., introduced its largest toolroom lathe, the TL-4. The flatbed unit, primarily for the oil-patch industry, has a large-diameter spindle, extended swing and length capacities and front and rear spindle noses. The CNC machine includes the Haas Intuitive Programming System, which allows manual machinists to transition into full-CNC operation without having to know G code. Using the IPS, operators can access canned cycles, allowing the machine to chamfer, turn, face, drill, tap and thread, among other operations.

The TL-4's high-torque spindle has twin-chuck capability and a 10.81"-dia. through-bore. The unit can handle heavy pipes and fittings, large couplers and long rollers. It has maximum part swings of 35" over the front apron and 16" over the cross-slide, with an X-axis travel of 18". The distance between centers is 91", permitting a maximum cutting length of 80".

A 55-hp vector dual-drive motor powers the spindle through a two-speed gearbox to provide 4,000 ft.-lbs. of torque in low gear. For faster cuts, the high gear provides a maximum spindle speed of 500 rpm. Both front and rear spindle noses accept a variety of chucks up to 25" in diameter. Other standard features include a 15" color LCD monitor with USB port, a traveling chip guard, an integral 100-gal. capacity coolant system and a manual tailstock with adjustable quill.

The TL-4 can perform pipe thread work—including tapered threads—and can recut workpieces up to 80" in length. The 80" of Z-axis travel between centers is also suited for large-diameter workpieces such as roller bearings and housings, according to Frank Ramirez, lathe product manager for Haas.

One of the key features of the TL-4 is automated thread recutting. In the oil-field industry, once a pipe thread becomes worn, some threads must be machined off the front of the pipe and the remaining threads recut.

"Since cross threading during manual thread recutting is a common problem, we developed an automated OD/ID thread repair program," said Ramirez. The operator first selects the threading tab in the IPS, and then selects the OD or ID thread repair tab and follows the onscreen directions. To recut the thread, the operator jogs the tool to the part, putting the tool tip into the bottom of any existing thread. With the tool tip in the thread, the operator pushes the X-diameter measure button (X-axis work offset) on the Haas control; this records the pitch of the thread. The operator then enters a value for threads per inch and follows the onscreen instructions to enter additional information (i.e., thread clearance, thread length, rpm, left or right thread, taper). Once the information is entered, the operator pushes cycle start to recut the thread. The TL-4 will retract from the part, find the correct thread pitch and recut the thread.

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If, after gaging the finished thread, the operator determines the diameter needs to be smaller, he can adjust the tool offset and recut the part, as necessary. The automated process takes about 3 to 4 minutes, compared to 30 minutes for manual recutting, said Ramirez.

TL-4 options include 25" 3- or 4-jaw manual chucks, a belt-type chip conveyor, tool posts and toolholders, spindle orientation, rigid tapping and user-definable macros. "The belt conveyor runs through the middle of the machine, where most of the chips fall, facilitating chip removal," said Ramirez.

The base TL-4 sells for $154,995.

Mori Seiki USA, Rolling Meadows, Ill., introduced the NL2500 turning center series. It is part of the NL class, which includes 30 variations on base models. According to the company, the NL line provides milling capability as robust as a vertical machining center. Compared with previous models, NL turning centers offer increased rigidity and minimized thermal displacement.

NL series turning centers use a milling motor inside the turret directly coupled to the milling tool. This design reduces transmission losses and vibration associated with traditional motors, which use gears and belts. The direct-coupled milling motor also reduces tool spindle acceleration time by two-thirds and cuts vibration and noise in half compared to indirect motors. "With the direct-drive technology, there is no loss of power to the rotary tools as is the case with indirect drives," said Gerald Owen, technical sales representative, Mori Seiki USA, Dallas.

The NL2500Y can handle turning jobs up to 14.0" in diameter and 27.7" in length. The lathe is in the 10" chuck-size class and has a maximum bar diameter of 3.1". The inclusion of 4.0" Y-axis movement provides off-center machining capability.

A rigid, triangular structure in the bed, spindle and tailstock reduces vibration. The unit's box way construction further reduces vibration and increases rigidity, enabling greater cutting depth and feed rates and reducing cycle times by up to 50 percent, according to Mori Seiki.

Owen said another key feature of the NL2500Y is the static weight capability of its main spindle, which can handle workpieces up to 1,102 lbs. "Many other lathes can't handle the same amount of workpiece weight on their spindles," he said. "A more robust spindle also leads to longer bearing life."

The NL series has new heat control features. Coverings isolate heat radiating from the oil controller and hydraulic unit, redirecting heat outside the machine. Transfer devices control the heat emanating from the headstock and servomotors. The direct-coupled turret milling motor also reduces heat generation to 10 percent of the conventional model, according to the company.

"We've taken heat control a lot farther than in past models," said Owen. "In addition to isolating and shielding the hydraulic unit, we've added a fan to cool the chuck cylinder. Many shops are trying to get away from using coolants, which leads to more heat in the machining envelope, so we focused on maintaining thermal stability."

The NL2500Y and other models in the line are changing the way some shops use lathes. "We have customers that are using NL lathes as if they were machining centers," said Owen. "Many are bar feeding, and doing 95 to 100 percent

The following companies contributed to this report:

EMAG LLC
(248) 477-7440
www.usa.emag.com

Haas Automation Inc.
(800) 331-6746
www.haascnc.com

Hardinge Inc.
(800) 843-8801
www.hardinge.com

Index Corp.
(317) 770 6300
www.index-usa.com

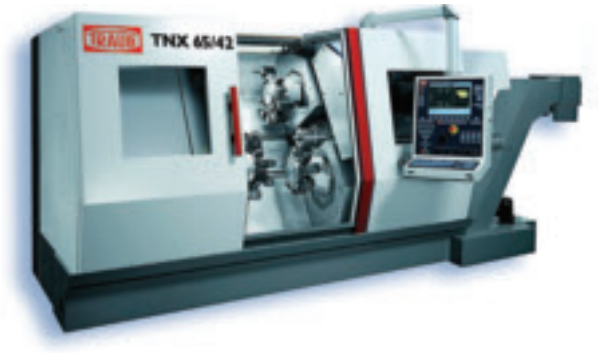
Mori Seiki USA
(847) 593-5400
www.moriseiki.com

of their milling work on the machine."

According to Owen, the NL2500Y can effectively replace a small VMC and a lathe. The turning center can machine bar stock and other workpieces in one setup, especially if the lathe is equipped with an optional subspindle. "The operator can access as many sides of the part as he needs," said Owen. "For example, if the part has a hexagon shape on the outside, the operator can do the front face and transfer the part once it is finished. On a traditional VMC or even an HMC, he will typically need multiple indexes to finish the part." With a subspindle, bar feeder and parts catcher, the NL2500Y can operate lights out.

Using a subspindle also expands machining options, noted Owen. "Anywhere from 60 to 90 percent of a lathe operation is in the first chucking, so the subspindle is for secondary operations," he said. "We are working internally and with tool companies to create tooling for cutting above and below centerline in the Y-axis so that we can have roughing and finishing tools in the same station. With a 12-station turret and a subspindle, you are coming close to machining center capacity."

Also, the operator can gang tools, load the turret and run more jobs without having to set up the machine. A quick-change collet system allows a new job to be set up quickly because tools are already loaded. "If the tools don't change, all the operator has to do is watch the offsets closely on the first part and he can be confident that he will be getting a good part every time," said Owen.



INDEX CORP., Noblesville, Ind., introduced the Traub TNX65/42 mill/turn centers, which can machine parts from bar stock up to 65mm in diameter and up to 300mm in length. The modular machine includes identical 37.5/32.2-hp main and counterspindles. The machine can be equipped with two, three or four turrets, each capable of holding 10 live or fixed tools. Each turret can travel in X and Z directions of 175mm and 650mm, respectively, and, optionally, ±40mm in the Y direction. For reduced setup times, up to 80 tools can be loaded using double toolholders.

A key feature is the simultaneous use of four turrets plus an identical main spindle and counterspindle in combination with 7.4-hp, 6,000-rpm tool drives. "The operator can have four tools in the cut simultaneously, with turrets working on either spindle," said Olaf Tessarzyk, CEO of Index Corp. "For example, you can use three turrets on the main spindle and the remaining turret on the counterspindle. You can even have all four turrets working on the main spindle or on the counterspindle because the spindles are identical—though that approach would typically be used infrequently."

The machine can simultaneously perform two dissimilar machining operations and can be used for keyway milling, off-center drilling, side facemilling and similar operations. Complex components can be completed in a single setup, according to the company.

Traditional 4-turret machines typically have two controllers, so the operator cannot run a part in one setup, said Tessarzyk. "In that arrangement, you need a handover because you basically are operating two 2-turret machines. However, with the TNX65/42, you have one controller operating the turrets on the counterspindle and on the main spindle, so it is possible to complete a part in one setup."

Turrets are arranged on independent slides above and below the spindle centerline. The headstock is thermosymmetrical (thermal growth occurs at the same rate throughout the machine) and the synchronous, C-axis motor spindles are identically rated at 24kW at 5,000 rpm for the 65mm bar-capacity machine and 28kW at 7,000 rpm for the 42mm bar model. Hybrid bearings (ceramic and metal) come standard and offer long service life, according to Index.

The TNX65/42 was designed using finite element analysis (FEA) to minimize thermal growth and stress. As a result, thermal compensation is at a minimum, according to

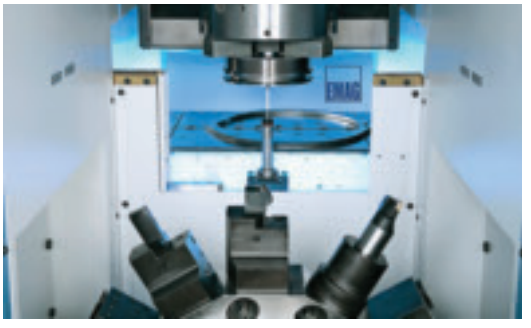
cool turning

Tessarzyk. "No matter what temperatures an operator works at, this machine holds its tolerances and does not experience rapid temperature change in the machining area," he said.

The TNX65/42 is constructed on a heavily ribbed, cast iron 60° slant bed that dampens vibrations and permits free chip fall. It features automated workpiece handling, including loading, unloading and bar remnant removal.

The machine is controlled by the Traub TX8i-s system, which runs Traub software. The software is backward compatible, allowing programs created on earlier controls to be run on the new machines. The Traub's 3D Win Flex process simulation shortens setup time and prevents collisions, according to the company.

The TNX65/42 has a price range from $450,000 to $700,000, depending on the number of turrets. The highest-priced unit features ultrahigh-pressure coolant for an optional high-frequency spindle on the turret drive.



EMAG LLC, Farmington Hills, Mich., introduced the VSC vertical turning center for chucked components up to 340mm in diameter. According to the company, the machine tool is essentially a manufacturing cell, where the pickup spindle ensures the machine loads itself.

The machine base is made from Mineralit, a polymer granite composite that helps extend life expectancy of turning, drilling and milling tools by offering excellent damping properties, according to the company.

A hydrostatic guideway supports the work spindle's Z-axis traverse. An overhead slide unit accommodates the quill with its integral work spindle and carries out the X-axis movements. The Z-axis movement of the quill unit takes place in the play-free, nonfriction, wear-resistant hydrostatic guideway.

The unit's spindle motor, work spindle and quill, turret, electrical cabinet and machine base are all fluid-cooled using a twin-circuit cooling system. Each of the 12 stations with VDI 50 receptors can be equipped with stationary turning or live drilling tools on turrets with tool drive.

Workpieces are removed automatically and measured by a stationary measuring probe outside the machining area (a standard feature), eliminating measurement interference from chips or dirt particles. Machining and measuring take place in the same setup.

Workpieces are automatically returned to the tooling area after measuring, where they—and all subsequent parts—are finished to size, taking into account any

necessary tool offsets.

Custom-made recirculating carrier prisms transport the workpieces to and from the pickup station. If a workpiece should be positioned incorrectly in its carrier prism, the machine stops automatically.

The VSC7 has a chuck diameter of 400mm, swing diameter of 420mm, nominal workpiece diameter of 340mm, nominal workpiece height of 160mm and an X/Z traverse range of 850mm to 315mm. It has a maximum spindle speed of 3,400 rpm.

The price for a VSC 7 is $320,220, but varies based on final specifications. Standard features include loop automation (L-type); safety enclosure; chip conveyor; coolant supply; oil-mist extraction; clamping cylinder; tool life monitoring; and sister tool management.

HARDINGE INC., Elmira, N.Y., introduced its Super-Precision RS-Series turning centers. The RS 42, 51 and 65 turning centers feature collet-ready spindles equipped with Hardinge workholding devices.

Designed for hard turning and hard milling parts in a single setup, RS-Series machines come standard with the Eppinger Self Alignment (ESA) top-plate tooling system. The machines have a Harcrete-reinforced cast-iron base and a collet-ready ground spindle.

RS-Series machines can turn material hardened to more than 80 HRC, according to Jeff Ervay, product manager, turning. Technologies offered include hydrostatic guideways, ICEFLY cryogenic machining (using -320° F liquid nitrogen as a coolant), and shape-compliant chucks.

Machine attributes include:

- 0.0002" total machining tolerance (on diameter)
- Up to 30 hp on the spindle drive and torque up to 270 ft-lbs.
- Hardinge/GE Fanuc i-Series RS control unit with Manual Guide i.
- Adaptability to Hardinge workholding systems.

There are two product ranges within the RS Series. At the top are three high-precision collet-spindle models. The second range includes three general-precision collet-spindle models. △

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