

Before & After

Remanufacturing brings new and improved life to old and tired equipment.

When a machine tool is no longer able to consistently produce parts within the required tolerance or the manufacturer needs to increase throughput without adding another machine, remanufacturing is often the most economically viable route to take. Unlike rebuilding, which brings a machine to the condition it was when it was originally purchased, remanufacturing involves taking an older and generally large machine and upgrading it with current technology.

"Remanufacturing the machine

tool is the process in which we renew that machine from the raw castings out," said Mike Daniluk, owner of The Daniluk Corp., Oklahoma City, a machine tool retrofitter, rebuild and remanufacturer. "We replace all of the mechanical drives, the hydraulic system and the electrical system. The remanufacture of the machine tool is basically reusing the base castings and making a new machine out of it."

Karen Fender, sales manager for Centerless Rebuilders Inc., a New Haven, Mich., company that specializes in remanufacturing Cincinnati

centerless grinders, added that the process begins by stripping down a machine and throwing away 90 percent of what's on it. This includes all wearable components, such as those for the electrical and hydraulic systems. "Hundreds of little parts," she said. "We do not inspect and determine anything. We simply take it out and toss it." What remains are the major castings and the guarding, if it's not bent.

Machines that are remanufactured are often 1970s vintage—or even older. Daniluk Corp. recently remanufactured a 1954 Giddings & Lewis

vertical boring mill and converted it to be a full CNC machine tool. "We gave the machine a lot of features it never had before, and the removal of the mechanical drives made it very quiet," Daniluk said.

The customer, a remanufacturer of jet engine components, experienced a mechanical drive failure, so The Daniluk Corp. replaced the original mechanical drives with precision-ground ballscrews coupled with installation of new GE Fanuc controls and AC digital drives to enhance the machine's function and provide full, simultaneous control of all four axes.

In addition, the ways and wear surfaces were ground. According to Daniluk, his company has the largest way-grinding capacity in the U.S. The way grinder is 120" wide, has 72" of "under the wheel" capability and has ground parts up to 34' long.

Technological upgrades integrated throughout the remanufacture include threading and the ability to execute complex profiles and run at a constant surface speed. "The thoroughly remanufactured VBM surpasses its former production capacities in both time and capabilities," he added.

There's Gold in Old

One of the features that made the VBM an ideal candidate for remanufacturing was the integrity of its "set-

The 3 R's

The terms "retrofit," "rebuild" and "remanufacture" have different meanings. A machine tool retrofit entails all things electronic: the controls, motors, drives and magnetic components. The retrofit process brings everything up to current standards.

A rebuild includes all things mechanical, such as the ways, spindles and thrust bearings.

A remanufacture is a combination of the two, including some engineering upgrades. The spindle might be redesigned or a new toolchanger might be installed. At a minimum, the machine is going to be better than when it was new.

Whether the work performed makes a machine like new or better, such a transformation doesn't happen overnight. A retrofit might take 3 to 6 weeks, a rebuild 10 to 12 weeks and a remanufacture 4 to 6 months.

—Kentucky Rebuild Corp.

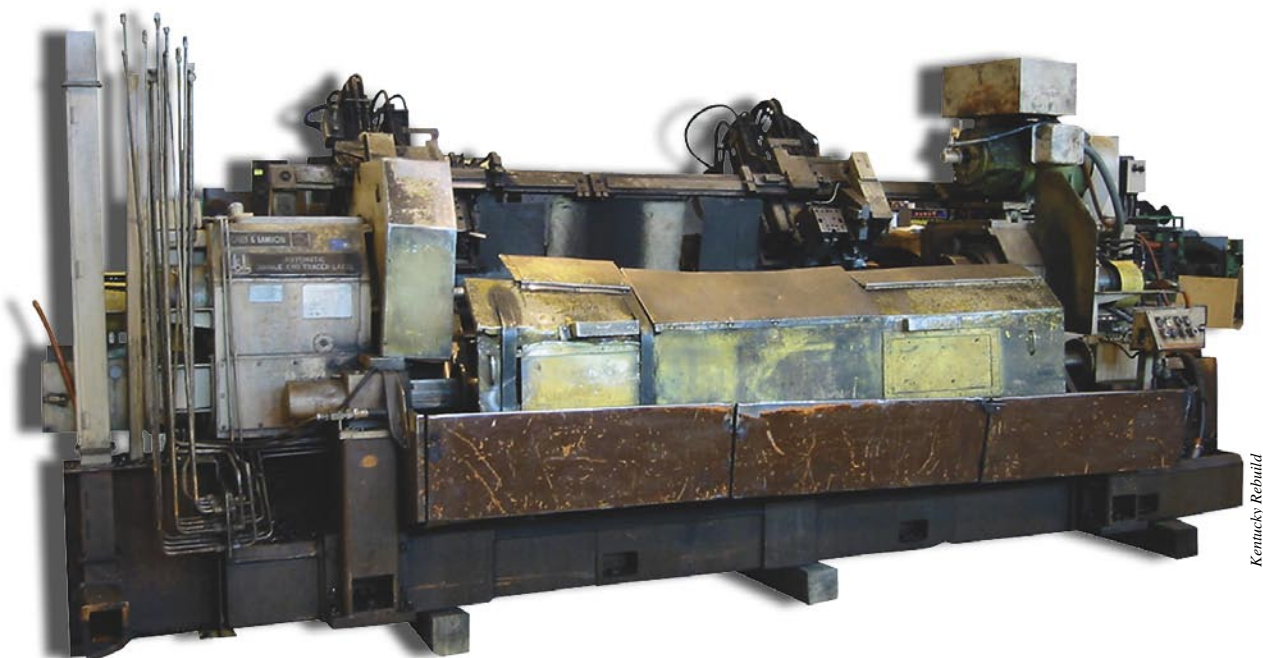
bled" iron. As a rule of thumb, Daniluk recommends remanufacturing older, American-made machines that have well-aged castings. He explained that, in the past, a typical casting from a large machine tool builder would be poured and exposed to the elements for 3 to 5 years to properly age it. The

casting's stint in a manufacturing environment increased its integrity further.

Daniluk said: "With newer manufacturing techniques, the attempt is made to use thermal stress relieving or vibratory stress relieving to age a new casting. This is very successful and it's a science, but a machine tool casting that's been in a plant for 20, 30 years, bolted down to a foundation, has taken what we call 'a molecular set.' That aged casting has taken a form that's not going to change. It's not going to shrink; it's not going to flex."

With the proper equipment and technique, a vintage machine tool can be remanufactured without altering the iron. "Our grinding capacity allows us to take an entire bed section, all in one piece, place it on the way grinder, check the alignment and grind it flat and straight," Daniluk said.

Therefore, the way-grinding process during remanufacturing helps to make an older machine better than when it was new. "The way surface is far more accurate than the OEM could make it, because at the time that the [G&L VBM] machine was made, the technology was to planar-mill the ways and hand-scrape them for final alignment or planar-mill the area the ways bolted to and bolt on ways that were ground off the casting," Daniluk said. "So with the ways ground in place, they are far more accurate than they would have



Kentucky Rebuild



Kentucky Rebuild

Remanufacturing includes a complete mechanical rebuild and an electronic and control retrofit, converting a worn-out machine (opposite page) into a productive one.

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been from the OEM.”

Of course, comparing what an older machine was made of to what a new machine is made of gets tricky when the materials are different. That’s the case with new centerless grinders, most of which have a nodular cast iron and epoxy-granite base or an epoxy-granite base. “The sellers of

new machines say the product has better vibration-dampening capabilities and they typically demonstrate that by taking a hammer and banging the new machine and then banging cast iron,” said CRI’s Fender. “Epoxy granite doesn’t ring like cast iron. It doesn’t have the same sound, but that means absolutely nothing. You’re not getting better dampening.”

CRI also builds new machines, giv-

ing them cast iron bases.

However, no matter how rigid a casting with molecular set might be, that doesn’t make it the best choice for every machining process. “Settled iron is great, but the reason we would go to a new machine is if there is no ‘old-style’ machine that has a certain feature,” Fender said. “For example, we’ve built machines with 30”-wide spindles but old machines only have

20”-wide spindles.”

In addition, an older machine may not be able to physically accept all the automation equipment or features that might come with a new machine. “A high-speed spindle may not be possible with an older machine without some major reconfiguring,” said Mike Dick, service manager for Moore Tool Co., Bridgeport, Conn. The company builds new machine tools, measuring machines and machining accessories and provides remanufacturing services. “Older spindles weren’t necessarily high speed, so they would probably necessitate a lot of mechanical changes, say, a whole new spindle housing. Because with high-speed spindles, a lot

of extra cooling equipment is needed and the machine may not have enough casting material to accommodate all of those changes.”

Money Rules

One thing is for certain when buying a new machine instead of remanufacturing a comparable older machine: It’ll cost more money. Because of that, more machine remanufacturing is performed when the economy is somewhat tight. “When the economy is a lot better, people are more likely, of course, to spring for a brand-new machine,” said Dick.

How much should be spent on remanufacturing is open to debate. According to Jim Luzak, manager of sales engineering for Kentucky Rebuild Corp., Independence, Ky., the rule of thumb is that a remanufactured machine should cost 50 to 60 percent of what a comparable new machine costs.

Daniluk has a different take. “Sixty percent of cost vs. new used to be the rule of thumb for the value of a remanufactured machine, but if you look at the true cost of a remanufacture, I believe a 75 percent cost justifies the

Rebuilding Bridgeports

Not all machine tools being rebuilt or remanufactured are large and expensive. South Elgin, Ill.-based S.T.K. Machine Rebuilders Inc. specializes in rebuilding Bridgeport mills.

“The machine costs \$15,000 to purchase new and we can rebuild it for 40 to 50 percent of that price,” said Colon Kelly Jr., the company’s sales manager.

“Bridgeport mills last because they made these machines so well,” he added. “The castings are second to none, and that’s the difference between a Bridgeport mill and an older machine that doesn’t last.”

The company offers two rebuilding options. The first is a partial rebuild for \$4,100, wherein S.T.K. repairs the head as needed and any additional cost for repairing the head will not exceed the complete rebuild cost. The second option is a complete rebuild, which takes 2 to 3 weeks, runs \$6,100 and includes some 18 procedures. Either way, the customer receives a milling machine that performs as well as the original.

“There’s no difference [between a new and rebuilt machine] as long as we’re not remanufacturing or retrofitting a CNC to the machine,” Kelly said.

The process of remanufacturing is basically rebuilding the machine back to its original specifications and then the remanufacturing part is just filling in the gap to take the machine to current levels of technology. “When you start remanufacturing,” he said, “you get closer to a new product’s cost and you may as well buy a new machine.”

In addition to rebuilding a machine a customer ships and delivering it when the work is completed, S.T.K. often can sell an already rebuilt machine so the loss of production capacity is minimized. “A lot of times, customers contact us first to see if we have a machine comparable to what they use,” Kelly noted. If so, S.T.K. will ship the comparable machine, rebuild the one the customer sends and “then the process starts where they’ll send us a machine and we’ll send them one. It goes back and forth.”

The rebuilder maintains an inventory of six or seven Bridgeport mills that it intends to rebuild, but is selective about the used machines it purchases because of limited storage space. “We’re a rebuilder. We want to buy machines that really need to be worked on,” Kelly said.

S.T.K. isn’t limited to rebuilding Bridgeport mills. The company also rebuilds other equipment, such as Mitsui and Harig surface grinders. Recently, the company has branched out into rebuilding CNC machines, which takes around 10 weeks. Recently, S.T.K. was rebuilding two Mazak VQC-15/40 CNC machines. “That is the future,” Kelly said. “We’re not going to get away from rebuilding the Bridgeports and the Mitsuis, but we’re also going to venture into the CNCs some more.” In addition to rebuilding the machines, S.T.K. is adding a 3-D simulation software package.

With the manufacturing economy doing well and the company targeting additional types of rebuilding work, S.T.K. finds itself in the enviable position of having a backlog. “We have enough work now to last the rest of the year,” Kelly said in August.

—A. Richter



A. Richter



S.T.K.



A Bridgeport mill being rebuilt at S.T.K. (top left) and a completed version. Bottom: When rebuilding a Bridgeport, S.T.K. scrapes and flakes worn way surfaces (left) to achieve a like-new condition.



The Daniluk Corp.

Daniluk took a mechanically worn out 1954 Giddings & Lewis vertical boring mill (top) and transformed it into a 2005 machine.

The following companies contributed to this report:

Centerless Rebuilders Inc.
(800) 249-8103
www.centerless.net

Cross Hüller North America
(586) 566-2400
www.crosshueller.com

The Daniluk Corp.
(405) 745-6644
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Kentucky Rebuild Corp.
(859) 283-8300
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Moore Tool Co.
(203) 366-3224
www.mooretool.com

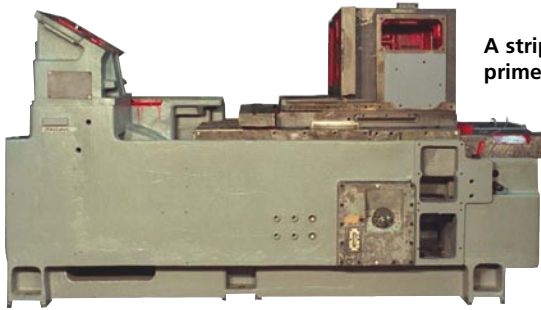
S.T.K. Machine Rebuilders Inc.
(847) 888-0797
www.stkrebuilders.com

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purchase of a remanufactured machine over a new machine,” he said.

Nonetheless, because large, non-commodity-type machines are generally the strongest candidates, remanufacturing isn't inexpensive. Fender noted that CRI recently remanufactured a centerless grinder that cost around \$350,000. “A new machine that would have anywhere near comparable capability would be about \$550,000,” she said. “Then, again, we've [remanufactured] machines for \$600,000.”

CRI not only remanufactures a machine to bring it up to date, the company also works with customers to



A stripped down, cleaned and primed centerless grinder is ready for remanufacturing.

Centerless Rebuilders

improve their processes. For the previously mentioned centerless grinder reman, CRI was able to reduce the cycle time from 1 minute to 20 seconds per part, which increased the output from 38 to 180 parts per hour. This was achieved by enhancing the electrical control of machine functions, which improved grinding consistency

and removed much of the operator's need for making decisions, and adding robotic part load/unload capability, which reduced load time.

As long as a machine tool is able to achieve ever-tightening tolerance specifications, it can be remanufactured again and again. “There are machines that we've remanned that helped us win World War II,” Fender said. “These machines have been around a long time. They still have a good base and they still do the job.” Δ

Engineered retools

Sometimes, machinery for transfer lines doesn't need to be rebuilt or remanufactured, because it isn't worn out. But it does need to be altered to make a new component. This work is called an engineered retool.

“We produce either a transfer machine or a group of Specht CNC machines that are focused on the production of a powertrain component, such as a cylinder block, cylinder head or transmission component,” said Ronald Quaile, vice president of sales and proposal engineering, Cross Hüller North America, Sterling Heights, Mich. “We've designed a set of machines that make a half-million cylinder blocks per year. A customer comes along and says ‘that's nice, but now we need to retool that line and instead of making a 90° V-8 we'd like to make a 60° V-6.”

Depending on its age and condition, the machine might also be refurbished during the process. This includes replacing the box ways with linear guide ways, installing new ballscrews or remanufacturing existing ones, updating the control system, swapping brake motors on the tap heads with servomotors, recoating all slide units with an antifriction coating, exchanging stub spindles with bushing plates, and replacing belt-driven spindles with motorized spindles to achieve more throughput. “We can get higher rpm,

quality and path cylindricity with a motorized spindle versus a belt-driven spindle,” Quaile said.

Quaile noted that the lead time for a smaller retooling job is 20 to 26 weeks and 50 to 60 weeks for taking a fixed production system out of production, retooling it and putting it back into



Cross Hüller

Cross Hüller refurbishes a multispindle head.

service. How retooling impacts the customer depends on whether it runs a high-volume, modular transfer system or an agile manufacturing system comprised of numerous CNC machines grouped into work cells.

For high-volume transfer-line equipment, “when you take it down, it's down,” said Mike Robbins, manager of aftermarket services for Cross Hüller. “There is no question about it.”

Therefore, before retooling a transfer line, customers need to know how long

their line will be down so they can produce an adequate number of components, or float, ahead of time to keep production flowing. Such was the case when Cross Hüller retooled the production system for a heavy-equipment manufacturer. “We told them before we started the job the day and hour that they could build their next engine,” Robbins said, “so they knew exactly how much float to build.”

With an agile system, “if I take any one machine out of any one of those operations and there are six machines in that cell, I'm only taking 16 percent of just that one operation,” Robbins said. “Thus, retooling or refurbishing of Specht CNC machines can continue in parallel with continued operation of the remaining machines in a work cell.”

Ultimately, it's the customer who decides what needs to be done, and Quaile noted that Cross Hüller is glad to refurbish its and its competitors' equipment—or sell new machines. “We have no ax to grind one way or another,” he said. “We have a strong aftermarket business and we have a strong machine sales business and one doesn't cannibalize the other. They are complementary.” —A. Richter