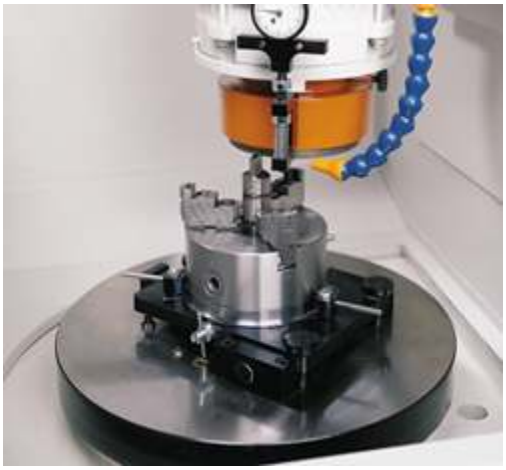
Better tool management, better punching

McQuay streamlines its turret press operation with efficient tool use, regrinding

THE FABRICATOR® APRIL 2008

April 15, 2008

McQuay international develops a strategy to prolong tool life for turret presses.



As part of its tool management program, McQuay International sharpens its turret punches with automated punch and die grinders. Source: DCM Tech Corp.

At McQuay Manufacturing, turret press operators follow a standard procedure. Once they observe parts with burrs or other signs of tooling wear, they remove the worn tools, place them in the box, and then carry them over to the machine shop where a dedicated technician sharpens them.

That's simple enough. Only, until recently, operators didn't always follow procedure.

For that matter, who could blame them? Tool grinding had become cumbersome and labor-intensive. The surface grinding system required an operator to monitor the operation continually. Things ran slow. If operators handed over tools for sharpening, who knew when they would get them back?

Ted Mittelstadt took initiative to change this. The tooling supervisor for McQuay's Air Handling Division tackled the problem on two fronts. He made tool grinding more efficient and promoted a procedure that both extended tool life and drove efficiency under the turret press.

A Significant Operation

Housed in two Minnesota plants, the Air Handling Division's turret press operation is significant by any standard, with three presses in Owatonna and another eight in Faribault. The company manufactures commercial air-conditioning units, some a few feet square, others larger than semitrailers, and almost any size in between. For some product lines, unit sizes are customized down to 2-inch increments, and the turrets must account for all of them.

"We're punching anywhere from 0.022- to 0.168-inch galvanized material,"along with some prepainted and stainlesses, Mittelstadt said.

Punching so many products requires turret press tools numbering in the hundreds, and the more operators can get out of them, the better. But herein lies the rub: Tool life isn't measured by the number of hours a tool spends in a turret press; it's about the number of hits it makes, and in what

material. Stainless, for instance, is hard and abrasive, so "it takes the tool edge off a little faster than the prepainted and galvanized material,"Mittelstadt said.

Different parts require different holes. Some parts require - or 3/8-in. round punches for screw holes. Others may need obround punches, and still others may use pierce-flare tools to create forms that aid part assembly.

As Mittelstadt explained, with so much tooling on the floor, "some have asked, 'Why don't we have a PM preventive maintenance day to schedule all tool maintenance needs?" This, he said, would be next to impossible. Some tools may perform a thousand hits a week, others only 50 or so. Not all tools need sharpening at the same time.

To maximize operating efficiency, Mittelstadt plays a balancing act between three strategies: maximizing hits per tool, minimizing tool changeouts, and maximizing the effectiveness of tool sharpening. Balancing all three, he said, allows the company's turret presses to process more quality parts in less time.

Punches, held in a gang fixture, are sharpened in a DCM grinder.

Efficient Tool Management

Because the plants work with a tremendous variety of products, hole sizes change frequently, so the company promotes practices to extend tool life—some conventional, some not. For instance, if a large number of holes requires one punch diameter, the operator may load two identical tools into the turret. This way, if one tool shows signs of wear, the operator can alter the program to punch with the new tool to finish out the run. Other turret tools may punch certain holes in one hit and nibble out other holes larger than the punch diameter—a 1-in. round punch nibbling out a 1-in.-diameter hole, for instance.

These are relatively common industry practices that follow that lean mantra: Minimize setups. However, nibbling can exert significant side loading around the punch outside diameter as well as the inside diameter of the sleeve. It also takes a significant number of hits. Depending on the application, a 1-in. punch may take 50 hits to nibble out a 1-in. hole. With certain parts, depending on volume, the company found it actually takes less time to change out to a larger tool that punches a hole with one hit than nibbling it with multiple hits. This not only takes less time, Mittelstadt explained, it also reduces tool wear, adds to punch life, and causes fewer trips to the grinding station.

Efficient Grinding

Nevertheless, an adequate number of trips to the grinding station remain a must, Mittelstadt said, adding that letting a tool go too long without grinding can seriously degrade tool and part quality, not

to mention tool life. To streamline operations, the company recently upgraded its grinding equipment at both plants.

McQuay had used traditional surface grinders. With hundreds of tools to manage, the operator spent more than half a workweek standing in front of the grinder, watching, and adjusting feeds as necessary. "For the surface grinder, the operator had to watch the table go back and forth under the wheel, reset the depth, and do it again, again, and again,"Mittelstadt explained. If the operator were interrupted and walked away, soon the surface grinder would be spinning through air, grinding nothing, waiting for the operator to reset the machine to descend and take another pass. He added that the operator could easily burn the tool if the machine took too much material off at once. The operator did gang tools on the table to increase efficiency, but even with this, tool grinding still consumed 20 hours or more a week.

So McQuay upgraded, investing in two punch and die grinders, one for each plant, from Winona, Minn.-based DCM Tech. The machine rotates both the cubic boron nitride (CBN) grinding wheel—in the shape of an upside-down soup bowl—and the table holding the punch underneath. And unlike the surface grinder, the grinding head is locked into position.

"With the head being locked into position on the downfeed, you're not having to traverse anything,"said Mike Anderson, DCM's industrial product manager, explaining that the locked grinding wheel makes the operation more stable. In a manual operation, "you bring the wheel head across the part,"which makes machine rigidity critical. If the machine isn't as rigid as it needs to be, it may flex as the wheel first contacts the tool. "If you're not careful, it might not grind the tool flat. So by rotating the part under a spinning wheel, it ensures the part will be ground down [flat],"Anderson continued, adding that it doesn't require the operator to feed and monitor the system.

Using these new systems, operators start by touching off the wheel to the part to establish the starting position. They dial in the grind amount, in thousandths of an inch, start the machine, then leave. The machine grinds to the preset amount, stops, lifts off the part, then automatically turns off all motors before the operator returns to remove the sharpened tool. Punches are held in place in a three-jaw chuck or on a permanent magnet chuck in a sine-plate base that can be set up to a 9-degree angle for rooftop and shear-angle punches.

The grinder actually takes less off with each pass than a manual surface grinder does, but because both the workpiece and grinding wheel rotate, it can make more passes in less time. "It's constant motion, and you're always contacting the part,"Mittelstadt explained. "You have two moving axes, instead of one going back and forth."

To minimize the chance for burning, the machine uses coolant delivery that accounts for centrifugal force. Two sources flood coolant into the work zone; one comes through the spindle, from the middle of the wheel, and another floods coolant externally, where the wheel meets the punch.

The Payoff of Tool Management

According to Mittelstadt, tool grinding time is about 25 percent of what it was. The new grinding technology, combined with optimized tool utilization on the turret, helps the plants' 20 turret press operators spend less time managing tools and more time punching parts.

McQuay International's Air Handling Division produces air-conditioning units in an array of sizes. Pictured here are small and medium-sized units. Large units can be the size of semitrailers, or even larger. Considering the company's expansion plans, that's a good thing. "McQuay was recently purchased by Daikin Industries, a Japanese company. The company has a vision of being the biggest industrial air-conditioning manufacturer by 2010", Mittelstadt said. "So that means we need to double our production by then—which means we'll be getting more turret presses."

More turret presses means more tools to manage. Considering the planned growth, Mittelstadt hopes McQuay's tool management strategy will help it meet such ambitious production goals.

Grind Less, More Often

Ted Mittelstadt, tooling supervisor at McQuay International, practices what has been preached many times by tooling vendors: Grind less, more often. In a world that measures efficiency with machine uptime, grinding tools more often may seem counterintuitive, but nevertheless the practice usually results in longer tool life.

Consider a punch that can be ground 0.050 inch before it needs to be replaced. Does this mean the tool could be ground 0.005 in. five times over its total life? Not necessarily. As Mittelstadt explained, grinding 0.005 in. off a fresh tool may allow the tool to make 10,000 hits before the next grind. But because the tool becomes a little weaker after every sharpening, it endures fewer hits before the next grind. An operator may get 10,000 hits out of a fresh tool, 9,000 hits after the first grind, 7,000 hits after the second, and so on.

Now consider a punch that performs 20,000 hits before its first grinding, which may require 0.010 in. to be removed to renew the punch surface. Not only does running a punch so many hits cause part quality problems, it significantly shortens tool life, and it takes longer to grind with each sharpening. Because running the tool over so many hits puts extra stress on the tool steel, the number of hits before the next grind drops dramatically, spiraling downward as the steel's microstructure degrades.

In the end, the tool spends more time at the grinding station and less time making parts.