

Quantified Improvements

Quantifying the benefits of an improved workholding system.

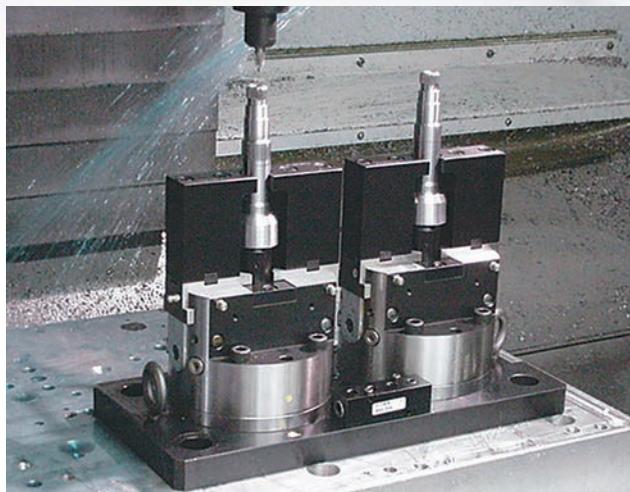
Most emphasis in machining is placed on the cutting action: the milling, turning, grinding, drilling and boring. Often, too little emphasis is placed on workholding, despite this being key in terms of accuracy and rate of throughput.

“Workholding is like a car tire,” said Malcolm Mason, workholding product group staff liaison for AMT—the Association for Manufacturing Technology. “You could have a Mercedes-Benz and the whole ball of wax, but what’s actually touching the road and making all the difference is the tire. It’s similar with a workholding fixture. No matter how sophisticated your machine is and how fast you can cut, if you’re not gripping the part correctly and accurately, you’re not going to get good results.”

A key issue in workholding is how long it takes the machinist to accurately and securely set up a workpiece to be machined. Shortening setup time, while maintaining accuracy, is one of the main factors to consider in selecting a method of workholding. But are the costs that a shop or plant incurs for workholding and, therefore, the amount of money a company can potentially save by improving its workholding system, quantifiable?

Matter of Time

If a machinist routinely switches out workpieces during the course of manufacturing a run of parts, then it is possible



Powerhold Inc.

to quantify the money saved by incorporating an improved workholding system. Knowing the fully loaded costs for the machine makes it possible to quantify the money saved. These fixed costs include the operator, the machine—including annual maintenance and repair costs—and plant overhead. Any shop doing repetitive work has fairly precise cost figures for machining or a per-unit total cost of an operation.

Once the rate of these fixed costs is determined on a day-to-day, hour-by-hour or minute-by-minute basis, the costs incurred in workholding can be determined merely by measuring the amount of time between completing the machining of one part and beginning the machining of another. Well-run operations can quantify these costs,

and thereby quantify the benefits of an improved workholding system, such as an automated system that replaced a manual one.

“The quantification is the difference in the time it takes a man to go around with a wrench tightening manual clamping elements, as opposed to pushing a button on a hydraulic circuit and clamping it all up,” said Dennis Kelly, estimating manager for City Machine Tool & Die Inc., Muncie, Ind., a manufacturer of hydraulic clamps.

Kelly recommends City Machine’s customers quantify the benefits of an improved workholding system from a simple perspective of time. Magneti Marelli Powertrain USA Inc., Sanford, N.C., does exactly that. The company produces automotive throttle bodies, fuel-injection systems and carburetors using 50 CNC machines, 15 of which are horizontal machining centers. A minority of its workholding involves manual clamps. The majority of its work is done on hydraulically actuated holding fixtures custom-designed and



The costs incurred in workholding can be determined merely by measuring the amount of time between completing the machining of one part and beginning the machining of another.

fabricated by City Machine.

“The raw time to change a part on a hydraulic fixture is roughly 8 or 10 seconds to take the part off, blow it off, present a new part and clamp it. That

compares with 30 to 40 seconds for a manual clamp or clamps,” said Mark Ziegler, lead engineer for Magneti Marelli.

The company uses the time it gained to have an operator run two machines instead of one, meaning labor utilization is increased by 50 percent. “We’re sensitive to that,” Ziegler said. “We measure labor in terms of hours per thousand parts, and we set specific dollar figures. Every dime is a big driver when you’re making so many parts, when you multiply it by 100,000 or 200,000 [parts per year]. You are easily able to justify spending the extra \$20,000 or \$30,000 for better fixtures.”

Time Is Money

Methods to quantify the costs incurred in workholding can vary according to the philosophy of a shop, but more often than not it comes down to measuring time spent in setup. “Most people do it the same way. They look at whatever their floor time costs,”

Ergonomically speaking

One factor among the potential benefits of an improved workholding system that is less quantifiable than time and money, but certainly holds value to a machining shop, is the human element. “You want to consider the wearing out of your operator,” said Doug Green, president of Vac-U-Lok, a Rockford, Ill.-based manufacturer of vacuum workholding systems.

This consideration is a matter of ergonomics, an applied science concerned with designing and arranging things people use so that they interact efficiently and safely. “If [machinists] aren’t exerting themselves in trying to clamp down a vice or screw in and screw out a dozen bolts at a time, they’re more refreshed and more excited about coming to work, and you get more out of them,” Green added. “But that’s really hard to quantify.”

Nevertheless, the condition of a shop’s staff certainly holds value, especially when one considers the cost of hiring and training, and the increased misloads and machine tool maintenance problems



An operator releases completed workpieces by simply turning the handle on a vacuum chuck valve by 90° to the “off” position.

that can come with a tired operator.

Mark Ziegler, lead engineer for Magneti Marelli Powertrain USA Inc., noted that he’s worked on jobs where operators frequently needed to be moved because they could no longer perform a certain task. “[Operator burnout] has real [costs] when you have to change out operators every 2 months because of a high burnout rate,” Ziegler said.

According to Dan Peretz, director of sales for De-Sta-Co Industries, Madison Heights, Mich., a manufacturer of work-

holding and parts-handling systems, this is an issue manufacturers often fail to recognize in considering an improved workholding system. He’s had discussions with customers in which he attempted to justify why they should improve their workholding processes. “They say, ‘We’re not really sure how much of an improvement that really gives us, and we don’t run that many parts,’ and they come up with a lot of roadblocks,” Peretz said. He added that, in these discussions, his customers often fail to consider the time and effort the operator spends setting up workholding.

However, simplifying workholding can have an adverse effect on some operators. “It goes both ways,” said Carl Reed, president and CEO of Abbott Workholding Products. “I have some folks in my shop that are wonderful at setting things up, because they’re very creative.” This is a valued challenge for his staff. “They’re bored stiff if you tell them to just push the button and watch the parts come off.” —D. Margolis

said Carl Reed, president and CEO of Abbott Workholding Products, a Manhattan, Kan.-based manufacturer of chuck jaws.

But once a value has been placed on floor time by determining the fixed costs per hour, how does a shop keep track of the time it spends on fixturing parts?

Spunmetals Inc., Brazil, Ind., is a metal spinning and forming shop that produces components primarily for the aerospace industry. It also makes its own tooling in the company's machine shop. As Spunmetals took on more machining work, it switched over from solid steel fixturing to aluminum soft jaws from Abbott.

"What that allows us to do is just put the piece in, hit the pedal and go, vs. having to actually indicate each part in," said Buddy Raderstorf, lead engineer for Spunmetals. He stated that the benefits from this improvement in workholding are between 30 to 40 percent of total floor time per job.

Spunmetals quantifies the benefits of this improvement by measuring the reduction in setup time using shop management software, which tracks the time spent in every operation to produce a part or batch of parts. "We

**The following companies
contributed to this report:**

Abbott Workholding Products

(800) 528-6459
www.abbottworkholding.com

AMT—The Association for Manufacturing Technology

(800) 524-0475
www.mfgtech.org

City Machine Tool & Die Inc.

(765) 288-4431
www.citymachine.com

De-Sta-Co Industries

(248) 397-6700
www.destaco.com

**Magneti Marelli
Powertrain USA Inc.**

(919) 775-6424
www.marelliusa.com

Realtrac

(800) 331-8094
www.realtrac.com

Spunmetals Inc.

(800) 526-3674
www.metalspinning.com

Vac-U-Lok

(888) 822-8565
www.vaculok.com

have bar codes on all of our routers and travelers," said Raderstorf. "[The operators] scan the bar code and [set up fixturing], and when they're done they scan it again and log off. So, all we have to do is open the job up [in the software] and see what time we saved."

Tom Ingraham, president of job shop software manufacturer Realtrac, Irvine, Calif., explained how such software provides up-to-the-second reporting on jobs, allowing operators to evaluate their costs. "When the operators do anything in the shop, they clock in and out, so if they start working on a fixture or setup of a job, they clock in on that job, on that machine, and [the software] records how long it took them to set it up," Ingraham said. This information is input by the operators using a bar-code wand. "When they log off, it starts the run operation, and then shows how long the machine was actually running and what the part yield was."

Tabulating time spent setting up workholding is a key function of Realtrac software. "It's the most important thing our product does," Ingraham said. "It might be the most important thing in CNC machining. Where money is made and lost is in how long it takes to set up the part." △