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BY MIKE PRINCIPATO

Do your employees feel your pain?

Please indulge me while I take a stroll down memory lane, because it seems like just yesterday that I was paying 100 percent of my employees' health insurance premiums. And I mean all my employees: full-timers, part-timers and their spouses and children. Quite possibly, even their pets.

But as my costs escalated on a per-employee basis from roughly $300 per family per month to four times that, I gradually stopped paying those premiums for all but the full-time staff and, ultimately, only a portion of that exorbitant bill. Employees were then required to contribute 35 percent of the cost. Along the way, I experimented with different insurance plans, insurance brokers and cost-containment strategies, but, when all was said and done, I still wound up with a policy from a major insurer and a premium big enough to choke a horse.

Not surprisingly, as health insurance costs increased, the percentage of companies offering it declined—from 68 percent to less than 60 percent.

If this tale has a familiar ring, it's probably because I'm in good company with you and a bazillion other small-business owners struggling to balance their well-intentioned desire to provide health insurance against its ever-rising cost. Studies by the Henry J. Kaiser Family Foundation, Menlo Park, Calif., indicate that private health insurance premiums rose more than 9 percent last year and more than 11 percent in 2004. Not surprisingly, as health insurance costs increased, the percentage of companies offering it declined—from 68 percent to less than 60 percent.

Businesses that employ hundreds or thousands of workers are in a position to negotiate rates with insurance carriers; not so with small companies. That means that small companies have basically three options when it comes to providing this benefit, which persistently ranks near or at the top of employees' and job-hunters' wish lists:

1. Don't offer health insurance.
2. Pay high enough wages so employees can purchase their own health insurance, either independently or through the company.
3. Offer a health insurance plan and pay all or a substantial portion of the premium.

As statistics reflect, more and more firms—particularly those that employ semiskilled and part-time workers—are choosing option No. 1. For most manufacturers, however, that's not a viable option. Skilled labor has been, and will continue to be, in high demand. The machinists, programmers and support staff needed by a manufacturing operation will, naturally, seek employers who offer the best benefits package.

Option two is a slippery slope, because it's unlikely the salary and wages paid by most companies can keep pace with skyrocketing insurance premiums. Consider, for example, that just to keep pace with the premium increases over the last 2 years, workers would need to receive a 10 percent wage increase in both years.

Implicitly or directly asking employees to go it alone on health insurance has another serious flaw, one that surfaces when companies use the same approach to retirement management by offering self-directed saving plans: Employees are human, and humans (at least the American species) aren't disciplined about managing their money. Thus, odds are that the "extra" compensation workers receive to help pay the cost of health care insurance will more than likely wind up somewhere else. Like, say, in the monthly payment on a Corvette.

This brings us to option three, which is probably what your company is doing right now: paying all or a significant portion of employees' health insurance premiums. Although a handful of ways exist for a small manufacturer to save a buck—health savings accounts (HSAs) and high-deductible plans are obvious possibilities—all have major shortcomings.

HSAs have the same inherent defect as the "go it alone" plan described above: Most people don't have the discipline required. And high-deductible plans are usually infeasible for low- and middle-income families. One night in the local hospital or a stopover in an emergency room can cost several thousand dollars, which quite possibly might be more than an employee's family savings.

So everything old is new again—it's just a lot more expensive. For small manufacturers, your best option is still to offer a health insurance plan with a reasonable ($250 to $500) deductible, and require that employees contribute to it. You'll be rightly perceived as an employer of choice who cares about his workers. And those workers will have enough skin in the game to understand how painful the cost of health care has become.

About the Author

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Threadmaking pointers

BY JAMES A. HARVEY

Threaded parts have been around for centuries and will likely be with us for many more because they have numerous uses and are relatively easy to produce. But, thread production can present certain complications.

Few people question a part's threads. Parts inspectors may check them with GO/NO-GO gages, and, if they pass, that's usually the end of it. Nevertheless, care must be taken when threadmaking. Threads should have correct pitch diameters, correct major and minor diameters, correct root and crest geometries, and correct angles, among other things. Also, a first article inspection before processing may save a lot of grief later on. The following suggestions can improve your threadmaking skills.

■ **Reduce the nominal OD by at least 1 percent before cutting a thread.**

For example, if I'm getting ready to cut a ½-13 UNC-2A thread, I turn the OD to 0.495 (0.5 minus 1 percent of 0.5). I'm not sure my "1 percent" rule holds up under all classes and sizes of threads in terms of producing a major diameter that is within Unified thread tolerances, but it works for the run-of-the-mill class 2A UNC and UNF threads.

■ **Use a knurled tap and die holder for threading in a lathe.**

A knurled tap and die holder is a common, easily made tool often used in a machine shop for holding die buttons to thread small parts. The body of the die holder slides on a shaft held in a tailstock chuck. The shaft keeps the die aligned perpendicular and concentric to the work, yet lets the die holder slide and turn freely.

The operator must push the die onto the work as the lathe spins while preventing the die from spinning. Once the part has been threaded to a shoulder or dimension, the operator can release the die holder, which will then turn freely. The threading die and holder is unscrewed from the part by putting the spindle in reverse while preventing the die holder from turning.

■ **Feed a single-point threading tool in at an angle to reduce right-angle pressure.**

Cutting pressure can be a significant issue when cutting threads with a single-point tool. Even by supporting the end of the part with a live center, the middle portion of the shaft may push away from the threading tool if the part's diameter is relatively small.

One way to reduce the part's tendency to push away is to feed the tool in at a 29.5° angle so that some of the pressure of the cutting action is directed toward the spindle.

Stick wax lubricant adheres to a tap even under a coolant stream.

■ **Use stick wax to lubricate taps in CNC machines.**

Coolants used in CNC machines usually don't have effective thread-cutting properties. Common bandsaw blade stick wax applied to taps used in CNC machines adheres to taps and resists being washed away in the coolant stream. The stick wax reduces friction and tap failure.

All images: J. Harvey

A die button mounted in a guiding jig is used to finish an external thread.

Another way to reduce tap failure is to program the machine to stop before a tapping cycle begins so an operator can apply cutting oil to the tap. The coolant stream should be turned off when using cutting oil so that it doesn't get washed away.

■ **Avoid power tapping with plug taps and hand taps.**

Plug taps and hand taps bind when power tapping because the chips lodge between the flutes. It is better to apply a spiral-pointed tap when power tapping because chips get pushed ahead and don't cause binding. Spiral-point taps are also called "gun taps."

About the Author

James A. Harvey is a machinist and plastic-injection-mold maker based in Garden Grove, Calif. He can be e-mailed at HarvDog42@aol.com. Machining Tips is adapted from information in his book, Machine Shop Trade Secrets: A Guide to Manufacturing Machine Shop Practices*, published by Industrial Press Inc., New York. The publisher can be reached by visiting www.industrialpress.com or calling (212) 889-6330.*

Effective parts finishing

Hand filing, one of the oldest metalworking methods, requires a high degree of manual skill. Filing is an art that can be learned only by long and patient practice. It takes longer to teach a person to be a good filer than it does to effectively train someone to run a lathe, mill or planer.

Metalworking professionals recognize a craftsman by his ability to apply a file correctly and efficiently. The touch of a file in the proper place can make all the difference in fitting a critical joint. The skill, or "feel," that the person with a file acquires from long experience comes from conforming to proper procedures.

First, the user must select the right file for the job. This is done according to the workpiece material, the amount of material to be removed and the size and contour of the workpiece. Then, the workpiece must be supported at the correct working height, the file must be held correctly—with the cutting stroke guided properly—and the proper pressure must be applied during the cutting stroke.

Selecting the appropriate rotary file, or bur, for a job depends on the workpiece material, cutting speed, desired shape and required surface finish.

In addition, the file must be clean. Cleaning a file with a file card and chalk keeps the workpiece finish smooth and free of scratches. The chalk also helps keep chips from building up in the teeth of the file. Chalk and a wire brush can be used to remove oil and grease.

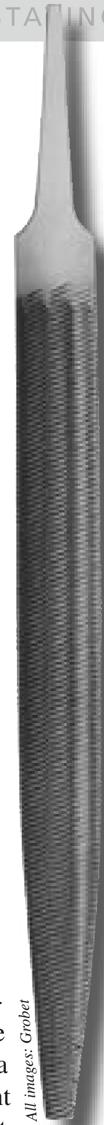
Most material to be filed is held in a bench vise or work fixture. The user usually places the workpiece so it is level with his elbow when his arm is bent. He follows this practice for average precision filing. When he is rapidly removing metal or rough filing, the user usually sets the work at a lower level and applies a coarser cut file.

However, when the work is small and delicate, the user files by the motion of his hand or his hand and arm alone, and he holds the work at a level that permits closer scrutiny. To keep the workpiece from being marred, cover the jaws of the vise with pieces of soft metal, wood, plastic or leather.

Four basic types of filing operations exist: lathe, straight, draw and fine precision. Lathe filing is an application for long-angle lathe files. When straight filing, a user pushes the file straight across the work. In contrast, when draw filing, the user holds the file at each end and guides it back and forth over the work under even pressure. During this operation, he holds the file perpendicular to the direction of motion.

Finishing and smoothing various narrow grooves and depressions of tools, molds, dies and fixtures calls for fine precision filing. The user holds small rifflers in much the same manner as a writing utensil. When using larger sizes, he holds the riffler in his hand with the index finger on the safe side to exert proper cutting pressure. When necessary for fine and delicate work, the left hand controls the direction and, in some cases, the stroke of the riffler.

When filing, exert only enough pressure on a file during a forward stroke to keep it cutting throughout the entire stroke. Too little pressure on the cutting stroke, especially when filing tool and chrome alloy steels, quickly dulls the file's teeth.



All images: Grobet

A file, one of the oldest metalworking tools, has evolved into a precision tool able to achieve tight tolerances when a skilled craftsman applies it.

Rotary files, which are run in a machine tool, are also available. These tools are also known as burs. Selecting the appropriate rotary file for a job depends on the workpiece material, cutting speed, desired shape and required surface finish. Rotary files are made of solid carbide or HSS.

Two popular types of solid-carbide rotary files are standard cut and double cut. Standard cut is mostly for general-purpose deburring of steel, cast iron and other ferrous parts. Double cut, or alternate diamond cut, is basically a standard cut tool, with cuts made on the left-hand spiral. But compared to a standard cut, this design produces a finer finish and reduces chip and sliver sizes.

Ground from blanks of hardened HSS, ground-from-the-solid burs have smooth, unbroken flutes. The design is particularly well suited for deburring mild steels and ductile, stringy materials such as aluminum, brass, lead and magnesium. They can also deburr some grades of plastics. These tools perform best at medium speeds in flexible shaft machines and air tools.

The skilled handcrafting required to produce chisel-cut rotary files sets them apart. Even rotary files of this type that are machine-chiseled must be completed with hand detailing. The teeth of these HSS burs are staggered in contrast to the smooth flutes of ground-from-the-solid burs. The irregular tooth design suits the requirements for working on dense, tough materials such as die steels and steel forgings. They are best suited for lower-speed operation in flexible shaft machines, drill presses and lathes.

Adapted from information provided by Grobet USA, Carlstadt, N.J. For more information about the company's files, burs, pneumatic grinders and other precision tools, call (201) 939-6700 or visit www.grobetusa.com.

A production state of mind

BY BILL KENNEDY, CONTRIBUTING EDITOR

By the nature of its business, a job shop may make thousands of the same part or only a few. However, Kevin Falcone said the goal at Falcone Precision Machine Inc. is to "try to do everything in a production mode. That's the way you want to think."

He and his brother, Mark, founded the Latrobe, Pa.-based shop in 1998. It handles the typical variety of job shop work, from machining small, tight-tolerance titanium parts for the optical industry to designing and producing large steel-plate fixtures for in-process manufacturing inspection.

One job for a customer in the P/M processing industry consisted of 10 pieces—five each of two machine components. Kevin Falcone devised fixturing and machining processes that maximized throughput and minimized workhandling and setup time for the job.

The customer approached Falcone with a faded part print, a sample of each component and a desire for new, altered versions of the components. Falcone studied the print, measured the parts, noted the changes required and then worked with the information in BobCAD-CAM software to design the new parts' geometric features and the toolpaths needed to machine them on the shop's Fadal VMC-15XT vertical machining center.

B. Kennedy

Falcone Precision Machine made aluminum test parts as a trial for a short run of brass components used in a P/M processing machine.

The two parts were similar in basic appearance but had different thicknesses. The thicker part required additional drilling and tapping on its reverse side. The parts were to be milled from 6"×6"×¾" brass plate.

In addition to using the CAD data to create toolpaths, Falcone employed it to create a layout for a 12"×6"×¾" aluminum subplate that would act as the fixture for most of the machining. Using HSS drills and taps, he made one 0.410"-dia. hole, one 0.156"-dia. hole and 17 ½-13 tapped holes in the aluminum subplate.

He machined test parts from 6061 aluminum, but used the cutting parameters he calculated for the brass stock to avoid rewriting the program after the tests.

Falcone clamped each workpiece plate in a vise and facemilled them at 400 rpm and 10 ipm with a 2"-dia. facemill tooled with four TiAlN-coated carbide inserts. One set of parts required a final thickness of 0.600", and those were rough-milled at a 0.100" DOC followed by a 0.025" finishing pass on the first side. The final thickness of the other set of parts was 0.490", which required two roughing passes of 0.105" and a 0.025" finishing pass. Before turning over each plate to perform a 0.025" finishing pass on the second side, Falcone drilled five ½"-dia. holes to be used in fixturing the parts on the subplate in subsequent operations.

After clamping the drilled subplate fixture in the vise, he bolted a workpiece plate to it through three holes in areas that would later be milled away. Falcone put cap screws in two other holes outside the part periphery to secure the stock that would remain after the part's outer contour was milled.

The first machining operation was milling the part's outer contour, us-ing a ¼"-dia., 4-flute, flat-bottom, center-cutting, solid-carbide endmill. He roughed the contour in 0.030" steps at 3,000 rpm and 60 ipm, and then finished it with a full-depth pass at the same rpm and a 30-ipm feed. Then, he cut a straight 0.156"-wide × 3.450"-long through-slot with an ⅛"-dia., 4-flute, flat-bottom, center-cutting, solid-carbide endmill run at 5,000 rpm and 30 ipm, taking 0.025" steps and finishing with a full-depth pass at 15 ipm. Falcone noted that the endmill was intentionally programmed to cut through the part and into the inexpensive and easy-to-machine aluminum subplate.

Next, he backed out the cap screws and removed the scrap left outside the part, and then secured the part with three clamps bolted into ½-13 holes in the subplate. Falcone was then able to remove the three fixturing bolts in the part's center. Next, with the ⅛" endmill run at 5,000 rpm and 30 ipm, and taking 0.025" steps, he cut a 0.170"-deep × 0.125"-wide × 2¼"-long arcing slot across the part's face.

Returning with the ¼" endmill, he milled three heart-shaped pockets through the part in 0.030" steps at 3,000 rpm and 30 ipm. A full-depth finish pass followed at half the feed rate. The same endmill was then applied to machine 0.170"-deep "gates" at the edge of each of the three pockets.

In the final operation on this side of the part, Falcone spot-drilled and then drilled a 0.375"-dia. through-hole at 800 rpm and 2 ipm, then circular-interpolated it to a diameter of 0.410" with the ¼" endmill. He ran the cutter at 1,500 rpm and a 1-ipm feed. The tolerance required for the hole was ±0.001".

The five 0.600"-thick parts were run as described previously. The five 0.490"-thick parts were machined in basically the same way, the exceptions being the shape of some contours and the depth of some features.

Using the single subplate as a fixture enabled Falcone to machine the parts "like a little production run," he said. He completed the five 0.600"-thick parts, moved to the other half of the subplate, called up the program for the 0.490"-thick parts and "just hit the start button." The programs included machine stops when the time came to back out the cap screws, set the clamps and remove the bolts from the part interior.

In addition to operations on the first side, the 0.600"-thick part required machining of two 10-24 drilled and tapped holes on the back side. For that, Falcone putpins in the 0.156"- and 0.410"-dia. holes in the subplate, flipped the part over, located the part on the pins and secured it with a clamp anchored in one of the ½-13 holes. He used a HSS drill and tap to produce and thread the holes. Falcone estimated that machining each part required less than 30 minutes, including the time spent rearranging the clamping arrangement in midprocess.

He also noted a fact of job shop life: "Everything is a rush," recalling that the job was completed in less than 2 weeks, from initial contact with the customer, through ordering and receiving materials, to delivery of the final parts.

For more information about Falcone Precision Machine Inc., call (724) 539-0560 or visit www.falconeprecisionmachine.com.

BY MICHAEL DEREN

A tale of two shops

Here's a question for you. Why is Shop A booked to capacity, while Shop B, just down the street, is running at just 60 percent capacity? Let's look at the possible reasons.

To begin with, Shop A knows its customers better. Unlike Shop B, it avoids bidding on simple jobs that require only 2-axis machining of mild steels and, instead, focuses on producing intricate parts made of nickel-base superalloys and other exotics. The setups are more complicated and the materials are difficult to machine, but fewer shops are performing this type of machining. As a result, Shop A is able to attract customers requiring more sophisticated—and higher shop rate—machining.

By getting to know its customers, Shop A is better able to fill their needs. A representative from Shop A visits a new customer's facility as soon as possible and makes notes of what the customer manufactures and what materials are used. When purchasing new equipment, Shop A reviews these notes.

More complex parts require more sophisticated machining—often state-of-the-art technology. Therefore, Shop A has the latest equipment it can afford, even if it means replacing a 5-year-old machine that is still functioning properly. Shop B, on the other hand, has old equipment—10- to 20-years old and older. And Shop B upgrades only to replace worn equipment.

A successful shop evaluates equipment purchases based not only on its current needs, but what it expects it will need in the future.

A successful shop evaluates equipment purchases based not only on its current needs, but on what it expects it will need in the future. For example, Shop A's current purchase requirement is for a vertical machining center with a table travel of 32"×84". After surveying its customers, Shop A determines that by purchasing the next larger size table, say 36"×120", it can get additional orders for larger parts from existing customers.

Many times, purchasing equipment a shop never used before can make a positive difference. Shop A once was a milling shop that didn't perform lathe work, but added turning technology even though it lacked the needed expertise. The shop acquired the expertise by working with the OEM, training existing machinists and hiring the right people. It is now able to efficiently produce milled and turned parts.

Inspection equipment also plays a role in generating work and justifying higher shop rates. By having a coordinate measuring machine, Shop A shows its customers that it is serious about providing quality parts. Without surveying existing customers, Shop A could have missed sales opportunities that required inspection equipment. This also allows its sales force to attract additional work from new customers.

A shop's staff must keep abreast of the latest technologies. Shop A has a high-quality staff, including machinists eager to learn and improve their skills. Conversely, Shop B primarily hires lower-cost and lower-skilled machine operators who have little interest in continuing education.

Shop A also employs engineers who are able to provide customers with solutions to unrecognized problems. Sometimes, Shop A's customers don't realize they have a part design problem; the shop's engineers then suggest process or design improvements. If a part is overengineered or isn't well-designed for manufacture, an engineer from Shop A sits down with the customer and discusses potential solutions and helps reduce the customer's costs by making the part more economically.

Many customers are looking for a one-stop shop. Shop A understands that providing customers turnkey solutions can be beneficial. When Shop A receives a request for quote, it doesn't just quote the machining to be performed in-house, but includes the cost of subcontracting the work it can't perform. This adds value to the order, which customers appreciate and pay for.

Remember, it is usually more economical for a customer to source many parts from a single shop than multiple vendors. Most customers prefer this. By subcontracting value-added services such as welding, brazing, heat treating, coating, assembly and testing, Shop A's customers have fewer things to worry about. Shop A develops mutually beneficial relationships with these outside service providers. Customers appreciate this and give Shop A nearly more business than it can handle. △

About the Author

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