BY MIKE PRINCIPATO

Ineffective associating

Generally, entrepreneurs don't look to government to solve our problems. We're a self-reliant bunch, confident in our own ability to provide for ourselves. So you won't be surprised to learn that I've never been an outspoken advocate of trade associations that purport to represent manufacturers on Capitol Hill. For that matter, I'm not a huge fan of most trade associations—period—for two reasons.

First, there are simply too many of them. There are dozens in manufacturing alone, representing the most highly specialized sectors of the industry and all allegedly with their sectors best interests at heart. These associations are led by executive directors and board members who earnestly believe that no other organization can accurately and fairly understand their membership and thus speak for their interests. From plastics to powdered metal, tooling and testing, there's a trade association ready, willing and able to accept your annual dues.

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These well-intentioned associations have successfully, if unintentionally, fragmented the world of manufacturing to such an extent that few associations merit any real attention from the government agencies and officials they presumably exist to influence. After all, elected officials are busy people, and given a choice between presenting a keynote address at a trade show in sunny Las Vegas or sitting down to a rubber-chicken dinner at the annual International Society of Wastebasket Design Engineers Expo in Iowa, well … let's just say I've never heard anyone exclaim "Viva Des Moines!"

Second, given that smaller associations tend to be less effective at lobbying than larger ones, I don't see a lot of value in being a member in most of them. Getting my name and ugly mug in the local newspaper for receiving an association award doesn't mean much to me anymore, and with two teenagers in my house, the last thing I need is another evening meeting—especially if I have to wear a tie. Even the "valuable membership discounts" on stuff like car rentals and life insurance offered by most associations are available elsewhere.

Longtime readers will recall that I provoked a mild furor some years back by opining that manufacturing would be much better served by consolidating the myriad trade associations into a unified bloc, the combined membership of which could truly constitute a voice in Washington. Naturally, the Letters to the Editor mailbox nearly burst with indignant rebukes from some trade association leaders who felt I was being unfair or angling for a job as an industry spokesman. The latter comment was downright hilarious; I'm way too opinionated to be a spokesman for anything but my own business.

But was I unfair? Four years after that controversy, I ask: Has the trade association you support created any substantial positive change in your business? If so, you've chosen wisely. If not, either you're in the wrong association or you have not, for whatever reason, been sufficiently engaged in the—hopefully—meaningful mission of that association.

The mission of a trade association is, at a bare minimum, to ensure the fair legislative treatment of the trade it claims to represent, and, at best, influence the political process to improve the regulatory environment for that trade. That's a tall order for associations that merely represent a few hundred or even a few thousand members. Heck, my local chamber of commerce has almost 5,000 members and arguably still can't be heard over the din that Philadelphia's chamber makes in the capital city of Harrisburg. That's because Philly is a more populous and thus more influential region than where I live.

My advice? Exercise the same relentless scrutiny when joining an association that you would when buying supplies and services for your shop. Your time and money are too valuable to waste on trade organizations that don't make a tangible difference in your sector's business conditions and U.S. manufacturing in general.

If you want your name in the newspaper, donate a bunch of money to the charity of your choice. If you want to socialize more, have at it. But when it comes to trade associations, don't confuse activity with results.

About the Author

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Be square

BY JAMES A. HARVEY

You've probably heard the cliché about the need to build a home on a solid foundation. In machining, square blocks are the foundation of many machined parts. Therefore, machinists need to know how to construct precisely square blocks and how to check them. It's nearly impossible to hold tight tolerances on subsequent machining operations if the blocks are not square.

The following are procedures for producing square blocks.

1. Use a modified ball bearing to hold rough sawed stock in a milling machine vise.

Use a steel ball with a flat to apply pressure to the center of the vise and the center of rough sawed stock when the stock has no parallel surfaces on which the vise can close. You may have to use the ball a few times to get some surfaces roughly square and parallel before beginning the subsequent precision squaring process.

The flat on the ball allows the vise to be closed tightly without damaging or indenting the vise jaw. The ball should be large enough so that it can be held in place without smashing your fingers when closing the vise. A ¾" to 1" ball bearing ground with a flat about ½" in diameter works well.

2. Face cut one of the widest surfaces first to begin the precision squaring process.

3. Cut two sides parallel to continue the squaring process.

When squaring blocks you must begin by getting two sides of the block parallel. The best way to get them parallel once you've made the first face cut is to set the block high in the vise

All images: J. Harvey

Square blocks are the foundation of many machined parts.

with the first side resting on some tall parallels. You want to hold the block with as little material as possible so you can tap the block firmly down on the parallels.

If you don't set the block high in the vise, you'll have difficulty getting the block to sit firmly on the parallels because as you close the vise, the block will tilt, depending on how out of square it is.

Once you tap the block down on the parallels with a soft hammer, make sure the parallels don't move. If they are snug, the second cut will make the second side precisely parallel to the first side.

4. Bury the block deep in the vise to cut the third and fourth sides.

Bury the block deep in the vise so the back jaw has plenty of surface area to square the block. Once you square the third side, simply turn the block over and square the fourth side.

5. Choose a method for cutting the fifth and sixth sides square.

The most common method is to side mill both ends square while reducing the overall length. This method is likely the best for squaring the ends of long, slender blocks or bars. Another option is to side mill one end of the block and then fly cut the other.

Another less common method has the advantage of the machinist being able to cut all six sides using a fly or face cutter without changing tools. The downside is that you have to make an additional cut and keep track of part orientation. The technique requires squaring the first four sides of the block according to the previously mentioned procedures, standing the part up approximately straight in the vise on one of the rough sawed ends, locking it in place and cutting the exposed end, or fifth side.

Then with a marking pen, place a mark on the upper end of the block on

A modified ball bearing is used to apply pressure to the center of the vise and the center of rough sawed stock.

the side facing you. That side and the opposite side are now square to the top of the block. The other two sides are not necessarily square to the top yet because the part is set in the vise only approximately straight.

Next, cut the other end square to all sides. You do that by flipping the part over and placing the marked side of the block down in the vise with the mark showing through the side of the vise. Lock the block in the vise. The block should now be standing straight with all sides square to the bottom of the vise. Once you take a cut across the exposed end, or sixth side, that end will be finished and square to all the vertical sides.

Recutting the fifth side is the final step. To cut that side square to all the other sides, you must turn the block over one more time and set the sixth side firmly against the bottom of the vise and cut the fifth side again—the additional cut. The block should be precisely square.

The beauty of this method is that you never have to change cutters or use additional tools, such as a machinist's square. Furthermore, the completed block will have a consistent finish on all six surfaces.

About the Author

James A. Harvey is a machinist and plastic-injection-mold maker based in Garden Grove, Calif. 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. He can be e-mailed at HarvDog42@aol.com.

More go for karts

BY BILL KENNEDY, CONTRIBUTING EDITOR

Die Quip Corp. makes die finishing machines, so you wouldn't think sprocket hubs for go-karts are also made at its machine shop, but they are, thanks to two entrepreneurial employees.

Bethel Park, Pa.-based Die Quip's machine shop mainly produces components for the company's equipment. However, President Tom Maxwell Jr. said his shop has two very talented workers who are involved in go-kart racing. "They have great ideas in product design and manufacturing."

So Maxwell was willing to arrange to have the workers, Jesse Exler and Jonathan DeLong (who operate as Jex Manufacturing), make accessory parts with the Die Quip shop as a subcontractor. DeLong, a designer at Die Quip and go-kart racer for about 20 of his 31 years, saw the need for a high-quality accessory maker when he experienced repeated disappointments with low-quality parts. "I had to bring those parts into the shop and work on them to make them right." Exler, a machinist, wanted "to do something on my own" and teamed up with DeLong.

Jex Manufacturing's most popular product is its Float Lock floating sprocket hub. The 6"-dia. hub mounts on a go-kart's rear axle and holds the drive sprocket, which is turned by the motor via a chain. The hub's patent-pending design features an oversize keyway and bore that allow it to oscillate and float about 0.030" or 5° on the axle, overcoming binding of the chain that can result from chassis flex or misalignment. The reduced friction enables the engine to rev more freely and produce more power. It also reduces sprocket wear.

Exler drew the hub's dramatic curves in AutoCAD. He calls it a "shark fin hub. It's designed for both good looks and light weight. Most of the hubs are just traditional spokes. I wanted to put some creativity in there."

B. Kennedy

Nesting workholding strategies and careful process planning enable Jex Manufacturing to produce two complete high-performance go-kart sprocket hub assemblies every 40 minutes.

Exler said the nesting approach to workholding enables efficient hub production. In each of two twin-cavity fixtures, the back cavity holds an unmachined plate and the front grips the inverted hub after the first side has been machined. A third fixture has four cavities similarly arranged to machine locking collars for the sprocket assembly. The aluminum fixtures are clamped in a Chick vise. "One tool does everything it needs to do on the parts held in the three fixtures and then goes back to the toolchanger," Exler said. Each 40-minute cycle produces two sprocket hubs and two locking collars, equaling two complete assemblies.

To begin, Exler loads two 6"-round, 1 1/16"-thick plates of T6 6061 aluminum into the back cavities of the two hub fixtures. The edges of the 0.105"-deep cavities have drilled and tapped holes for small setscrews that push against the plate and provide additional workholding power. "I call them my poor man's grippers. With the setscrews, I'm able to push my speeds and feeds a little," Exler said.

Machining starts with roughing of the hub's larger features using a Manchester 2½"-dia. facemill tooled with polished, high-positive inserts and run at 5,500 rpm and an 85-ipm feed rate. Then a Data Flute ¾"-dia., high-helix, 2-flute carbide endmill run at 6,000 rpm and 75 ipm completes roughing of the smaller features and pockets and helically interpolates the hub's 1.255"-dia. bore.

Exler applies a special tool ground from a ⅞"-dia. HSS endmill to generate an undercut beneath the 0.100"-thick hub flange and simultaneously create a radius where the hub's center joins the spokes. The tool runs at 3,500 rpm and 50 ipm. An Accupro ¼"-dia., 3-flute, TiN-coated carbide endmill then finishes the pockets in the spokes and machines a keyway in the bore. Exler runs the endmill at 6,000 rpm and feeds it primarily at 65 to 70 ipm, but slower in the pockets. At first, he machined the keyway with a broach, but endmilling enables him to generate small radii in the slot to give it strength. Use of the endmill also permits "controlling the size of the keyway," he said. "If I want to make it a little bit bigger to give a little more oscillation, I can."

Next, six holes in the hub's spokes are spotted with a 90° countersink, drilled with an Accupro 0.213"-dia. (No. 3) stub drill and threaded with a 2-flute ¼-28 tap. In the final operations for the first cavity, the hub is deburred and sharp edges are rounded with an Accupro 0.125"-dia., 0.025"-radius corner-rounding tool.

After the first sides of the first hubs are machined, the parts are flipped and put into the fixture's front cavities, and unmachined plates are loaded into the back cavities. This is where the nesting efficiencies come into play. After the 2½"-dia. facemill roughs the fresh plate, the tool simply moves to the second cavity and mills the back side of the previously machined part. Similarly, after the corner-rounding tool finishes deburring the first side, it travels to the second cavity and deburrs the hub's back. Identifying information is engraved on the back side with an Onsrud engraving tool.

While the hubs are being machined, the locking collars are milled with the same tools in a quad-cavity fixture. The collars begin as 0.800"-thick sections of 2¼"-square 6061 aluminum bar. The first sides of the collars are machined two at a time with the 2½"-dia. facemill and ¾"- and ¼"-dia. endmills. A No. 406 Woodruff cutter undercuts the collar flanges.

After deburring and engraving, the collars are flipped and clamped in the second set of cavities for machining the back sides. On each side of the collar fixture is a mount to hold a collar perpendicular to its bore, secured by a bolt and a split washer. There, Exler interpolates a hole for a setscrew with the ¼"-dia. endmill and then threads the hole with a ⁵⁄₁₆-24 tap.

The finished hubs are hard-coat black anodized and coated with Teflon. Anodizing "gives you a hard surface and the Teflon gives you lubrication," Exler said. The collars are soft-coat red anodized.

DeLong said Jex Manufacturing makes about 500 hubs a year, including the six-spoke version described here and a three-spoke design for smaller karts.

Although making go-kart accessories appears to be a different machining challenge than manufacturing components for die finishing machines, Maxwell is convinced that the creativity and productivity Exler and DeLong bring to their kart part manufacturing carries over into their work on Die Quip equipment. *For more information about Jex Manufacturing, call (412) 292-5516 or visit www.jexmfg.com. For more information about Die Quip, call (412) 833-1662 or visit www.diequip.com.*

Sharpness is relative

Archives MNATP, Collection Meillassoux

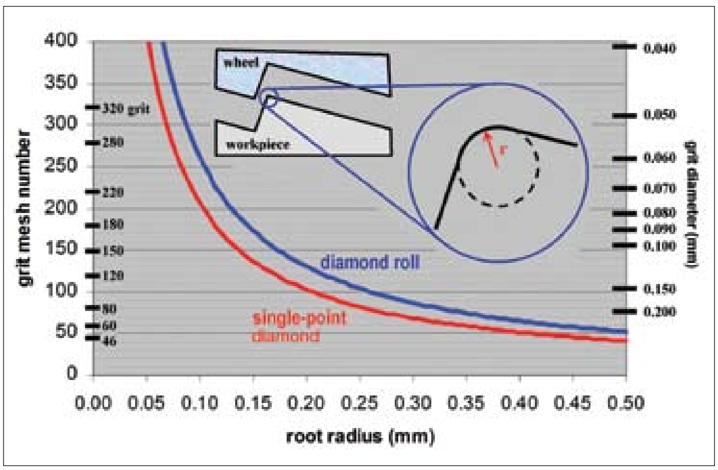
Dear Doc,

I use a step plate to dress a form in a grinding wheel with a single-point diamond. I then impart the form to the workpiece. I grind this step plate accurately with a grinding wheel hooked up to a shadow-box projector. I'm trying to get the corners perfectly sharp. But when I see the final workpiece, the corners are rounded. What can I do?

The Doc Replies:

First, you have to forget the idea of a "perfectly sharp" edge. It doesn't exist. Every edge has a radius at its corner. Even a sharp razor blade has a radius at the cutting edge.

So, before doing anything else, define the radius you want to achieve. Next, see if you can achieve this radius by grinding your step plate. After grinding the step plate, put it in the projector, sketch the shape on a transparent sheet and estimate the radius at the corner. That's the sharpest possible radius you can get on the grinding wheel and, hence, on the workpiece.



J. Badger

Grit mesh size required to achieve a given corner radius.

Next, choose a grit size using the chart shown here. Let's say you want a 0.15mm radius. You'll need about a 120/150 grit size in the wheel if you're using a single-point diamond dresser. Then, make sure the dresser-diamond radius is not too large to achieve this corner radius.

Finally, see if your grinding machine is capable of following the step plate accurately enough to impart this radius. Even if you have the perfect step plate and the proper grit size, if the dressing diamond is moving too fast while the step plate is being traversed, you won't achieve the desired corner radius.

If you get the radius on your part that you want, great. If not, you'll need to determine whether the problem is in the grit size, the step-plate radius, the diamond radius or the grinding machine. But, wherever it is, get away from the thought of a perfectly sharp corner.

Dear Doc,

I OD grind steel shafts with a B126I100V CBN wheel. It grinds well, but wheel life is short. What can I do?

The Doc Replies:

Several options exist to reduce wheel wear.

First, try a larger grit size. Switch from a B126 grit, which is 126µm in diameter and has a 120/140 mesh size, to a B181 grit, which is 181µm in diameter and has a 80/100 mesh size. Larger grits make the wheel "act harder." An apt metaphor is that it's more difficult to dig a boulder out of the ground than a pebble.

Second, try a harder-grade wheel, such as moving from I grade to J or K grade. This means there's more bond material in the wheel.

Third, try a higher concentration, such as moving from 100 concentration to 125 or 150 concentration. This means there's more abrasive grits in the wheel. However, the switch will increase wheel cost.

Fourth, if the machine and wheel-safety rating can handle it, increase wheel speed. A faster speed makes the wheel act harder. However, there's a point at which wheel wear starts to increase again as wheel speed increases. Where this point is depends on the wheel and the process.

Fifth, decrease workpiece rpm for a fixed in-feed, or plunge rate (the speed at which the workpiece is moved into the wheel, measured in millimeters per minute or ipm). This reduced rpm won't change the material-removal rate or cycle time, but it will increase the arc-of-cut length, distributing the grinding forces over a larger area and reducing wheel wear.

The downside of the first option is a rougher surface finish. The downside of the others is increased risk of burn and chatter.

Finally, don't perform all the options at once or else you'll have a rock-hard wheel. Try them one at a time and see which one works best for your particular process. △

About the Author

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