



Technology

Optimize or Replace Your Tools? Here Are 5 Questions to Ask

Kip Hanson | Apr 27, 2021

Whether you call them maintenance-grade or general-purpose, it's essential to know when to replace cutting tools, and what to replace them with.

Maintenance and repair departments, prototype and development firms, academic and government research facilities—these are just a few of the manufacturing environments where machine tool operators are not trained machinists, but rather mechanics, design engineers, and university professors or their students, whose grasp of basic machining and cutting tool practices is often incomplete.

Unfortunately, cutting tools are frequently misapplied in these situations. Edge wear and damage that would set off alarm bells in a production shop are either overlooked or misunderstood. The wrong grade or geometry might be used, with improper feeds, speeds and depths of cut making matters even worse. The result is waste and lost time, with less than stellar performance from machine shops under the same pressures as their skilled CNC counterparts.

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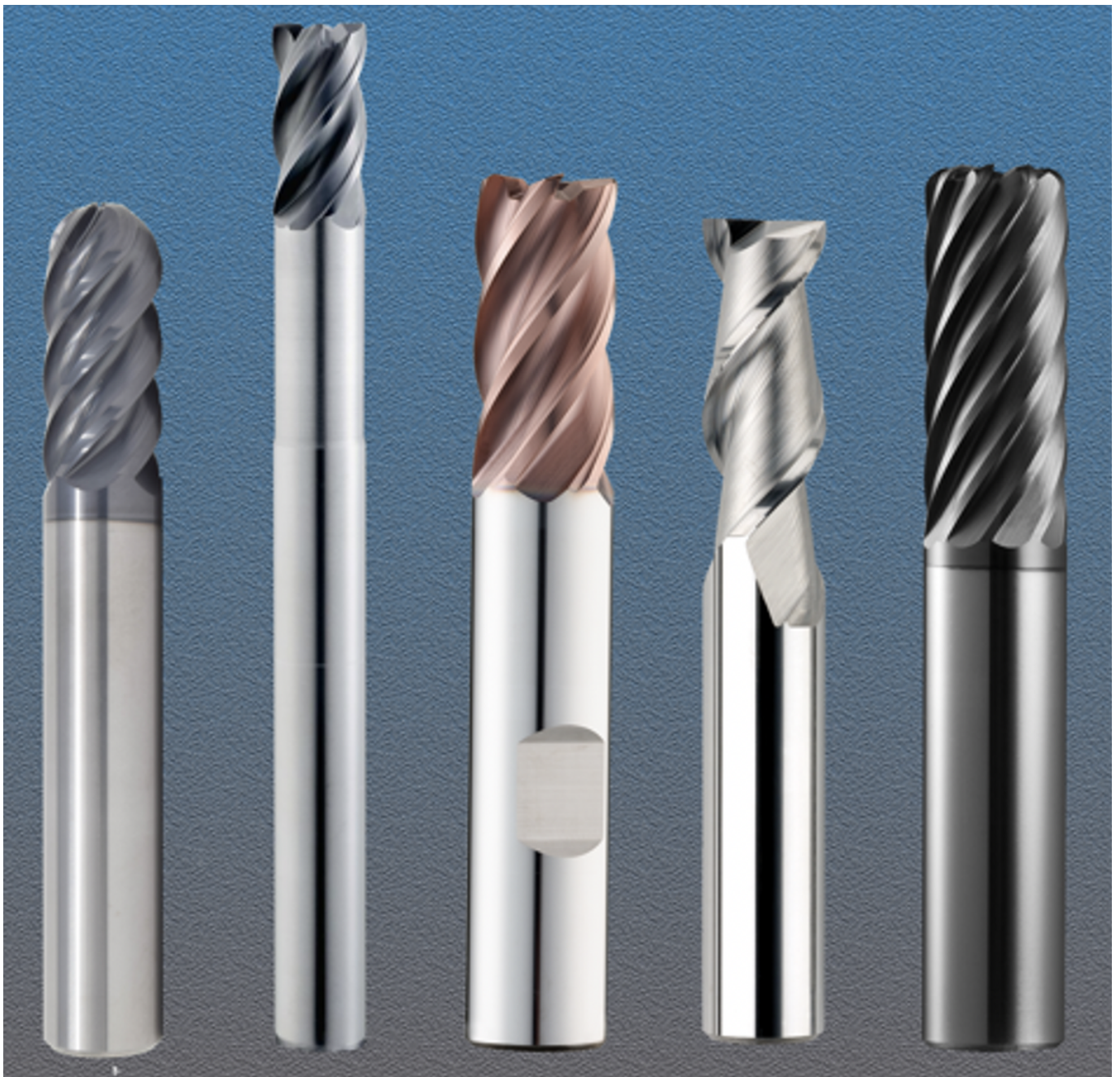
The good news is that machining isn't rocket science. With a bit of training and the right cutting tool, practically anyone can produce good parts, achieve acceptable tool life, and above all, stay safe while operating machinery.

This article offers some questions you should ask when evaluating your shop's tooling choices—whatever its size or experience level—and whether cutting tool upgrades or a tool crib makeover is in order:

No. 1: The edge doesn't look too bad, and the drill, end mill or reamer is still cutting. How do I know when to replace a cutting tool, and whether my current tool was the right choice?

The signs of cutting tool wear are manifold. Chipped or worn edges, notch wear on cutting tool at the depth of the cut line, discoloration of the tool or workpiece, material buildup on the cutting surfaces, poor part quality and surface finish, increased noise from the machine spindle—it's a long list, and even the most experienced machinists occasionally misdiagnose an application problem. Fortunately, a wealth of online, paper-based and educational resources are available to help troubleshoot cutting tool wear, all of which stress the importance of inspecting tools periodically, then adjusting operating parameters or changing to a different grade, coating or geometry if needed.

"Cutting tool manufacturers are always coming out with new and better technologies, so it's important to stay current, but just as important is the need for sound machining practices," says Jake Rutherford, research and development engineer for KYOCERA SGS Precision Tools Inc. "That means using as short a gauge length as possible, making sure you're applying the right feeds and speeds for the material, and why routine toolholder maintenance is critical."



KYOCERA SGS and other cutting tool manufacturers offer a wide variety of application and material-specific grades, coatings and geometries. (Image courtesy of KYOCERA SGS Precision Tools)

No. 2: We cut aluminum one day and stainless the next. Do we really need special grades or coatings for each material? Why not just use a general-purpose or maintenance-grade cutting tool and ease back on the speeds and feeds enough to get through the current task?

It's a fair question, and in some cases, the answer is to do precisely that—settle for lower performance in order to get the job done. And yet, the get 'er done approach can lead to bigger problems down the road.

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Worn or chipped tools increase the load on expensive machinery, possibly causing damage to spindle bearings and electrical components. They can also damage the workpiece, generating enough heat to work harden the material, or snap off unexpectedly deep inside a hole. This last event might damage the operator as well, which is why it's crucial to avoid overloading tools.

"Let's say you need to drill a series of holes in a stainless steel component, or one made of superalloy, and end up burning through a bunch of tools," says Tim Griebno, technical support specialist at Greenfield Industries. "A lot of folks might not realize that there are cutting tools made especially for these materials, and by switching to one, they can save a ton of time and money."



General-purpose tooling like the drill index shown here is an excellent choice in many cases, but that doesn't always mean it's the most cost-effective solution. (Image courtesy of Greenfield Industries)

No. 3: But high-performance and application-specific tooling are a lot more expensive than what we've been buying. How do we justify the additional cost?

As Griebno just mentioned, spending more on an optimized cutting tool solution generally saves money in the long run.

KYOCERA SGS' Rutherford seconds this, noting that cutting tool consumption represents between 3 percent and 5 percent of the total costs for producing any part; because of this, a 30 percent decrease in tooling cost or 50 percent increase in tool life only reduces part cost by roughly 1 percent. Far more important than either is cycle time.

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"That's why the key to higher profitability in practically any situation is the selection of high-performance tools that are optimized for the application," he says. "For example, spending a bit more for a coated tool almost always makes sense, as does switching to a tool with higher flute counts on finishing operations. Both serve to reduce cycle time, which means more product out the door at the end of the day."



Because one tool can accept multiple grades and geometries, indexable cutters are another alternative to general-purpose and maintenance-grade tooling. (Image courtesy of KYOCERA Precision Tools)

No. 4: Yes, that all makes sense, but who has time to investigate new cutting tools and learn how to use them. Any suggestions?

It's not as difficult as one might think. Aside from the educational resources mentioned earlier, Rutherford and Griebno both suggested that help is but a phone call away. That said, shops should set aside some time for testing of new grades and geometries. These often require more aggressive machining parameters than one might expect, and unless applied properly, even an optimized cutting tool will fail.

"A lot of plants will shut down once a year for machine maintenance," Griebno says. "This is a great time to go through the tool crib and evaluate what's working, what's not, and do some testing and optimization of new tools. Doing so can reap big benefits when the shop starts up again."



Summer plant shutdowns offer a great opportunity to train up employees on the latest cutting tool technologies and machining practices. (Image courtesy of Greenfield Industries)

No. 5: What should I do with this box of old drills and end mills? And what about my toolholders? Do they need replacing, too?

Let's answer the second question first: quite possibly. Toolholders that are nicked and dented on their locating surfaces or exhibit a rust-like appearance known as fretting should be discarded. If not, this damage will translate into poor tool life and part quality and may damage the machine tool as well. And as with cutting tools, only high-quality replacements should be used in their stead. As for the box of tired soldiers sitting in the bottom of most toolboxes, Drew Strauchen, executive vice president for GWS Tool Group, says to send them his way.

Read more: Tips for Good Toolholder Hygiene: Leading Tooling Suppliers Weigh In

"Maintenance shops in particular are a great place to use refurbished tools," he says. "We'll regrind

them for a fraction of the cost you'll pay for a new tool and can apply coatings or special grinds to increase their effectiveness. Just be sure that the original tools aren't pushed past the point of no return, otherwise they might not be salvageable. Generally speaking, you can get far more regrinds out of a cutting tool that's been well cared for than one that's been abused. Probably 10 percent or so of our business is on tool reconditioning, and MSC is one of our preferred partners on this as well as custom cutting tools."



Though usually reserved for high-volume work, polycrystalline diamond (PCD) tooling and combo cutters like those shown here can provide excellent results even in low-volume, maintenance and repair facilities. (Image courtesy of GWS Tool Group)

What questions do you ask when evaluating your shop's tooling choices? Share your thoughts and insights in the comments below.

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