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Prioritizing Precision with Multi-Flute End Mills

Kip Hanson | Apr 22, 2025

Back in the day, selecting an end mill was a simple matter. Machinists would typically grab whatever two-flute, high-speed steel (HSS) end mill was in the drawer and use it for roughing operations. A four-fluter was the first choice for finishing, and if serious hogging was in order, a corncob rougher might be just the ticket.

That's all changed. As anyone who's cruised the pages of MSC Industrial Supply's website knows, cutting tool providers today offer ***a broad range*** of end mill geometries, coatings and flute counts, with some cutters sporting a dozen or more cutting edges. When used with high-efficiency and high-feed milling strategies, all promise better performance, tool life and part quality. And HSS? It's slowly going the way of the dinosaur.

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> Kennametal

The question then becomes: Which one will give the biggest bang for the buck? How many flutes will be most effective, and does it really make a difference whether you use a five-flute end mill or one with seven, nine or 13 flutes?

Why More Flutes?

Katie Myers, global product manager for solid end milling at Kennametal, says the answer depends mainly on what materials you're cutting, how you're cutting them, and what equipment you're using. "Every situation is different, but for shops that are transitioning to dynamic milling and high-efficiency machining, it's important to use the right tool for the application. More often than not, this is a milling cutter with more cutting edges and advanced geometry, such as an eight-flute tool from our HARVI IV line."

With a ***high-efficiency milling (HEM) strategy***, she adds, tools typically see full-length engagement (part geometry permitting) and shallow radial cuts. Not only does this spread tool wear across the entire cutter, thereby extending tool life, but it dramatically boosts material removal rates. This last part is especially true when using end mills specifically designed for this modern metalcutting strategy.

Jake Rutherford, a research development engineer at Kyocera SGS, agrees. “The key benefit of increased flute count isn’t only about faster cutting. You get to use the entire end mill rather than just burning out the end. It also means a stronger cutter—because flutes get shallower as the count increases, there’s additional room for the tool’s center core, making the end mill more rigid. The result is greater stability, potentially reducing vibration and improving surface finish.”

Myers points out that higher flute counts often provide the greatest benefit on metals that are tough to machine. “If you’re going to be cutting titanium or Inconel, you typically want to use those higher flute counts,” she advises. “You’re just going to be more productive than you otherwise would, especially when paired with a trochoidal toolpath.”

Kyocera’s experience confirms this. Scott Pettay, director of national accounts at Kyocera, notes that the company’s Multi-Carb tool—which has up to 11 flutes, depending on the diameter—has performed well in these metals as well as hardened steels during internal testing.

When Tradition Wins

Obviously, parts with deep pockets and tall walls provide an ideal scenario for these tools, for all the reasons already provided. Yet Rutherford suggests that shallow axial cuts, “probably anything less than one times the cutter diameter in depth,” might be better suited to traditional machining approaches.

Production volume is also a factor in the tool-buying decision. “When you’re working on a thousand-piece job, using an end mill and machining strategy that shaves a few minutes off the cycle time is a big deal,” Myers says. “Compare that to making two of these and five of those; you just need whatever it takes to get it done. In these instances, it might make more sense to go with a general-purpose end mill.”

The same can be said for softer materials ***like aluminum***, which is very forgiving in terms of toolpaths and cutting parameters alike. “Here, tools with two and three flutes are really common,” she adds. “However, Kennametal has developed a five-flute tool specifically for dynamic milling applications in aluminum—the KOR 5DA—which breaks that paradigm.”

Then there’s part geometry. For instance, operations requiring center-cutting capabilities generally favor traditional end mills with larger chip gullets. As Pettay observes, “You can’t plunge with an 11-flute tool—it’s not center cutting—nor would it be appropriate for any part with aggressive entry requirements. In this situation, a lower flute count tool like our new XPR would provide better performance.”

Rutherford seconds that, explaining how part geometry is often the decision-maker when choosing an end mill, although material properties, workholding rigidity, machine capabilities, and other considerations also play a role.

One of these is chip control. Both manufacturers recognize the fact that the low-radial, high-axial cuts common with HEM toolpaths produce longer chips that are often difficult to manage. Because of this, Kennametal and Kyocera SGS alike have developed end mills with chip splitters and chip formers (as have most cutting tool suppliers) that address this problem.

Whatever the brand, Rutherford emphasizes the importance of effective chip control with the deeper cuts just described. “Those chip breakers become crucial when you have high axial engagement. You’re going to be creating these really long chips that are difficult to remove from the pocket and can easily get recut, possibly damaging the tool or workpiece in the process. They can also clog up your chip augers and conveyors, which is going to cause downtime.”

Expert Guidance

Given the universe of available options, finding the optimal cutting tool can be a tough nut to crack. As such, both manufacturers recommend seeking expert advice. Talking to someone familiar with the tools and what they're capable of in various machining applications is critical for success, Rutherford explains.

"This is why we have a machining principles tool clinic that looks at the eight aspects of the machining environment—material, fixturing, toolholding, coolant, chip evacuation, machining parameters, methods, and the cutting tool itself—and provides guidance for each. I highly recommend it, even for experienced machinists."

Pettay recognizes, however, that sending someone to class can be a tall bar for businesses unable to disrupt production. For these customers, Kyocera SGS offers a test-cut service that "replicates their machining environment, evaluates different tools and toolpaths, and provides strategies for each without impacting a shop's ongoing operations."

Myers points to a similar offering—the ***Kennametal Knowledge Center (KKC)***—which also offers training classes. Both companies also have a wealth of online resources, including YouTube videos, tool selection guides and application guidance.

"Shops definitely have a lot to consider these days," she says. "Flute count is important, obviously, but so are all the other variables like feeds, speeds, depth of cut and so on. Regardless, it's important to stay current on the latest technologies, and don't hesitate to reach out to your cutting tool supplier when questions come up. That's what we're here for."

What cutting tool challenges have you encountered at your machine shop? Tell us in the comments below.

