



Machining

When to Upgrade Your Drills: Solid Carbide Has Come a Long Way

Kip Hanson | Jul 24, 2020

As with all machining technologies, it's a good idea to periodically reevaluate your cutting tools. Here's some of what's new in solid carbide drilling.

If your shop is using solid carbide drills, congratulations! You're a member of a growing club that places performance and tool life at the top of your requirements list and recognizes that one of the best ways to remain competitive is to use state-of-the-art tooling wherever possible.

Carbide or not, however, when is the last time you evaluated your shop's drilling capabilities?

Given recent advances in coatings and geometries, it's clear that yesterday's solid carbide drills can't compete with the new kids on the holemaking block, as described here by representatives from two of the industry's leading cutting tool manufacturers.

The HPX Factor

One of these innovations is Kennametal's new HPX Series, designed for high-performance holemaking in ISO-P steel alloys.

"Setting aside any geometry considerations, the carbide drills made today are simply much better than they once were."

Brandon Hull
Guhring

Product manager Frank Martin says the HPX provides up to twice the tool life and three times the metal removal capabilities of competing drills in 8620, 4140, A36 and other alloy steels. That's due to several recent advancements, including a patented, self-centering point gash, a straight cutting edge for reduced buildup, rounded margin lands and polished flutes. Kennametal has also eliminated the traditional tapered web in favor of one with a continuous cross section, which is said to increase stability.

Going Modular: A Lower-Cost Alternative to Solid Carbide

Guhring's Brandon Hull has no problem making a case for investment in solid carbide drills, citing the greater tool life, better hole quality and significantly higher throughput.

All that said, he's also the first to admit that solid carbide's higher cost is prohibitive for some shops and in some applications. Before throwing in the carbide towel and reaching for a high-speed steel bit, however, he suggests a more productive approach, one that boasts many of carbide's benefits but at a much lower cost.

"Our HT 800 replaceable tip drills utilize a tool steel body and screw-on carbide insert," Hull says. "They start at 1.5xD and go all the way up to 10xD on the length, with diameters ranging from 11 millimeters to 40 millimeters. As with our solid carbide drill offering, we have different grades and geometries on the insert itself, depending upon the workpiece material. So we have a point geometry for steels, another for stainless steels, one for cast iron, and another for aluminum. There's also a piloting tip available that's slightly larger in diameter than the standard drill inserts and is used to drill pilot holes for the 10xD drill."

Kennametal also carries modular tip drills, notes Alexander Schmitt, who is director of round tools marketing. The company's KentIP FS series combines a "full solid" carbide tip with polished flutes, a self-piloting point and up to four coolant holes for maximum chip evacuation, delivering better positioning accuracy and hole straightness at a cost comparable to that of indexable carbide drills.

The KentIP FS also offers material-specific geometries: the HPG for alloy steels, the split-point HPL for stainless steels and superalloys and the HPC for irons. All boast 143-degree points and polished or honed edges.

"Between these three geometries, the KentIP FS can handle most anything a solid carbide drill can but at a lower cost per hole," Schmitt says.

Replaceable tip drills, both experts explained, provide a balance. They combine the toughness and lower cost of HSS with the wear resistance and higher productivity of solid carbide. Their size range extends well beyond solid carbide's 3/4-inch or so diameter limit into indexable insert drill territory. And as already mentioned, they're also less expensive than carbide—depending on the size, a customer can expect to buy a replaceable tip shank and insert for about the cost of a comparably sized carbide equivalent.

Assuming that customers monitor tool life and do not push the drill past the point of no return, possibly damaging the mounting area behind the carbide tip, they can expect years of productive life from a one-time investment. Granted, replaceable tip drills are not quite as effective as solid carbide, but they might be just the ticket for shops looking for a lower-cost alternative.

For aerospace and medical parts, Martin recommends the B21*SGL series drill. These and other industries rely extensively on stainless steel and heat-resistant superalloys (HRSA), metals that create extreme heat and high amounts of mechanical force. The result is a built-up edge (BUE), chipping of the drill corners and margin lands, and chip binding, ultimately leading to unpredictable drill breakage. Kennametal has addressed such failure modes, Martin says, with special point gashing and a positive rake angle at the cutting edge to reduce cutting forces. A polished cutting edge and flute help to further reduce these forces and promote chip evacuation, as does the drill's hard, wear-resistant KCSM15 coating.

"The B21*SGL drill is available in a broad range of inch and metric sizes, and hole depths up to 8xD," Martin says.

Hard, but Tough

Brandon Hull agrees with the need for shops to periodically reevaluate their drilling tools.

The vice president of product management and business development at Guhring ticks off an equally impressive attribute list, adding that modern drills are also much tougher than those of even a decade ago.

Read more: Meet Guhring's RT100XF: A High-Performance Carbide Drill Developed for Tough Metals

"Setting aside any geometry considerations, the carbide drills made today are simply much better than they once were," he says. "For example, our RT100XF high-performance drill is now available in a new grade, K40XF, which retains the hardness of carbide but is tough enough for interrupted cuts and similarly abusive applications."

It also makes these drills more suitable for less-than-rigid or manual machining environments, applications that often have shops reaching for high-speed steel tools, due to the steel's greater toughness and flexibility. Granted, Hull suggests dropping feed rates by roughly 50 percent when breaking into a cross-hole or starting on an angle with solid carbide drills, yet this is a small price to pay given that carbide runs four to six times faster than HSS, especially when coated with one of the many multilayer coatings now offered by most cutting tool manufacturers.

One of these is Guhring's nano-FIREX, which Hull explains is an upgrade to the company's decades-old FIREX coating, one that relies on "additional but thinner" layers to extend tool life and increase operating parameters. Of course, there's also geometry to consider. The makers of high-performance carbide drills pay special attention to details that, at first glance, might seem insignificant. Hull points to features such as micro-honing of the cutting edges for greater strength, and polishing of the flutes for improved chip evacuation, and don't forget that many carbide drills are equipped with double margins, an attribute that increases stability as well as hole quality.

There are also several material-specific options, starting with the RT100VA, a coated, coolant-fed drill in 3xD and 5xD lengths, and designed specifically for stainless steel.

"We also have the RT100HF, which is similar to the RT100XF but better suited for nickel alloys and titaniums, as well as our RT100AL for aluminum," he says.

"Lastly, there's the RT100U for steels, probably the most general-purpose of our drill lineup but still falling into the high-performance category," he adds. "That's the one I often recommend to job shops that are drilling a wide variety of materials in lower production volumes."

What types of drills do you find most useful in your shop? Are you rethinking your drilling capabilities?