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The pros and cons of purchasing standard, application-specific and custom cutters.

Freedom of Choice

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Consumers of perishable tooling have never had a wider variety from which to choose. Cutting tool manufacturers continue to introduce new geometries, coatings and substrates. These developments, along with new methods for ordering products, offer manufacturing engineers and machinists an expanding spectrum of choice, from traditional off-the-shelf standards to application-specific tools to customized cutters (a.k.a. specials).

Let's review each of their respective strengths and weaknesses and examine productivity gains possible with application-specific and custom tools.

Standard Issues

For decades, cutting tool manufacturers have produced an ever-growing selection of standard, or catalog, tool designs. Virtually every toolmaker started out making a tried-and-true, industry-standard design and then expanded from that point.

Expansion in the standard cutting tool field has led to the immediate availability of some types of tooling that, just a few years ago, would have required a delivery lead time of 8 to 10 weeks.

The advantages of off-the-shelf standards are numerous. Not only is there immediate availability from a single vendor, but similar designs are also stocked by countless other companies. Tool inventories are available at the manufacturer, distributor and catalog-house levels.

Another benefit is that consumers who have used a standard tool previously are usually comfortable with its feeds and speeds, and confident they'll get repeatable, benchmark results.

Because of their generalized design, standard tools are typically effective for general-purpose work and can be used in a wide variety of applications in the job shop environment. This versatility also reduces inventory costs.

In addition, standard tools are the least expensive of all options, in terms of initial cost. And, generally, they can be reground more times than application-specific and custom tools because they usually have simpler designs.

However, standard tools have drawbacks. Because of their generalized design, productivity falls short of optimal levels. The specified tolerances for standards are looser than for many of their specialized brethren.

More significantly, the one-size-fits-all approach can compromise setup parameters. For example, an end user

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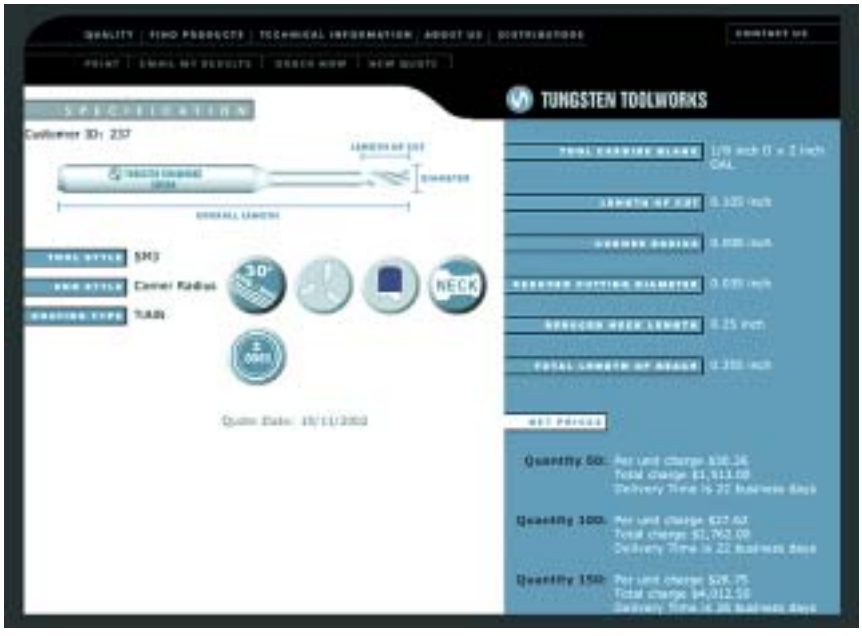
Custom tools offer numerous productivity and competitive advantages.



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Online tool design has shortened lead times for specials.

might select a drill whose flute length is ½" longer than the job requires because it's the closest configuration available. This compromise could easily lead to tool deflection, requiring a reduction in machining parameters to avoid making scrap. Production rates would be lower as well.

Getting More Specific

Application-specific tools are manufactured for a primary application or to machine a certain workpiece material. Many toolmakers offer a selection of application-specific tools, and availability is increasing at a rapid clip.

The new generation of application-specific tooling has created opportunities for part manufacturers to dramatically boost productivity. The cost of one of these tools, though higher than that of a standard tool, is quite reasonable when the higher productivity it allows is factored in.

Typically, the cutter's geometry, substrate, surface finish and coating are tailored to maximize the efficiency of a specific application. The most significant benefit is reduced cycle time.

Provided the appropriate machining center, toolholder, fixture and other elements of the "machining system" are in place, high-speed machining is possible with an application-specific tool. HSM can lead to previously unthinkable reductions in cycle times and overall tool costs, even though an application-specific tool costs more initially than a standard model.

In HSM, where the tool runs dry or near dry, the machined chip carries away heat generated in the cutting zone. The ability to machine dry can significantly reduce coolant and coolant-disposal costs.

Other benefits of application-specific tools are that they hold substantially tighter tolerances and offer extended wear life, which leads to increased machine utilization.

An Illinois-based moldmaker has realized the benefits of application-specific tooling for slotting graphite electrodes on a vertical machining center. The company recently switched from a standard, TiAlN-coated, carbide endmill to an application-specific design with a chemical-vapor-deposition-diamond coating. The results were startling. With identical axial and radial depths of cut, spindle speed increased from 2,100 to 15,000 rpm, the feed from 9 to 65 ipm and the parts per endmill from four to 285.

At another company, productivity dramatically improved when shoulder milling an aluminum alloy on a horizontal machining center (maximum speed of 6,000 rpm) by using an application-specific carbide tool tailored exclusively for aluminum. Again, with the same axial and radial DOCs, the speed was increased from 1,000 to 5,900 rpm, the feed jumped from 4.3 to 75 imp and parts per tool rose from six to 133. In addition, a single endmill replaced separate roughing and finishing tools.

Despite these and other advantages, the higher cost of application-specific tools stops many potential purchasers in their tracks. However, an application-specific tool often costs less in the long run, when the increased productivity it provides and its longer tool life are factored into the cost equation.

The ability to successfully demonstrate the benefits of application-specific tooling requires a laundry list of factors, including—but not limited to—the skills of the manufacturer's representative, the machinist's competence and the capability of the equipment itself. A deficiency in any one of these "ingredients" can lead to an unsuccessful test, causing a potential HSM customer to adopt a negative attitude toward application-specific tools.

Lastly, application-specific tools can increase inventory costs. Their limited applicability and the fact that fewer suppliers offer them may require users to stock more at their facility.

Special Considerations

A custom tool's configuration is manufactured to the user's exact specifications. An absolute, zero-compromise approach can, and should, be taken when custom tools are specified.

This means that if the consumer desires a 3-flute, 40°, right-hand-spiral/right-hand-cut, ⅜"-length-of-cut with a 0.025"-radius, 2"-clearance, TiAlN-coated, 6"-overall-length tool, then that is exactly what should be delivered. This no-compromise approach lets users optimize their speeds and feeds.

Designing a cutting tool from scratch means that an infinite number of design iterations are possible. An end user could easily have a custom tool in stock for every operation.

True custom-tool vendors allow for both geometry and size-specific configurations. They combine application-specific designs with "made-for-you" callouts on the diameter, cutting-edge

length, overall length, radii, clearance necks, coatings, etc.

An impediment to the acceptance of customized tooling has always been lead time and cost. Obtaining quotations for specials could take days and create substantial administrative and related-activity costs. It is now possible to design specials and obtain pricing via the Internet. Specials can be designed and quoted, with the price and a firm delivery date, in literally 1 minute.

Delivery times have improved dramatically, too, thanks to CNC advances, Web-based ordering systems and improved grinding machines. Small lot sizes of uncoated special tools are being quoted for delivery in days instead of weeks, and it is not unusual for order sizes in the hundreds to be delivered in 1 to 3 weeks.

A Michigan company received its coated specials 3 weeks after ordering them. Because the lot size was substantial, the price per tool was actually lower than the per-unit cost of the previously used application-specific tool.

This company realized significant productivity benefits, too, when shoulder milling 15-5 stainless. It ordered—online—a customized, solid-carbide tool for the job and saw improved results beyond what the application-specific design provided. By reducing the length of cut from 1" to ⅝", tweaking the geometry and changing from a TiAlN to an AlTiN coating, the factory increased the spindle speed from 1,640 to 1,900 rpm, the feed from 26 to 30 ipm and the number of parts produced per tool from 14 to 32.

These improvements, though less dramatic than the examples cited previously, demonstrate that even after high performance levels are achieved, incremental improvements are still possible through customization.

Any productivity enhancement provided by a custom tool gives the end user an advantage over competitors. And, because the design is the user's alone, a competitor wishing to match a gain in productivity would be forced to launch its own R&D project.

Like standard and application-specific tools, specials do have drawbacks. By its very nature, this subset of tooling is not available for immediate delivery, so customers who don't plan production requirements will find that this is a difficult hurdle to overcome. Also, despite powerful CNCs and virtual programming, production in small lots still requires amortizing a setup cost—meaning high unit prices.

Constant Improvement

A competitive marketplace has led toolmakers to improve their products, lead times and ordering systems. As a result, today's manufacturers have more high-quality tools to choose from than at any time in history.

And more improvements are needed. The flight of commodity-product manufacturing to countries with low labor rates is leading U.S. manufacturers and consumers to develop and utilize high-value-added products in their fight for survival. It is essential that partnerships involving manufacturers, distributors and consumers continue to evolve and generate true efficiency gains whenever possible to maintain and expand the U.S. industrial base.

Cutting tool manufacturers have a unique legacy in the U.S. Together with other industrial suppliers, they share a responsibility to lead this charge through continued innovation, creativity and resolve.

To learn more about Tool Alliance, call (800) 854-2431 or visit www.toolalliance.

ABOUT THE AUTHOR

Dave Povich is president of Tool Alliance, Huntington Beach, Calif., which manufactures the following brands of carbide tools: Ultra-Tool International, RoundTool Laboratories, Tungsten Toolworks, Mil-Tec and Routco. Povich also serves on the Board of Directors of the United States Cutting Tool Institute.