

Innovate

Hot Turning Concepts Offer Cool New Tools

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Cutting tool manufacturers are always looking for ways to give their customers an edge — both figuratively and literally.

Demand for more effective turning processes is growing again in one of the most cyclical of industries — the resurgent oil and gas industry. Meanwhile, high-precision manufacturers in aerospace, automotive, and other manufacturing industries are on the lookout for more efficient turning processes.

Cutting tool manufacturers regularly test the waters with new product categories and, in some cases, new and innovative processes.

The one common denominator is that suppliers are not bashful about making eye-popping claims about possible machining improvements.

The problem is that manufacturers in shops of all sizes might be a bit slow to adopt the new tools. It's in their nature. That said, here are several current approaches to improving turning processes.

Aiming for Oil and Gas

When *Iscar* (Arlington, TX) developed its Dove-IQ Turn product category some five years ago, the oil and gas industry was about to enter one of its cyclic downturns. "Today, that isn't the case as the oil and gas industry is coming back strong," said Randy Hudgins, Iscar national product manager for turning and threading. "Today there is demand in the oil and gas segment for large depths of cut (DOC) and high feed rates. Dove-IQ Turn is able to deliver high DOC of 4–12 mm and high feed rates of 0.4–1.0 mm/rev," said Hudgins. The 1½" (25.4-mm) IC inserts can even reach up to 15-mm DOC.

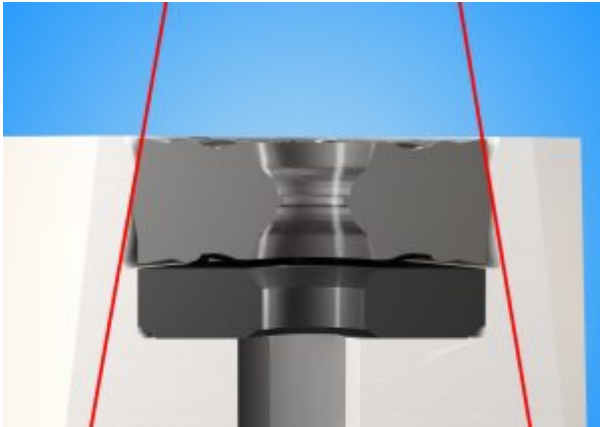


Iscar's Dove-IQ Turn can take larger DOCs and high feed rates.

"What is unique about the Dove-IQ Turn that makes this possible is the application of the dovetail pocket — similar to the dovetail design for milling tools — in combination with a lever clamping mechanism," he said. "The combination provides a very firm and rigid insert clamping system and eliminates the need for a top clamp." The Dove-IQ Turn design overcomes the disadvantages of conventional rough turning with a single-sided insert, which has a flat geometry on the bottom of the

insert and flat shim for security but only two cutting edges.

"The Dove-IQ Turn clamping mechanism can firmly hold double-sided inserts featuring double negative prism flanks," said Hudgins. "The dovetail pocket and insert prismatic flanks prevent the insert from being lifted by the cutting forces, and the lever lock doesn't interfere with the coolant flow or the chip flow in heavy cuts," said Hudgins. Iscar offers three insert geometries with prismatic flanks: WOMG-R3P-IQ, COMG-R3P-IQ and SOMG-R3P-IQ, designed with a new R3P chipformer for rough turning steel, enabling machining with heavier DOCs and heavier feed rates than standard 3/4 or 5/8" (19 or 15.8 mm) IC COMG inserts, according to Hudgins.



Dove-IQ Turn from Iscar features a 10° prism press.

Iscar's **COMG**, **WOMG**, and **SOMG** geometries are available in 5/8" IC, 3/4" IC and 1" (25.4 mm) IC. "The square geometry SOMG is really strong," Hudgins said. "The COMG is the most popular. The C geometry is generally stronger than a W, but not when you put the dovetail geometry on the side of it. It allows us to deliver six cutting edges compared with the two edges for conventional turning inserts."

Another feature of the WOMG is using a slight entering angle for high feed rate by turning the tool over onto an 18.5° lead angle. With the WOMG insert, the maximum DOC is only 0.110" (2.8 mm) but the feed rate can exceed 0.120" (3 mm) per rev. "You would typically want to use that when you've got a long length of cut in a longer part. It does require a more secure setup because when you come in on a slight lead angle, you're going to put more radial or downward pressure on the workpiece," Hudgins said.

Dove-IQ Turn inserts with CVD coatings are available for alloy steels, typically used for oil and gas applications, cast iron grades and stainless steels. Iscar's post coating Sumo Tec treatment smooths microscopic imperfections and helps material flow over the insert to minimize chip welding. The inserts are typically used on higher horsepower machines, 50 and 60 hp (37, 44 kW), but can also be used on 30 or 40 hp (22, 29 kW) machines. "At our facility in Arlington, we demonstrate Dove-IQ Turn using a 3/4 IC COMG taking a full 1/2" [12.7-mm] DOC on a 50 hp [44-kW] machine," said Hudgins.

Iscar offers a variety of aids on its website for finding the right machining solutions, including the Iscar Tool Advisor (ITA) which helps select the right tooling once the machine power, material, DOC, etc., are entered into the app. Access to the Iscar e-catalog and MachiningCloud.com provide solid models of Iscar tools that can be downloaded into the user's CAD/CAM. Information about feeds and speeds is provided through Iscar's IBAQUS app.

Hudgins said that high-pressure coolant is one of the most effective cutting technologies for turning. Iscar's Jet Cut can deliver coolant effectively at pressures greater than 1000 psi (68.9 bar) or even at pressures below 450 psi (31 bar). "Our Jet Cut delivers coolant right down to the cutting zone, quenching the hot material, cooling the cutting insert, and forming chips that are easier to evacuate, resulting in longer tool life and better feeds and speeds," said Hudgins. "It's one cutting technology that I believe is a must."

Taking Out the Guesswork

Seco Tools LLC (Troy, MI) draws upon its expertise as a large global company to help its customers in the automotive, aerospace, and oil and gas industries meet their production turning requirements, according to Aaron Eller, product manager-ISO turning & advanced materials. "Our advanced Duratomic technology now incorporates used edge detection in turning inserts. The chrome-colored inserts instantly show tool wear. We did some spot checks at customers and found that carbide inserts in their used insert bins still had 20–30% of edge life that was usable," said Eller.

Seco continually tests PVD coatings with proprietary nano-laminate element combinations and layer thicknesses to get the best combination for specific materials, according to Eller. In CVD aluminum oxide coatings, the atoms are arranged in a hexagonal form. In the past, the orientation of the building blocks of the coating were randomly arranged.

"Today, through advanced coating technology, we can control the orientation and bring a harder and tougher structure to the point of cut. These textured coatings are 15% tougher than the old version and also 10% harder. That again means as much as 20% more cutting speed and as much as 20–30% longer tool life," said Eller.



Seco Tools' Secomax CBN complete HPT grade chain.

"An analogy that might help explain texturing is the splitting of an oak log," he continued. "It can be easily split with the grain but is practically impossible to split against the grain. Aluminum oxide has a similar property: harder and tougher in one direction than another. We use special coating processes to bring the right direction into the cut," Eller explained. "In automotive applications, these types of insert coatings are used on what we call a green or soft turn when the component is being formed or after rough turn when components are hardened by heat treating after machining."

Recent innovations in turning from Seco include its Secomax CBN complete HPT (hard part turning) grade chain, and its Steadyline anti-vibration system, which is available for long-reach applications. The company also offers coolant-through ID turning heads. The company offers more than 5,500 standard turning inserts and over 3,000 toolholders.

"Many of the tools we make are custom tools through our Component Engineered Tooling [CET] department. These tools are often determined by material composition, component configuration, and customer-specific requirements," said Eller. "We will analyze the part and create or refine a full manufacturing process for producing it, including tool selection and application support. Automotive requires dependability and continued support for improvement. Aerospace demands critical surface finishes and oil and gas requires specific thread forms," he added.

Seco is rolling out its Guaranteed Cost Savings Agreement. "Under the program, when we implement cost savings over a specific period of time, for a year or two for example, the customer will get back a certain percentage of their tool spend," said Eller.

Prime Turning Developments

When **Sandvik Coromant** (Fair Lawn, NJ) introduced its **PrimeTurning** concept, aerospace and automotive manufacturers were cited as principal potential beneficiaries. The reason: they need to perform external turning operations in large production runs or where multiple setups and tool changes are often required. In PrimeTurning, the tool enters the component at the chuck and removes material as it travels toward the end of the component, leading to some interesting possibilities.

One is the application of small or shallow entering angles and higher lead angles that create thinner, wider, curved chips that spread the load and heat away from the nose radius. The result is both increased cutting data and extended tool life due to increased feed rates. In addition, because cutting is performed in the direction moving away from the shoulder, there is no danger of chip jamming, which can be a problem in conventional turning. Entering angles of 25–30° are used to maintain chip control and tolerances.

PrimeTurning then can be regarded not just as a new tool, but as a totally different way of performing turning operations more efficiently and more productively, according to the company.



Sandvik Coromant's PrimeTurning concept.

Sandvik Coromant has introduced two dedicated inserts: CoroTurn Prime A-type features three 35° corners and is for light roughing, finishing and profiling, while CoroTurn Prime B-type, with its ultra-strong corners, is for rough machining. PrimeTurning is suitable for ISO P (steel), S (heat-resistant superalloys and titanium), and M (stainless steel) category materials. Nine CoroTurn Prime A-type and six CoroTurn Prime B-type inserts are currently available, with expansion to other materials planned. The inserts are supported by 52 variants of toolholders, including Coromant Capto, CoroTurn QS, and shanks.

A PrimeTurning code generator supplies optimized programming codes and techniques. This not only ensures maximum output but also process security with adjusted feed rate and entry radius parameters. To improve efficiency and quality in CAM operations, both the CoroPlus ToolLibrary and the PrimeTurning method have been integrated into Mastercam 2018.

CoroPlus ToolLibrary is a digital tool library that facilitates user access to tool data. Based on the ISO 13399 tool data standard, CoroPlus ToolLibrary allows users to import tool assemblies directly into their CAM systems and provides access to tool catalogs containing digital representations of physical tools.

Machining operations can be planned using the exact dimensions and models of the tools, enabling accuracy in CAM programming and reducing the risk of collisions during machining.

From Coolants to Coatings

Walter USA LLC (Waukesha, WI) has launched several solutions for challenging turning applications, according to Sarang Garud, product manager. "We have introduced a substantial number of through-coolant holders for both turning and grooving systems to apply coolant directly to the cutting zone. Coolant is applied to the rake face through a rigid top clamp, which serves the dual function of insert clamping as well as coolant nozzle. Coolant is also applied through a secondary outlet in the holder on the clearance face. This results in up to a 150% tool life increase as well as very efficient chip evacuation, with coolant pressures between 150–2,200 psi [10–151 bar]," said Garud.



Walter has introduced through-coolant holders for both turning and grooving systems.

Walter's new MX style (four-sided) grooving inserts are tangentially mounted. With shank sizes suitable for small gang tooling, they cater to the Swiss-style machining market. Pressed chipbreakers as well as niche width sizes are directed toward circlip grooving applications, resulting in stable seating and center height accuracy of ± 0.0025 [0.05 mm] and repeatability of 0.0012 [0.03 mm], according to Garud.

"Also, our new RM5, RM4, MM4, and MS3 turning chipbreaker geometries all have the advantage of TigerTec Silver PVD coating grades, along with the precision-guided coolant channels. We recently introduced the Perform line for turning. These are negative inserts in all common ANSI shapes. They have a lower price point with an excellent price to performance ratio for markets where batch sizes are smaller and tool life can't be or isn't monitored," said Garud.

He noted that most of Walter's turning geometries are less than four years old. Some of the latest geometries, such as MS3 for medium machining and RM5 for roughing of superalloys as well as stainless steels, have precision-guided coolant geometry. "These are basically coolant channels pressed in on the rake face of the tool. They receive a coolant from the through-coolant top clamp of the holder and deliver the coolant directly to the shear zone at a high pressure. [The system] doubles the tool life," said Garud.

Walter's TigerTec Silver coating is a uniformly sized grain structure that leads to predictable and uniform flank wear and produces "best in class" crater wear resistance and improved tool life with PVD coating technology, according to Garud. The company also has a full line of PCD inserts in standard ISO

geometries with laser-etched chipbreakers. PCD inserts are available in both corner tipped and full-edge style configurations.

Previously featured on [AdvancedManufacturing.org](https://www.advancedmanufacturing.org).

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