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The LOGIQ of Machining Intelligently

This year has seen ISCAR launching its new LOGIQ line with a series of major events at ISCAR locations around the globe, where thousands of customers and ISCAR salespeople have been captivated by ISCAR CEO and IMC president Jacob Harpaz's comprehensive and compelling presentation featuring ISCAR's latest cutting tool developments.

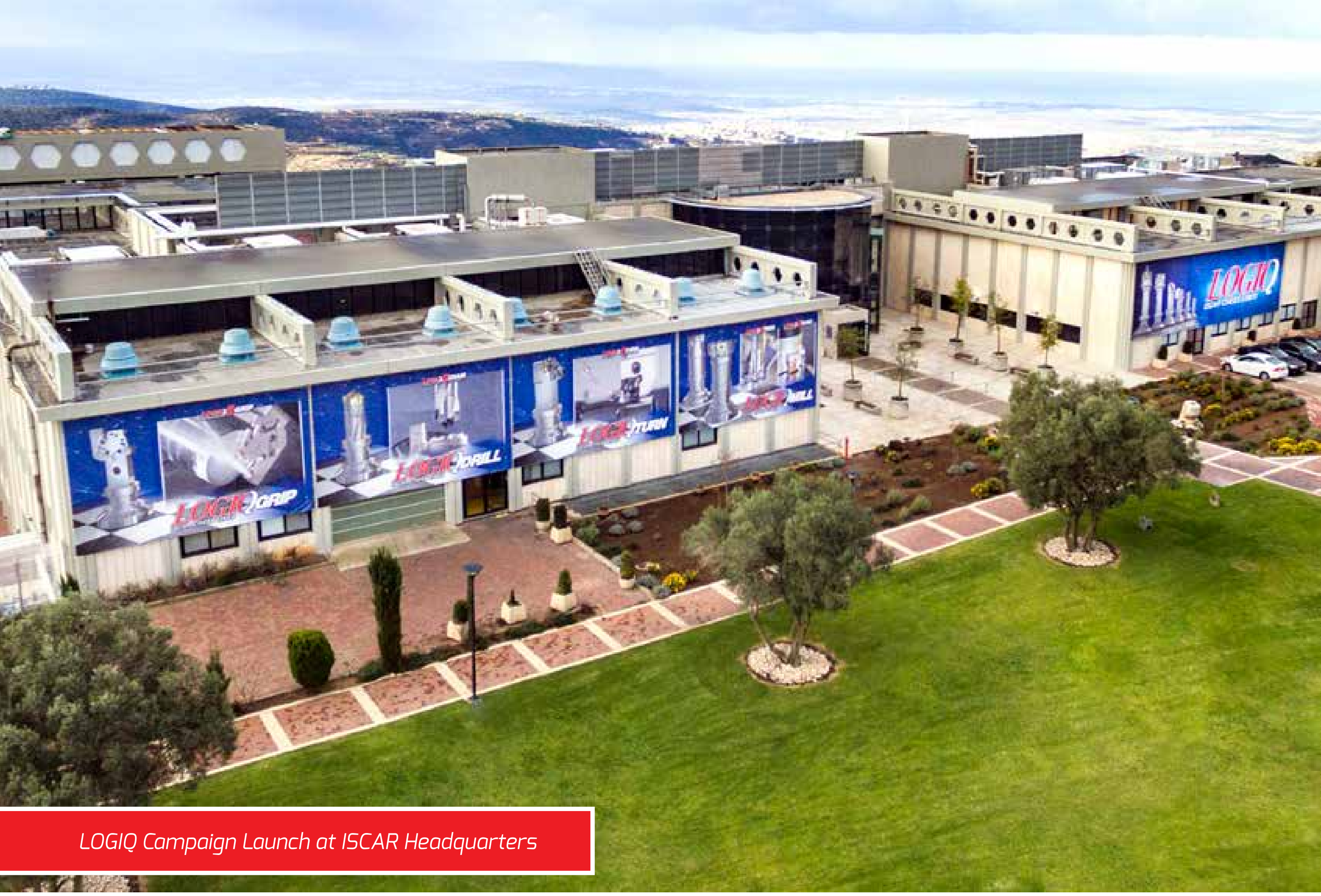
An industry leader and innovator in the world of metalworking, ISCAR has taken the IQ concept of machining intelligently even further by applying logical improvements to tool development. The result is the LOGIQ range of tooling solutions that both predicts and fulfils customer needs. LOGIQ represents a smart logical progression in a series of strategic moves to implement Industry 4.0 standards while ensuring continuity and stability.

Industry 4.0 directives - to integrate interoperability, technical task assistance and decentralized decision-making into factory practices - challenge machining centers to review their operations and adopt procedures to meet these objectives. Machining logically responds to this need. ISCAR provides the tools to make it happen.

LOGIQ applications have created new tool families, upgraded existing lines, and inspired innovative product ranges to maximize equipment utilization and optimize performance. Listening to customer concerns and staying ahead of market developments, ISCAR's product managers, R&D engineers and designers have combined their expertise and experience to develop highly effective and logical tool solutions that meet today's machining center demands.

MACHINING INDUSTRY 4.0 INTELLIGENTLY

IMC President and CEO of ISCAR, Jacob Harpaz



LOGIQ Campaign Launch at ISCAR Headquarters

In an industry where every second makes a difference and every movement counts, logical strategic design and tactical enhancement of even the most basic cutting tool can contribute to increased productivity, less wastage and lower costs.
LOGIQ's unrivalled, out of the box tool innovations include new cutting geometries and locking mechanisms for stable, vibration free machining with higher repeatability. The indexable inserts are equipped with sophisticated chip formers and contain geometries that facilitate soft cuts at high feed rates.

Solid carbide tools are enriched with new designs that feature substantially increased anti-vibration strength – a key factor for boosting productivity in unfavorable cutting conditions. The latest cemented carbide grades reflect ISCAR's forward looking knowledge and know-how in powder metallurgy and coating technologies. The toolholding line includes new heat-shrink-fit and vibration-dampening devices, which significantly improve performance when tool rigidity is critical.

The new LOGIQ milling solutions include strong, durable inserts and milling heads with enhanced capabilities. The LOGIQ turning applications offer new solutions to decrease machining loads, produce thinner and wider chips, and resolve vibration issues and coolant flow capabilities.

The LOGIQ drilling tool concepts provide advanced productivity solutions for high accuracy and repeatability, to reduce machine cycle time and produce high-end machined components.

The LOGIQ lines feature LOGIQ3CHAM to significantly improve drilling productivity; LOGIQ4TURN for enhanced performance in general-duty turning operations; LOGIQ4FEED, which enables rough milling at high metal removal rates; LOGIQ8TANG, a new 90° square milling shoulder; LOGIQ5GRIP, a versatile and high-efficiency solution for parting and grooving, and other tool families comprising hundreds of new products; each designed and developed to perform essential tasks in the most efficient possible method.

From concept to realization, LOGIQ-inspired tools reflect ISCAR's commitment to create and deliver high quality products that contribute to increasing productivity and profitability.

The fourth generation of the Industrial Revolution has unveiled new standards and requirements for machining metals.
ISCAR is at the forefront of this important industry trend, developing relevant technologies and implementing methods of effective machining to reflect and respond to the dynamic needs of the metalworking industry.

LOGIQ Campaign Launch in Las Vegas, U.S.A.

Industry 4.0 for Cutting Tool Manufacturers

> **The term “Industry 4.0” has already entered our everyday lexicon in many spheres: from journalism and applied science to vocational training and industry.**

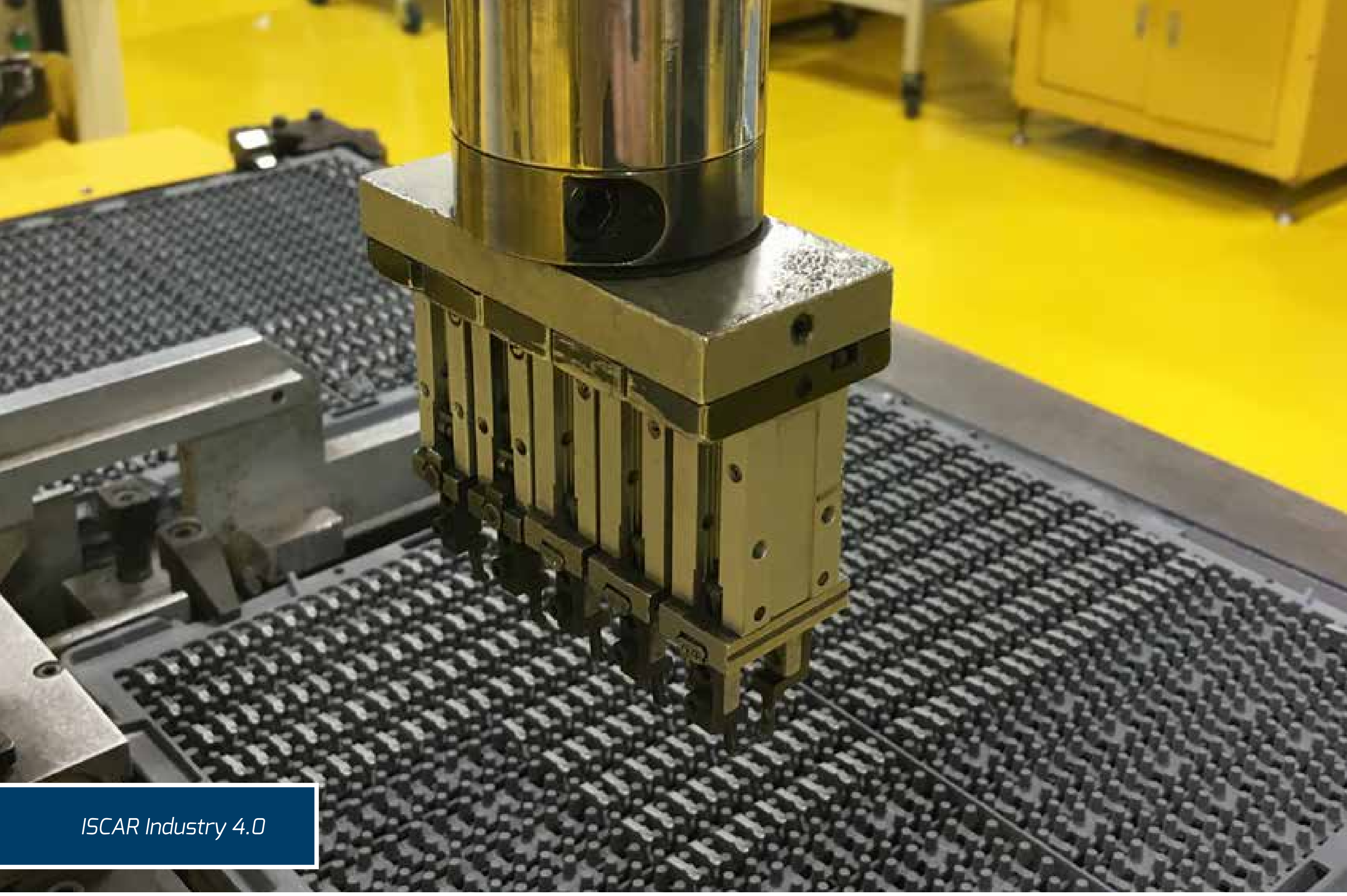
Concepts such as “smart factory”, “Internet of Things”, “cyber physical systems” and “machine to machine” are no longer considered science fiction and we may soon be meeting the reality behind these phrases in metalworking plant processes. Yet there remains a world of misinterpretation and miscomprehension between terminology and implementation. What does Industry 4.0 signify in practical terms and how do we apply and optimize Industry 4.0-related technologies in our manufacturing processes?

Industrial Revolutions

Originally, “Industry 4.0” (“Industrie 4.0”) was a German governmental initiative to digitize manufacturing industries. A source of irresistible inspiration to even the most cynical industry players, the Industry 4.0 concept has brought the ideas of complex computerization and production automation, inter-object data exchange, and decision-making processes to formerly unattainable levels. “Industry 4.0” epitomizes the fourth industrial revolution.

The first industrial revolution saw the transition from manual labor to machine production and the second industrial revolution – the technological revolution – transformed mass production. The third industrial revolution replaced analog with digital electronics, also causing radical changes not only in manufacturing but in everyday life.

“Industry 4.0” is how we refer to the fourth industrial revolution, which encompasses cyber physical systems - integrating digital components into physical processes, the Internet of Things (a concept of networking physical objects with embedded informatic technologies), 3D modeling and printing, virtual reality applications and other concepts; some already implemented and some waiting in the wings.



ISCAR Industry 4.0

MACHINING INDUSTRY 4.0 INTELLIGENTLY

Smart Factory

The smart factory represents the central model for smart manufacturing. Cyber physical production systems perform under the conditions of real-time information exchange in an environmental context that combines real and virtual worlds, with systems interacting via the Internet of Things. For example, the physical system shows the position of a cutting tool and acting cutting forces, and the virtual system specifies the tool's 3D path during operation and set machine stock allowance.

Integrating IoT

The main principle of a cyber physical system (CPS) involves the integration of digital resources into physical processes and their reciprocal interaction – the Internet of Things (IoT). IoT ensures data exchange between the systems and so interconnects the objects or "things", which are then able to understand each other, intercommunicate, and make decisions depending on a current situation. Introducing IoT in manufacturing processes increases flexibility and adjustability, with the potential to improve efficiency considerably. Today's cutting tools and toolholders contain microchip sensors to automatically control tool identification and changing, and a range of devices and machine-tool blocks offer automatic tool wear monitoring, temperature changes, and more: the tool evolves to become a component of the emerging cyber physical system.

The main principle of a cyber physical system (CPS) involves the integration of digital resources into physical processes

ISCAR Adopts 3D Printing Technologies

MACHINING INDUSTRY 4.0 INTELLIGENTLY

Virtual Manufacturing (VM) integrates digital modelling and technical process simulation. VM started as a production design tool and a means for collision checks during machining; it is considered a textbook “Industry 4.0” solution, combining virtual processing with things (including the manufactured product), based on data capture from sensors.

The third industrial (digital) revolution opened the door to a new technological method – **additive manufacturing** (AM) or 3D printing. Currently utilized mainly for prototyping, this technology is beginning to be adopted as a means of fabrication.
3D printing accuracy limitations cannot replace fine machining. Yet AM is already a significant element of the Industry 4.0 concept: it is enough to send the computer model of a part to a 3D printer, which may be located remotely, and then produce the part there. This feature takes customer service to another level and may significantly reduce delivery factors.

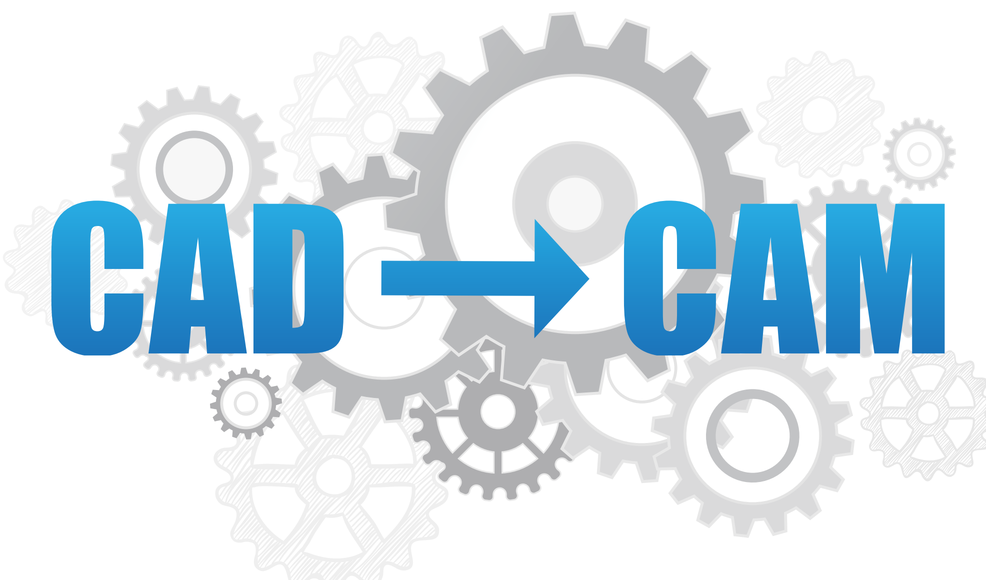
Cutting tool manufacturers are their own customers, which means they can tap into customer needs directly from one important source - themselves.
A good example is the MATRIX intelligent computerized tool storage unit, developed by ISCAR to improve manufacturing efficiency in its own production divisions. Realizing that MATRIX could resolve similar issues at customers facilities, the system is today regarded as a typical component of an Industry 4.0 directed factory.

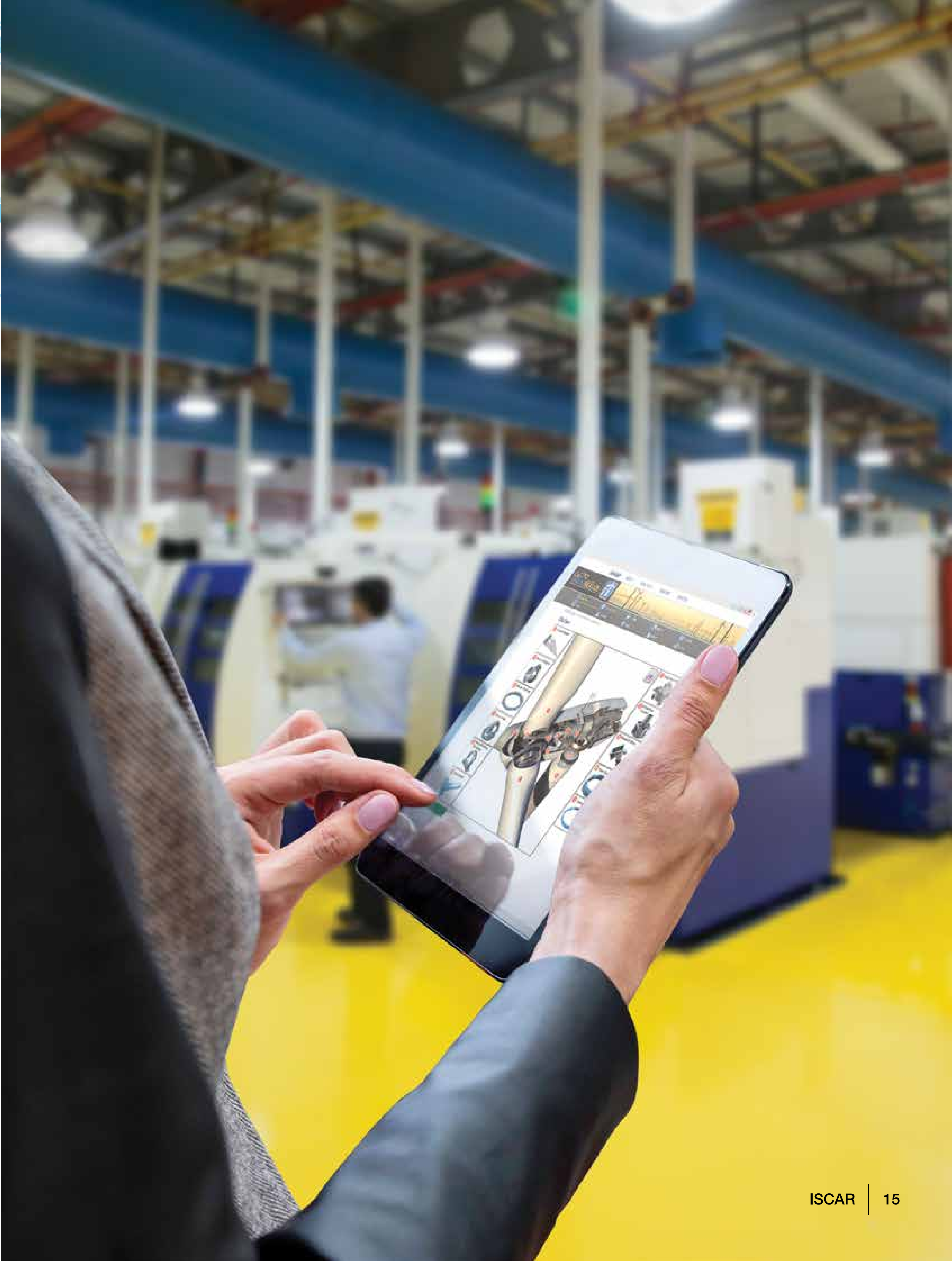
United by a common language

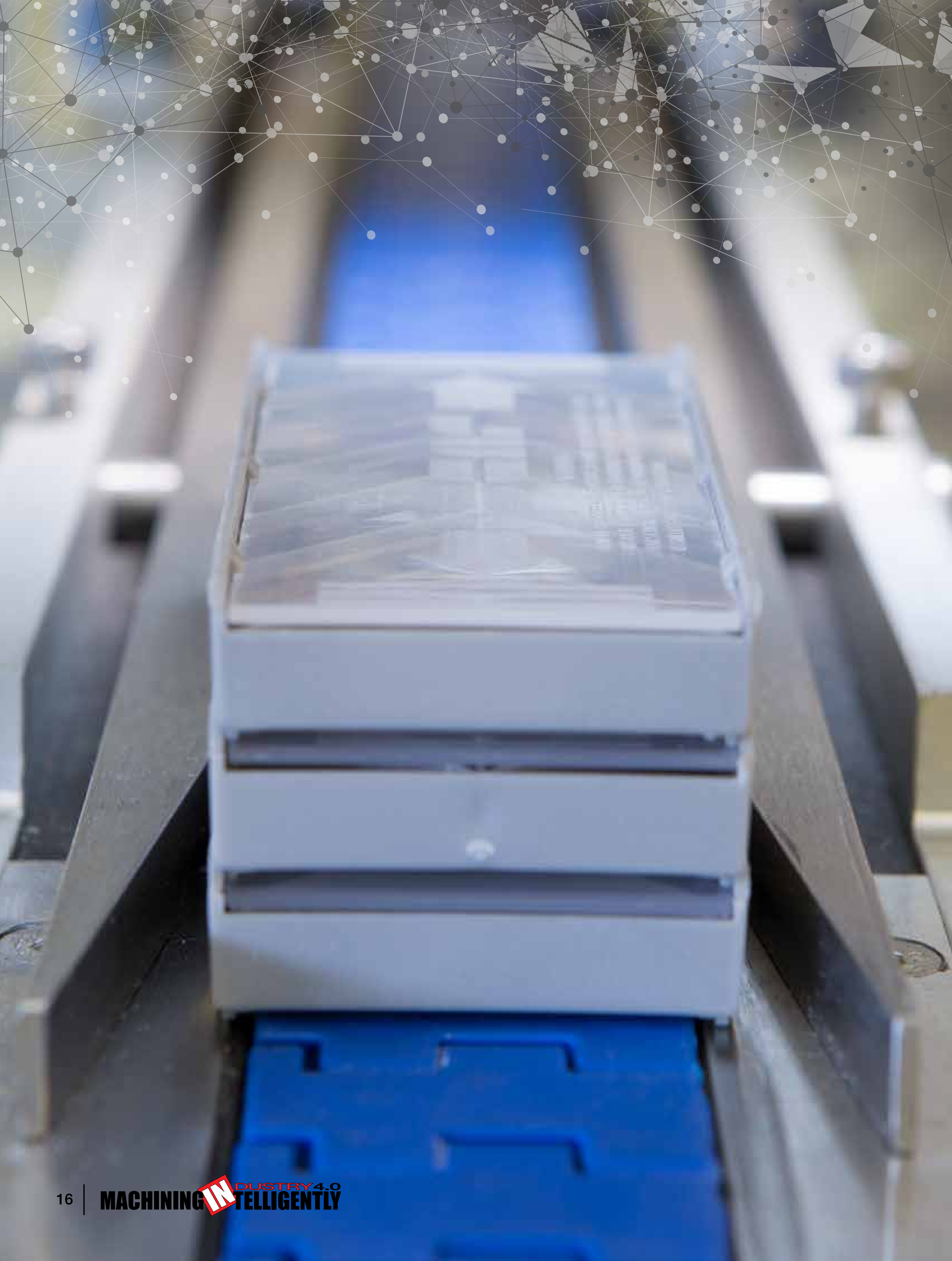
The first step towards unified intercommunication has been taken already. The ISO 13399 standard specifies computer representations and data exchange related to cutting tools and their holders - the lexicon of the language. Tool digital data is platform-independent and CAD/CAM and VM systems can utilize the data seamlessly. With Industry 4.0 linking physical and virtual things, cutting tool manufacturers are having to rethink how data is supplied to the customer and to adjust accordingly.

A smart factory requires smarter tools that will digitally store data related to tool properties, such as predictable tool life, accumulated cutting time, and tool designation, as well as limitations like maximal rotational speed. The need for uniform rules - to classify data and its computer representation - will require the cooperation of both companies and governmental agencies.

Understanding the importance of information interoperability is critical. A meaningful data exchange requires the things to “speak” the same language and the data should be represented in a single format; manufacturers need to bring their product information in line with the new language rules and implement it in a unified way. This is the cornerstone for building a smart factory and tool producers who do not learn to speak the language may find themselves outside the smart factory walls.







MACHINING INDUSTRY 4.0 INTELLIGENTLY

A meaningful data exchange requires the things to "speak" the same language and the data should be represented in a single format

Moving ahead with Industry 4.0

Cutting tool manufacturers would do well to integrate Industry 4.0 elements into their processes, to improve production quality and increase tool reliability and tool life predictability. Developing tools that can communicate with other devices via IoT technologies will require systematic cooperation between manufacturers to establish a common language, uniform specifications and standard data implementation.

Tool design engineers will have to enrich their theories of metal cutting, mechanical design and technology bases by acquiring knowledge of the communicative abilities of things and an understanding of how to implement Industry 4.0 directives into their practices.

The fourth industrial revolution started building the walls of the smart factory and manufacturers should not ignore these momentous changes. "Smart tools for a smart factory" is not just a buzz phrase but a real guideline for savvy manufacturers to move production processes in the right direction - forward.

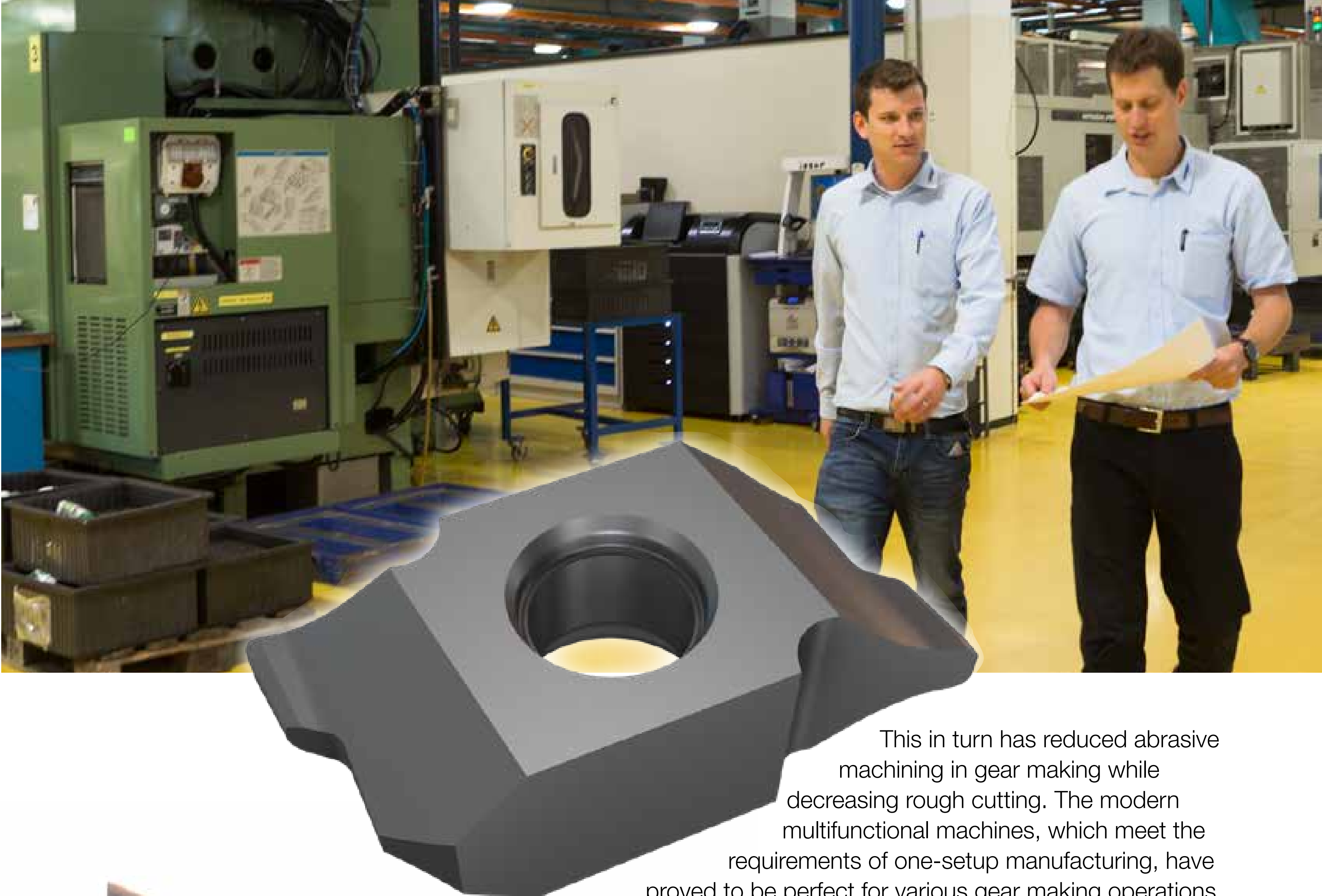
A New Look for Gear Milling?

> **Technology and its products are often causative: a technology might be applied to develop more effective and intelligent products, which in turn can play an important role in advancing that technology.**

Over the last few years, leading-edge technology has resulted in multitasking machine tools and machining centers with impressive working possibilities. At the same time, this progress in machine tool engineering is significantly changing metal cutting technology.

The advanced multifunctional machine tools increasingly widen the range of machining operations that can be performed. Technological processes developed for these machines are oriented to maximize machining operation for one-setup manufacturing, creating a new source for more accurate and productive manufacturing. Milling gears and splines is one of the operations suitable for performing on the new machines.

Traditionally, gear (and spline) making is a complicated process that involves milling, chamfering, grinding and other operations.
With batch manufacturing, the majority is made on specific machines: gear hobbing, gear shaving, gear grinding and so on. Developments in technology have changed the limits of hardness for cutting and considerably increased operational accuracy.

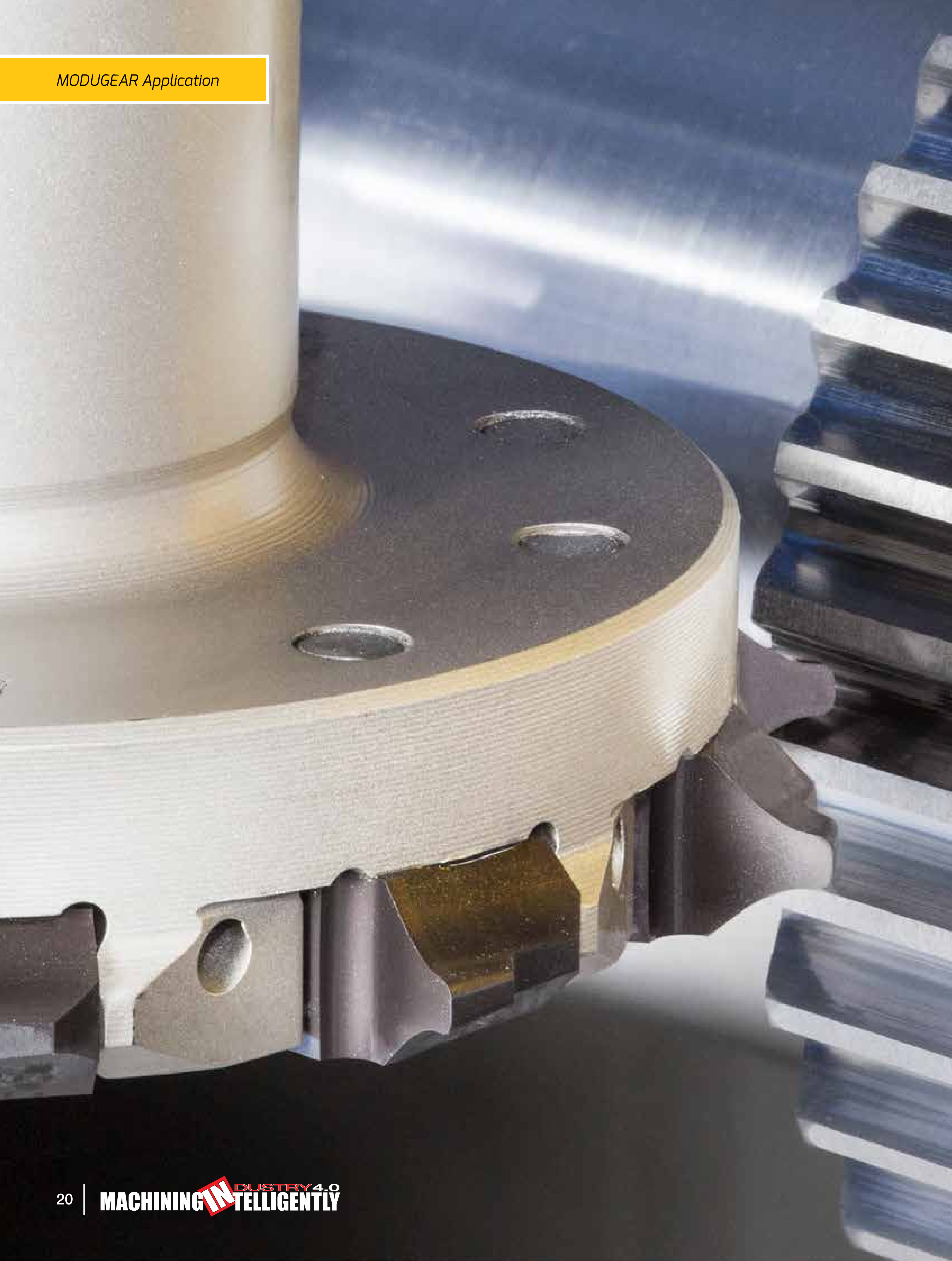


This in turn has reduced abrasive machining in gear making while decreasing rough cutting. The modern multifunctional machines, which meet the requirements of one-setup manufacturing, have proved to be perfect for various gear making operations.

These new machines require appropriate tooling and cutting tools manufacturers should prepare their response accordingly, which is why producers of general-purpose rotating cutting tools are reconsidering the role of gear-milling cutters in their program for standard product lines.

ISCAR, a leader in the cutting tool industry, is embodying this trend with a three-point program for form gear-making tools:

- Milling cutters carrying indexable inserts
- Milling cutters with replaceable cutting heads based on the T-SLOT concept
- Milling cutters with replaceable MULTI-MASTER cutting heads



MODUGEAR, the family of indexable gear-milling cutters, reflects a conventional design approach, comprising disk-type tools with tangentially clamped LNET inserts. The tangential clamping principle provides an extremely rigid and durable cutter structure that results in stable and precise enough machining tooth or spline profiles. Its principal application is producing involute gears of relatively low accuracy and rough gear-milling operations that feature a 1-1.75 mm (039-.069") gear module range.

The cutters with replaceable heads have two significant advantages compared with gear milling tools carrying indexable inserts: they offer better precision and allow the design of gear-milling cutters that are small in diameter but feature quite a large number of teeth. The replaceable heads are mounted in bodies (shanks), which are standard-line products suitable not only for the gear-milling heads but also for other types of head (for milling slots and grooves, for example). This enables customers to increase operating efficiency of the versatile shanks and to reduce tool stock, providing added value.

The replaceable solid carbide heads of the T-GEAR SD D32-M…-SP15 family are mounted in standard T-SLOT SD-SP15 cylindrical shanks and transform the latter into 32 mm (1.26") diameter gear milling cutters. The precise profile of the cutters' teeth and the accurate and reliable SP-connection between the shank and the head define its range of use: milling involute gears featuring a 1-2 mm (.039-.079") module.

T-Gear Application

Both types of milling cutters (those with indexable inserts and those with replaceable heads) meet the requirements of standard DIN 3972, basic profile II.

There are two types of MULTI-MASTER spline and gear making solid carbide heads.

The first type is represented by the MM SS heads that were specially designed for milling involute spline shafts, specified by DIN 5480 and ANSI B92.1 standards. These heads are intended for 1, 1.25, 1.5 …, 3 mm (.039, .049, .059...,.118") module (DIN 5480) and 8, 10, 12 …, 24 diametral pitch (ANSI B92.1).
The heads of the second type, MM SG, are used in milling spur gears in accordance with DIN 3972 (module 1-1.75 mm (.039-.069")) and ANSI B6.1 (diametral pitch 15-24) standards.

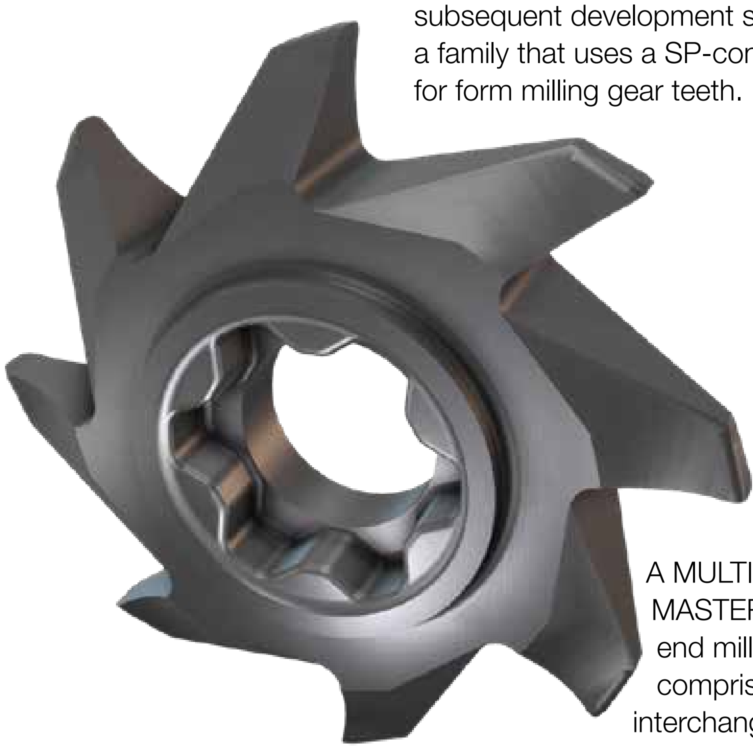
The main application field for MULTI-MASTER heads is the efficient production of small to medium batches of spline and spur gears in various industrial branches.

The world of gears encompasses a wide variety of external and internal gears: spur, helical, bevel, hypoid, and more. Manufacturing these gears involves an entire industrial sector with its own methods, equipment and tooling. The introduction of multitasking machines in gear milling - as a serious alternative to a dedicated machine - could shake up this sector and producers of commonly used cutting tools should "gear up" for the challenge.

The connection ensures a very durable assembly that withstands considerable cutting forces during slot milling

T-SLOT, a family of modular milling cutters SD-SP…, was originally developed for milling relatively narrow slots and grooves.

A cutter comprises a shank and an interchangeable solid carbide head, mounted on the shank with the use of a specially designed SP-connection. The connection ensures a very durable assembly that withstands considerable cutting forces during slot milling, even in cases when a tool works with high overhang. The heads of the same diameter vary in their width. The cutting geometry of the heads is intended for efficient slot milling of different engineering materials.
The design features of the heads do not limit their field of application by milling slot and grooves. The subsequent development stage introduced T-GEAR – a family that uses a SP-connection but is intended for form milling gear teeth.



A MULTI-MASTER end milling tool comprises a shank carrying interchangeable solid carbide cutting head with treaded rear area for quick-change connection with the shank. MULTI-MASTER benefits include minimum setup time and more than 15000 possible configurations of tools assembled from the standard shanks and heads. If necessary, the assembly can be completed by extensions. The shanks have been developed in a variety of materials: steel for general-duty applications, tungsten carbide having higher rigidity, and heavy metal featuring increased vibration resistance, which considerably expands assembly options.

MATRIX

MATRIX family

Harmonizing Vending Systems with Industry 4.0

New vending and vending-related solutions, inspired in part by Industry 4.0, have been appearing on the horizon recently, with a shared aim of providing manufacturers with better and leaner ways to manage and dispense items to the shop floor.

Here is a brief overview of some of the most relevant and exciting developments to maximize – and harmonize - production efficiency.

Compact Smart Vending

Big bulky machines have their place, but they will never be fully point of use, or provide the smart manufacturing cell with its own autonomy. Some suppliers offer bench top units which are compact in size but pack a punch well above their weight when it comes to features. They typically offer a full software suite and provide 100% control and accountability per bin or per individual item. This makes them ideal for the modern shop floor, where the machining process and selection of cutting tools cannot be compromised.

Mobility

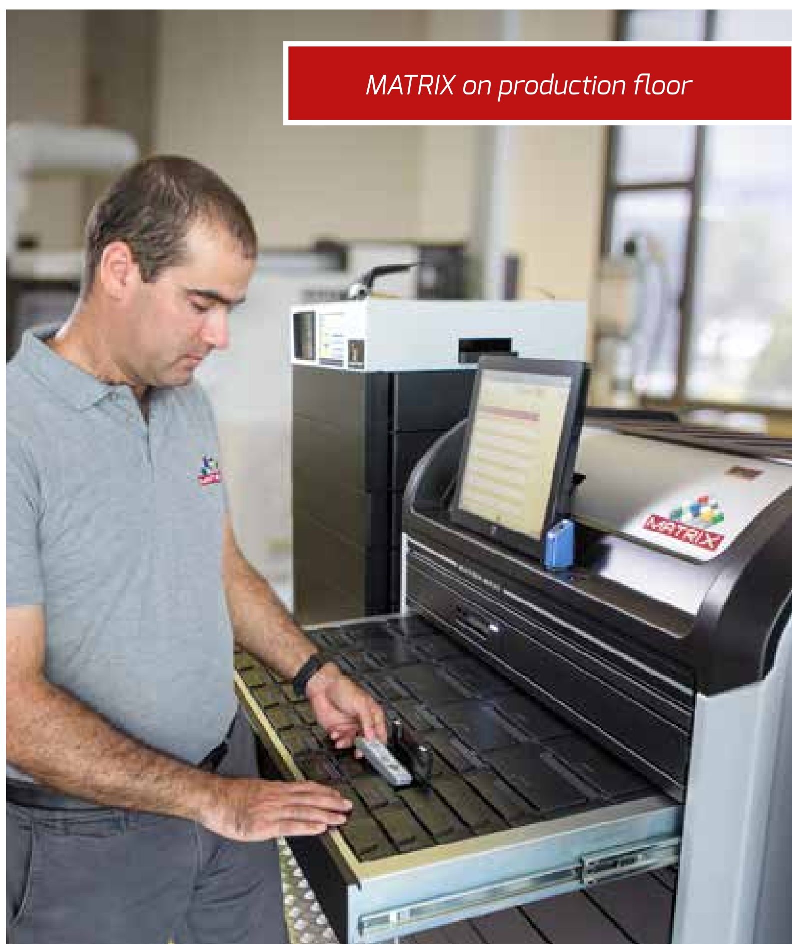
This has been one of the catch words of the last decade or so. Today we take it for granted that our office, social activities and more sit in our pocket. Users expect to be able to transact and track tool crib activity on the go. A new generation of Android based hand-held devices – each one loaded with a rich menu of reports and data presented in a mobile- friendly format – allows users to see what's happening. These devices can be a full substitute for those old cumbersome Windows CE hand-held devices that had to be carted around to issue items from warehouse or tool room stock. The UI is what one would expect of an Android-based app, with a clear uncluttered interface that offers just enough information for users to promptly and easily carry out daily transactions.

And there's some more good news – the Android devices are usually a fraction of the cost of the older Windows-based systems. There are also some great devices out there that combine a professional 2D scanner with a rugged hand-held device, which have both changed the limits of hardness for cutting and considerably increased operational accuracy.

IoT – the Internet of Things

Some unique ideas have surfaced that bring the Internet of Things to the shop floor in a manner that doesn't require complicated and expensive installation, or subscription fees that can virtually break the bank.

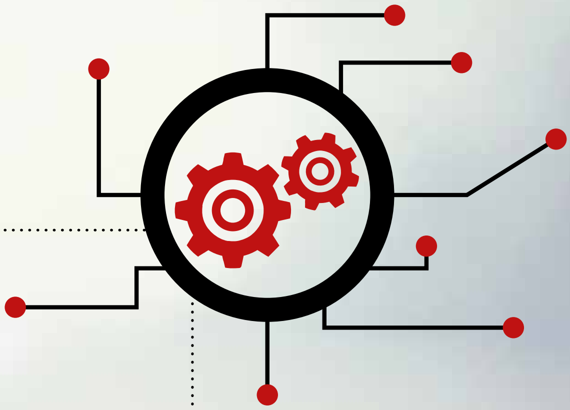
One such innovation is the integration of real time location systems – or RLTS - into a host of production assets that tend to be very nomadic, such as gauges, fixtures, measuring devices, test equipment and more. Knowing where they hide out can save money by lowering capital investment and reducing downtime. There are different technologies out there, using RFID (passive) and BLE (active Bluetooth low energy). The trick with all this stuff is to make it simple to use and focused on what the end user really needs. Flashy dashboards with tons of graphs and analytics look great, but it's usually just a simple location ID that allows the user to quickly locate an asset. Accuracy can be affected by the physical environment, and where and how many gateways are deployed to receive data transmissions. However, knowing the general position, within a meter or so, will normally be enough, and the current technologies can deliver on this. Metrics that log and analyze location history allow for greater optimization in the use of production assets for further indirect cost savings.



MATRIX on production floor

MATRIX on production floor

MATRIX



Smart Manufacturing

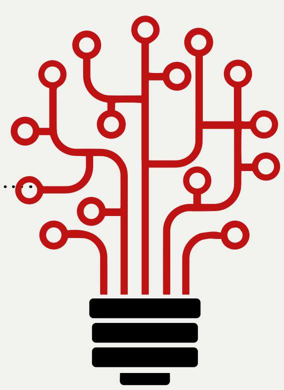
RFID chips on tooling and adapters can be loaded with tool assembly and other production data to allow for an error-free experience at the point of use. Tooling is placed in a modular housing where the chip data is read and transmitted to the tool management software, which then limits vending to tools authorized for the job. The cost of using the wrong tool can be exorbitant and lead to scrapped parts, delayed orders and risks that could compromise the manufacturer's reputation.
In aerospace, for example, it is critical to eliminate the risk of using the wrong tool.

Cloud Tool and Data Management

Several companies already offer cloud-based applications to find, select and assemble the right tools for the job. Many cutting tool manufacturers develop and offer their own digital catalogs and tool selection apps. Integrating all of these with job planning and vending platforms makes sense and some vending systems offer this important feature.

Real-Time Data Analysis

Pulling it all together with advanced reporting options, analytics and customization is essential for targeted and efficient navigation through the huge quantities of data that a vending system can generate. This includes thousands of SKU's, hundreds of thousands of transactions, multiple users, cost centers, logistics parameters and more. Mining out what you need and calculating the performance metrics will make all the difference between staying ahead or drowning in all that data.



What's next

The above innovations already provide us with tangible advances, bridging the gap between the past and the future smart factory - where AGV's, artificial intelligence and robotics will probably deliver tools to the point of use just in time.

Indexable Tools Challenge Solid Carbide for Small Diameters

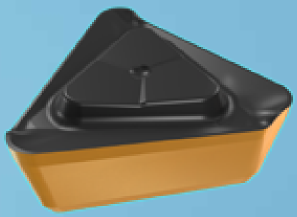
Rotating one-piece solid carbide tools traditionally dominate the market for diameter ranges of up to 20 mm (.75") and indexable tool manufacturers have not yet succeeded in penetrating this solid stronghold. Several important factors contribute to the historical perception of solid carbide as a better bet for tooling reliability.

Solid carbide tool accuracy compares favorably with that of indexable tools, particularly for small-diameter endmills and for tools with diameters beyond the range. However, the role of reduced accuracy for tools of small diameter (for example, a milling cutter's radial run-out) increases in significance as a factor affecting tool life.

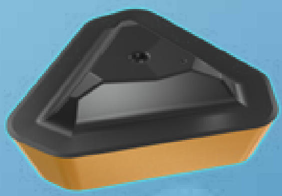
An indexable tool is made up of a tool body, replaceable inserts, and mechanical parts such as clamping screws or wedges, which secure the inserts in the body. Decreasing the tool diameter necessitates reducing dimensions of the assembly components. Reducing the size of the securing elements leads to weakening their strength and the tool becomes unable to withstand cutting loads under normal machining data. This seriously limits the tool application; further decreasing may cause degradation of the entire assembly structure.

The prices of small rotating tools are often high compared to the assembled concept, which adds to the perceived limitations of indexable tools in the small diameter range.

NANMILL



NANMILL
NANO ENDMILL



NANFEED
NANO FEED MILL

HELI3MILL
HM390 LINE

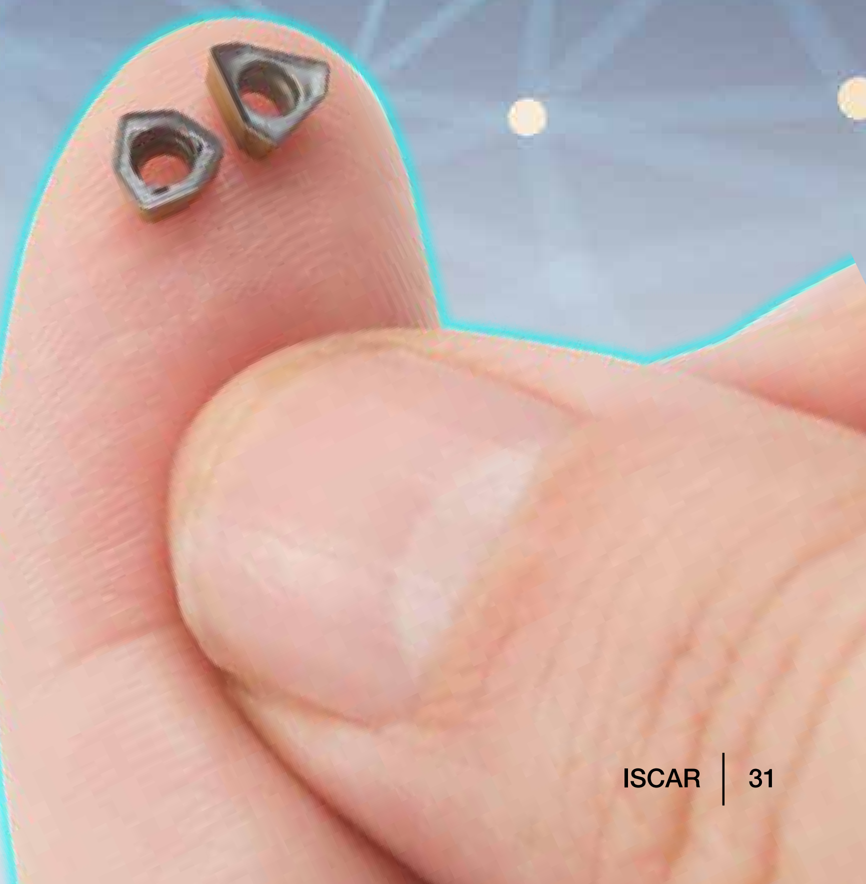
MICRO3FEED
MF 300 ENDMILL

HELI4MILL
HM490 LINE

HELI4MILL
HM490 LINE

SUMOCHAM
CHAMDRILL LINE

An indexable tool is made up of a tool body, replaceable inserts, and mechanical parts such as clamping screws or wedges, which secure the inserts in the body.



The Indexable Option

Indexable tools possess several distinct advantages that makes applying these tools within the above range very attractive in the eyes of the customer. In many cases, especially in rough machining, changing a worn cutting edge by simple indexing provides economic benefits compared with having to replace a whole life-expired solid tool with a new tool. In addition, there is no need to use up time and resources on regrinding and recoating worn-out one-piece cutters.

Tool manufacturers have made significant progress in developing reliable designs that could be commercially viable against the solid carbide concept. Work in this direction has shown results already, and assembled mills and drills with interchangeable cutting heads are proving to be a realistic alternative to solid carbide tools.

Competitive performance

The introduction of tools with replaceable solid carbide cutting heads signifies a change in focus. ISCAR provides two examples of this concept with the ISCAR MULTI-MASTER milling line and the CHAMDRILL line in drilling.

Performance and accuracy characteristics have positioned the new tools to be functionally competitive with solid carbide designs. Versatility of these lines, where a head can be mounted in different bodies and vice versa where a single body can carry different heads, facilitates various assembly combinations and contributes to reducing items in tool stock.
Another important design approach - “no set-up time” - characterizes these lines, as a worn-out head does not require spending time on set up and can be replaced while the tool is still clamped in the machine tool spindle. This cuts cycle time and, consequently, reduces production costs. In contrast, replacing a worn-out solid carbide mill or drill inevitably leads to a new set-up procedure.

In addition, the concept ensures sustainable use of cemented carbide with all the associated advantages. The principle of “indexable” carbide tools has distinct merits and features strongly in tool design within the diameter range that is under discussion. The minimal diameter of MULTI-MASTER milling heads is 5 mm (0.2") and that of SUMOCHAM drilling heads is 6 mm (0.236"), while the MULTI-MASTER combined countersink heads for center drilling feature a minimal 1 mm (0.04") diameter.

The LOGIQ factor

ISCAR has recently introduced a new range of small size indexable rotating tools under its LOGIQ range, featuring cutters with a nominal diameter of up to 20 mm (.75"). The new families of indexable milling cutters within the diameter range of 8-16 mm (.315-.625") attract the most interest and possess several common features: the cutters carry triangular-shape inserts with 3 cutting edges and the mechanical part that secures the inserts is represented by a screw. These families are intended for milling square shoulder or fast feed (high feed) milling. But here the similarity ends, and the difference begins.

While the design of the HELI3MILL and MICRO3FEED families for tool diameter 10-16 mm (.375-.625") secures the insert by clamping the screw through the central hole of an insert, the NANMILL and NANFEED families for tool diameter 8-10 mm (.315-.394") adopt a different concept, as a central clamping screw is not feasible within such a small diameter range.

According to the new concept, the screw is located above the insert, and the screw head plays the role of a wedge. This approach provides reliable and rigid clamping, ensures a durable homogeneous insert structure with no hole, and allows insert indexing to be quick and simple.

It is predicted that these new families will be particularly effective in manufacturing compact parts and in machining small-size cavities, pockets and small parts utilized in industrial sectors such as die and mold making, as well as in producing miniature components.

HELI3MILL Application

MICRO3FEED Application

NANMILL Application

NANFEED Application

Small change, large impact

A 1 mm change in size: is this a lot or a little? For indexable tools in the small diameter range, it makes a noticeable difference. ISCAR's new SUMOCHAM 4 mm (.039") diameter drilling head represents an important step ahead in expanding the application fields of indexable drills.

Within the small diameter range, indexable tools can offer precision and performance advantages that position them competitively against the more traditional solid carbide tools. Indexable tools are beginning to shear their way into metalworking practices - and the industry is taking note.

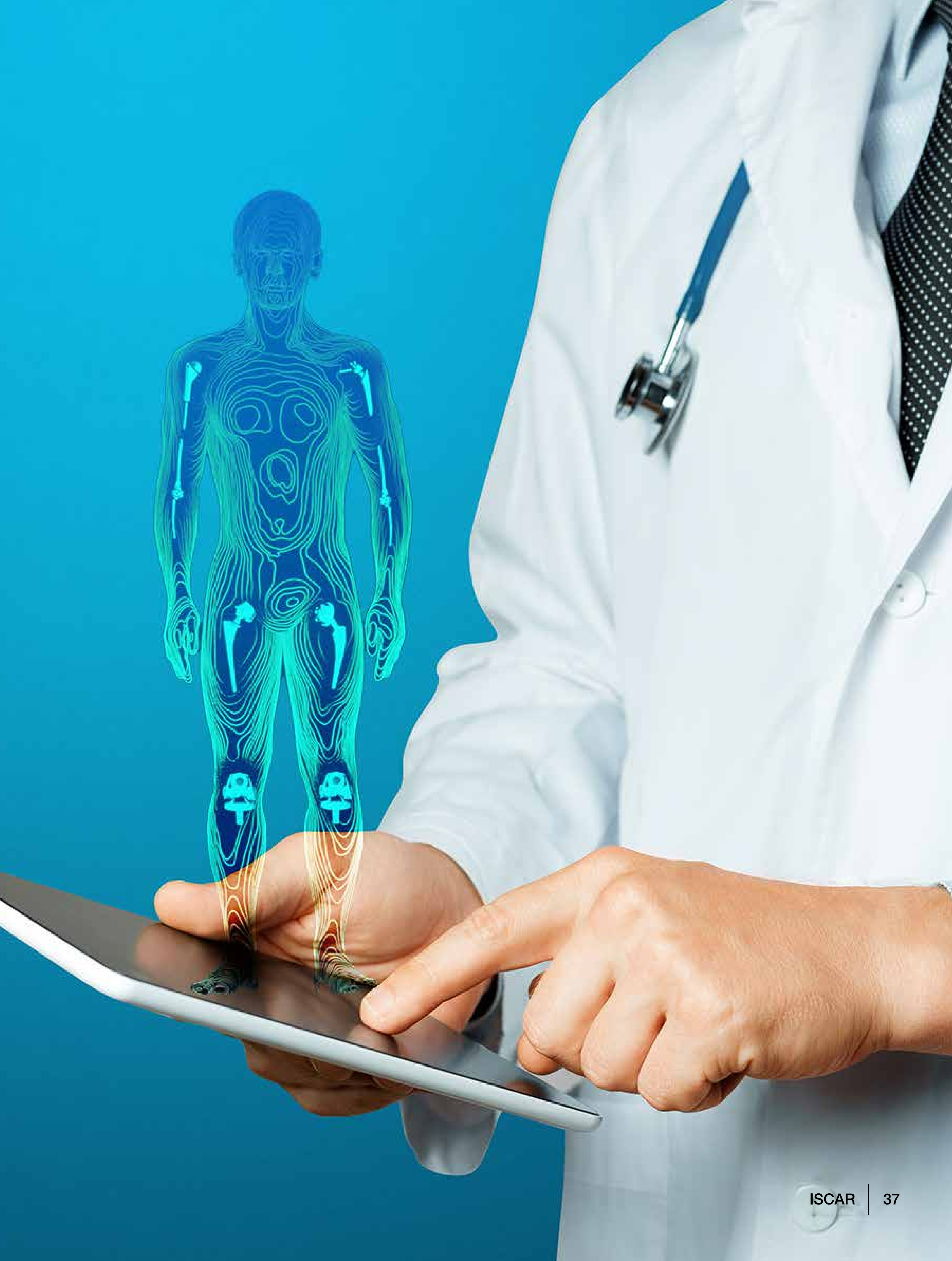
These new families will be particularly effective in manufacturing compact parts and in machining small-in-size cavities, pockets and small parts utilized

Machining Miniature Medical Parts

> The miniature medical manufacturing industry is one of the world's fastest growing industrial sectors and the demand continues to increase for smaller, more intricate and accurate medical industry parts. Machining intricate and minute devices, often using hard-to-machine metals such as titanium, represents a major challenge for metalworking shops, who need to develop a range of advanced capabilities to meet these specialized demands, especially when involved in small batches and prototype work

ISCAR conducted numerous research and field trials to develop a new range of cutting tools for miniature parts production in the medical industry. In addition, a series of modifications were applied to existing popular tools to enable the efficient and economical machining of miniature parts.

The expanded range of machining solutions for small scale cutting tools was made possible by developing user-friendly quick indexing inserts, suitable tool geometries, and by designing ultra-secure clamping systems.



CUTGRIP Application

Tools for Miniature Medical Parts

High Pressure Coolant Channel for Grooving and Turning

Incorporating a jet high pressure (JHP) coolant channel, the GHSR/L-JHP-SL tool family is an improved version of the popular GHSR/L screw-clamped tools. The tools are designed for Swiss-type and screw machines.

The insert clamping system enables the inserts to be fastened using a key from either side of the tool: the torx screw is inserted on one side, while a specially designed plastic screw blocks the opposite side to prevent chip entry. If indexing is required from the other side, the screw can be switched to the opposite side of the tool.

The GHSR/L-JHP-SL tools are manufactured in 10, 12 and 16 mm(.375, .5 and .63") shank sizes to hold GEPI and GEMI inserts carrying different chip former geometries, and the inserts range from 2.2 to 3.2 mm (.087 to .126") widths. Integrated jet high pressure coolant channels extend tool life and improve chip evacuation.

Turning small parts requires light cutting parameters, making small sized economical inserts more suitable than large inserts for this type of machining. The shorter head design of the GHSR/L tools allows higher rigidity and improved machining stability, which enables the application of higher cutting conditions to enhance surface finish.

HPC at pressure up to 340 bar

4900 PSI

SWISSCUT XL INNOVAL

A new SWISSCUT XL line featuring up to 10 mm (.394") grooving depth capability has been designed to enable deeper machining than that provided by the SWISSCUT INNOVAL line, with the aim of reducing the number of items needed by half and cutting users' inventory costs.

The clamping design uses a special screw that can be accessed and operated from both sides of the tool, enabling inserts to be indexed without the need to fully remove the screw.

This represents a significant improvement over existing tools, where the clamping screw must be fully removed for insert indexing and can easily fall and get lost.

PENTACUT

The popular PENTACUT line now includes 17 mm (.67") diameter PENTA inserts, designed with 5 cutting edges for machining miniature parts with up to 4 mm maximum grooving depth capability.

The inserts are produced in a range of widths from 0.25 to 3.18 mm, with different edge configurations for parting, grooving, turning and threading.

SWISSCUT Application

PENTACUT Application

PICCO Inserts
ISCAR expanded its range of PICCO inserts' application options and insert sizes by adapting insert geometry and a carbide grade especially for machining medical parts made from titanium, stainless steel, and other difficult to machine materials, including hardened steel up to 65 HRC. The family includes profiling inserts for minimum bore diameter range of 0.5 – 4.0 mm, with 0.02 mm corner radii and an internal cooling channel close to the cutting edge.

Advanced PICCOACE Tool Holders
The growing demand for high accuracy and flexibility in clamping orientation brought about an advanced new series of tool holders developed by ISCAR, the PICCOACE range. Featuring a patented clamping system, the tool holders set new standards in three highly important areas - accuracy, rigidity and clamping orientation flexibility.

PICCOACE's fast action and very secure clamping system increases machining efficiency by saving time when replacing an insert, ensuring rapid indexing and guaranteeing extremely high clamping repeatability of 0.005 mm.

The wide variety of Swiss-type machines available today has increased the need for multi-orientated clamping; however most of the existing tools provide a single clamping orientation. In contrast, ISCAR's PICCOACE offers a high-quality, universal solution that is suitable for all Swiss-type machines, enabling operators to install and remove the boring tool from any desired direction.

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MINCUT Grooving Line

New MIFR 15 inserts and tools for face grooving up to 15 mm depths and turning operations play a significant role in maximizing the possibilities for small scale tooling.

The new MIFR 15 inserts are screw-clamped into a long pocket on the MIFHR -15 bars with very rigid clamping, enabling high machining parameters and resulting in prolonged tool life.

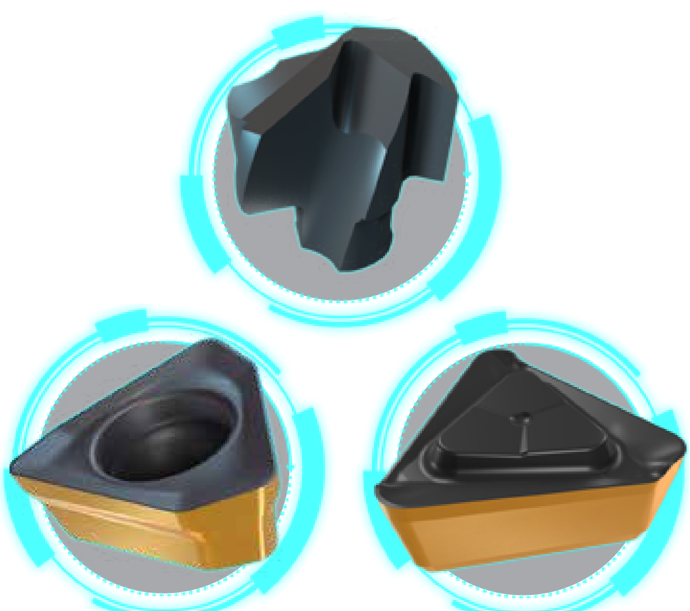
The MINCUT line includes MIFR 15 inserts in 2.5, 3.0 and 3.5 mm widths, as well as full radius 2.5 and 3.0 mm inserts made from IC908 grade.

Turning Miniature Parts
To accommodate small boring diameters, ISCAR has developed positive and negative boring tools with steel and solid carbide shank options, new small size inserts, and coolant channels directed precisely to the insert's cutting edges.

The tools carry new positive (single-sided) ground EPGT and CCGT inserts. The EPGT insert has a 75°geometry designed for a minimum bore diameter of 4.5 mm, and the CCGT insert features an 80° geometry for minimum bore diameter of 5.0 mm, with shank sizes in a diameter range of 4 to 7 mm.

Tools for negative (double-sided) inserts Dmin=12 mm carry ground WNGP and DNGP inserts. WNGP has an 80° geometry for a minimum bore diameter of 12 mm and DNGP features a 55° geometry for minimum bore diameter of 13 mm, with shank sizes in a diameter range of 10 to 20 mm for forward and back turning operations.

The VNGU, CNGX, CNGG and CXMG double-sided inserts with 4 cutting edges present an alternative to the conventional ISO standard positive inserts with only 2 cutting edges; operating similarly to positive inserts with the same corner angles, they provide the added advantage of double cutting edges.



Drilling with SUMOCHAM
The small diameter range of ISCAR's SUMOCHAM hole making line includes new drilling heads and tools covering diameters of 4 mm up to 5.9 mm, with 0.1 mm increments. The 4 to 5.9 mm drilling range is covered by 4 sizes of SUMOCHAM DCN drill bodies in 3xD and 5xD length to diameter ratios; and is designed especially for this industry. A user-friendly key was specifically developed to enable easy mounting with no set-up time.

The medical device and implant industries have made major and highly significant advances in miniaturizing medical parts; it is up to cutting tool manufacturers to enable the realization of these achievements by providing the tools for the job, however small.

A Road Map For Effective Cutting Tools In The Automotive Industry

Developing artificial intelligence applications and self-drive vehicle algorithms aren't the only challenges facing OEM automotive companies today. Consumer demand is increasing for new cars to be fully equipped with the latest accessories and technologies.

International authorities and environmental protection agencies try to keep pace with automotive developments by introducing relevant legislation and specifying automotive engineering and manufacturing standards that, at the end of this chain, affect vehicle costs.

Meanwhile, automotive OEMs are expected to supply consumers with state of the art equipment and enhanced car performance - and all for an affordable price.

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To achieve this complex goal and reduce the end price without compromising on quality, OEMS are constantly investigating how to lower production costs, which represent the most significant part of the total manufacturing cost. Global cutting tool making companies have been charged with identifying effective methods to lower production costs and ISCAR, following intensive task analysis and research, recommended first breaking down the overall goal into two objectives:

- Increase production floor productivity by implementing process efficiency measures
- Decrease cost per unit (CPU) by improving cutting tool architecture

ISCAR's expanded range of machining solutions for small scale cutting tools was made possible by developing user-friendly quick indexing inserts, suitable tool geometries, and by designing ultra-secure clamping systems.

Increasing productivity

The metal cutting process can be divided into two states: the cutting tool operation during material removal from the stock part and the air motion of the tool. This stage combines approach, retract and tool changing movements.

Cutting operation

Proper cutting conditions represent an important parameter while cutting. Cutting tool manufacturers provide their own recommendations for cutting parameters based on their rich experience and understanding of metal cutting processes at the microstructural level.

To meet these needs, ISCAR developed the ITA – ISCAR Tool Advisor application, a set of online adviser tools for users to enter desired job parameters and limitations, to obtain appropriate machining solutions for each job. The software selects the best available solution for the inputted application, providing cutting tool recommendations (including depth and width of cut and number of passes), cutting data, power requirements and productivity results for each solution option.

All parameters are expressed in the parameter MRR (Metal Removal Rate) and a higher value indicates higher productivity. Users can utilize the primary knowledge database to machine applications with optimal technology and cutting conditions, to achieve high productivity with maximum efficiency and minimum wastage.

Air motion

The air motion mode in the cutting process cannot be neglected in mass production, as idle movement time is costly. ISCAR approaches this issue by advising manufacturers to review their technological processes and to utilize a combined tools approach in order to reduce retract and tool changing movements.

Combined tools

As a modern full-solution technological process comprises dozens of tools, this contribution to production optimization is highly significant. Every combined tool design takes in account a machine center parameter, such as maximum cutting diameter, spindle speed limitations, spindle motor power, and more.

The picture on the right shows a combined tool designed by ISCAR, for machining a cast iron steering knuckle part. The tool combines drilling, front chamfering, back chamfering, shouldering, and bottom shouldering. By using this tool, cycle time is reduced significantly, and the customer can decrease chip-to-chip time by up to 60%.

As a modern full-solution technological process comprises dozens of tools, this contribution to production optimization is highly significant

Saving space

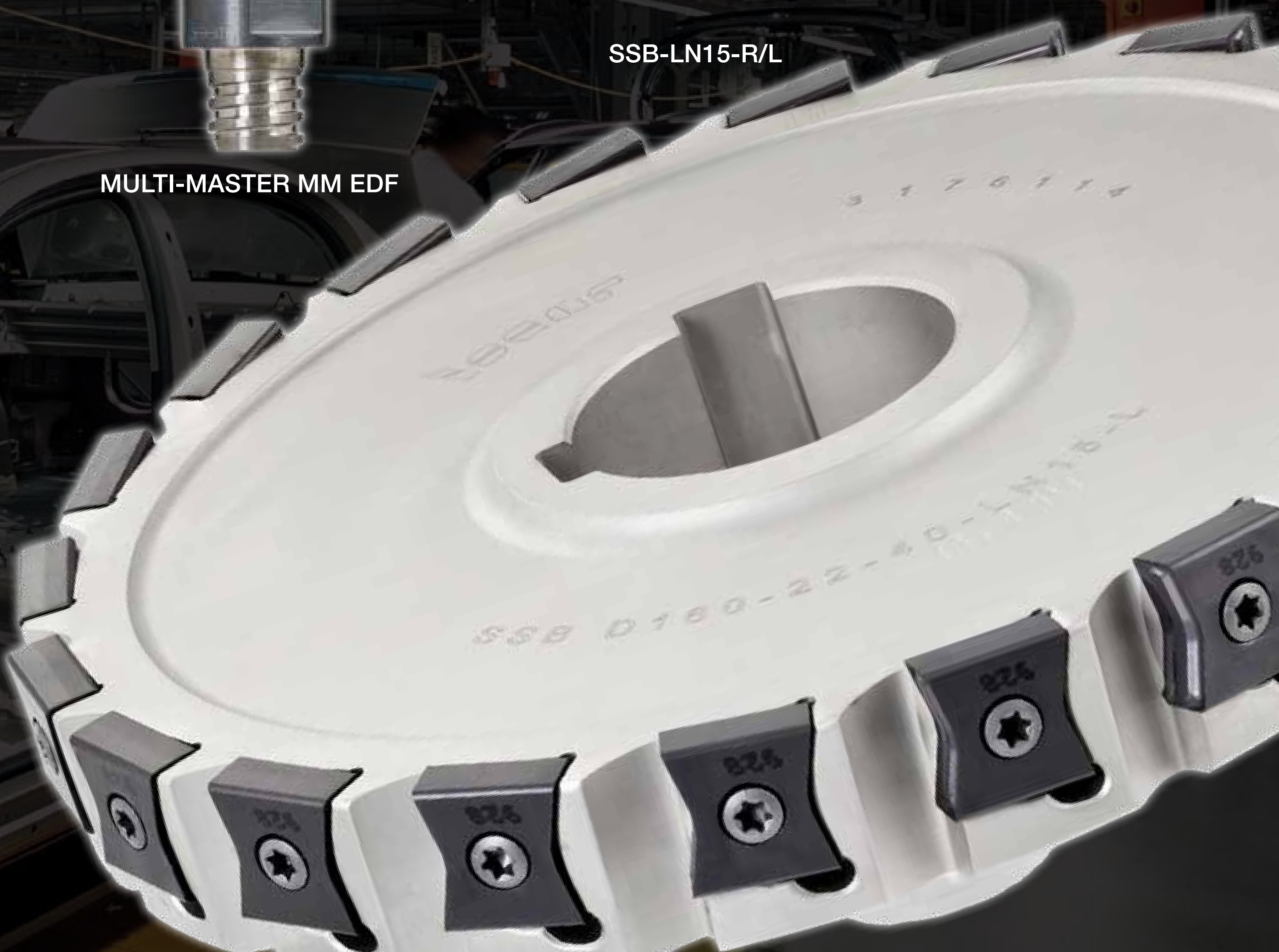
Combined tool designs also offer a solution for tool storage magazine capacity issues, particularly when production floor space is limited. Tool storage magazine capacity is proportional to the machine footprint and the machine size affects costs.

Shown on this page are a selection of ISCAR combined tools:
PRE-THREAD DCNT (M8-M24) Indexable head drills with chamfering inserts, used mainly for pre-thread holes.
MULTI-MASTER MM EDF Interchangeable 3 flute solid carbide heads for upper and bottom chamfering.
SSB-LN15-R/L Single-side cutting, disk type slotting cutters carrying tangentially clamped LNKX 1506 inserts.

PRE-THREAD DCNT

MULTI-MASTER MM EDF

SSB-LN15-R/L



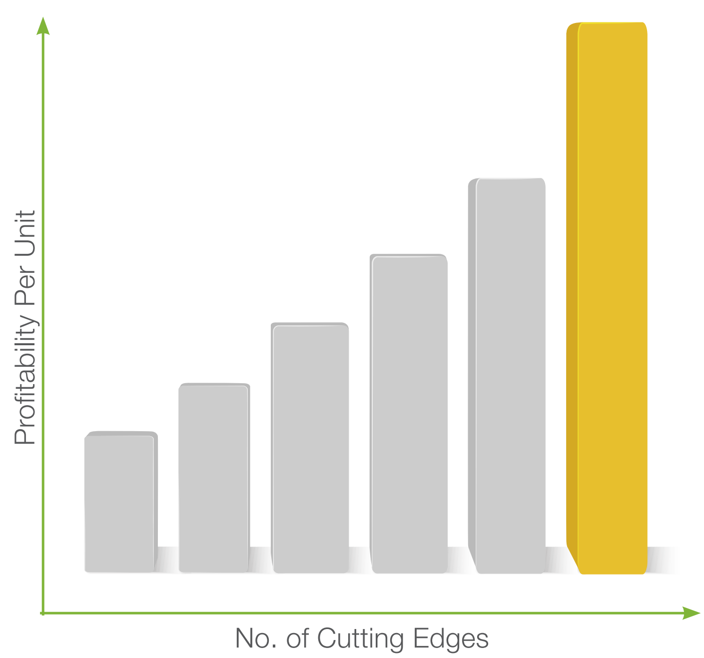
New Concepts for Cost Reductions

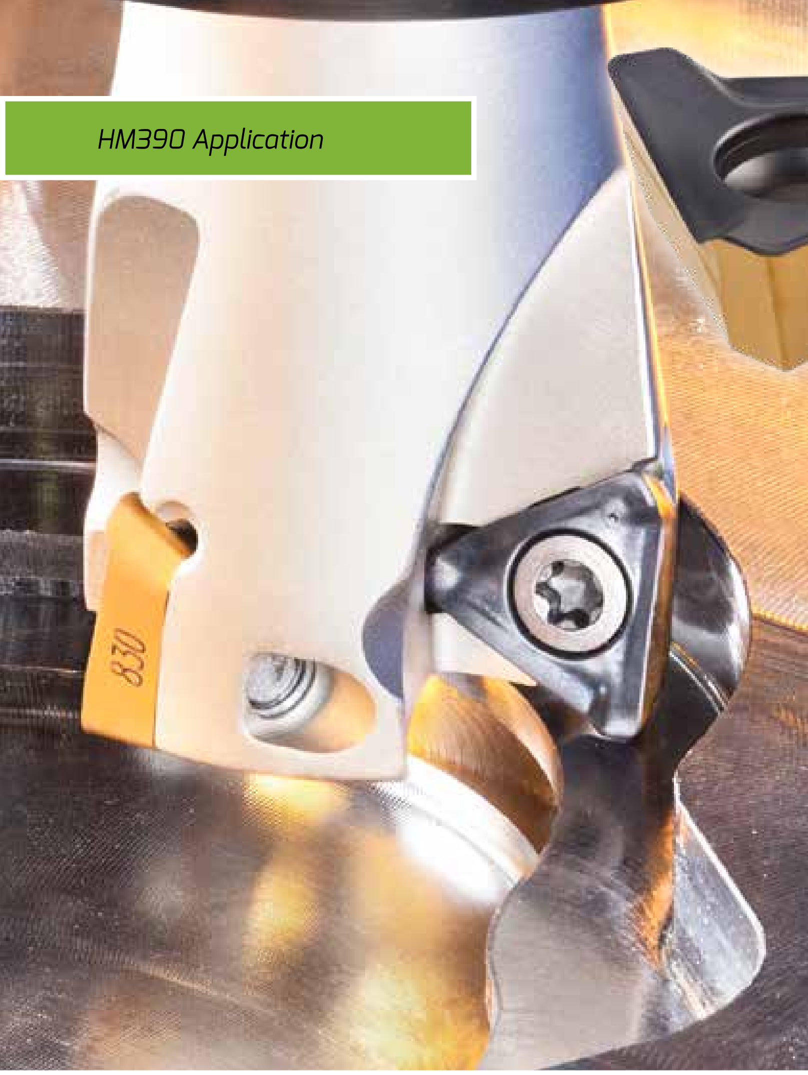
The number of cutting edges per insert represents a significant parameter for tools with interchangeable inserts, with a higher number of cutting edges decreasing the CPU.

Cost Per Unit (CPU) reduction
The bottom line for automotive OEM manufacturers is the cost of producing a part and cutting tools represents a variable cost factor in setting a cost per unit parameter.

Leading metalworking companies applied this concept to create new generation products with multiple cutting edges, with ISCAR developing a range of multi-edged products that includes the HELIQMILL, a tool family with three cutting edges that "evolved" from the well-known HELI2000 family. The HELIIQMILL HM90 ADCT 1505 HELI2000 radial clamped insert with two helical cutting edges was adapted to integrate three edges, resulting in the HM390 TDKT 1907 HELIIQMILL radial clamped triangular insert with three helical cutting edges while retaining the same price level.

A wide range of intellectual properties, stable insert production process, proper cutting-edge treatment and tight quality control: these points are considered essential for staying competitive and research and development of new materials and their implementation is an integral component of this multipurpose objective.





HM390 Application

Turbine Housing

Synergic cooperation between OEM and metalworking companies regarding turbo-chargers illustrates this strategy, where both parties aimed to optimize and stabilize the technological process of turbine housing production. The most common raw material used was steel DIN 1.4848 – an austenitic heat-resistant casting steel – but rationalization forces and cost reduction pressure necessitated a switch to cheaper alternatives: austenitic heat-resistant casting steels DIN 1.4837 and DIN 1.4826, which are more difficult to machine.
Leading metalworking companies were asked to find solutions to this new challenge. ISCAR achieved this with the integration of new insert material grade MS32 together with cutting edge geometry and treatment to produce tools with improved cutting conditions and maximum insert tool life, including the S845 SNHU 13 MS32 radially clamped insert with 8 helical cutting edges. And the market benefited from receiving new, dedicated tools for turbine housing production.

On the right track

This development shows how the collaborative manufacturer-OEM customer model has led to a new road in tool development, and how ISCAR applies its intellectual resources to create smart combined tools for improved productivity and reduced cost per unit. The automotive market benefits from the new applications and everybody stays on track in keeping down prices while optimizing performance.

S845 Application

The Right Grade For Industry 4.0 Productivity

> **Cutting tools have different design configurations. Some of them are assembled comprising a body with replaceable cutting elements (indexable inserts, for example), another is wholly produced from solid material. Functionally, a cutting tool may be divided into a cutting part that is involved in cutting, and a mounting part, which is necessary for mounting the tool in a holder or a machine spindle.**

A tool material is the material from which the cutting part of a tool is produced. This is the material that directly contacts a workpiece during cutting.

The tool material must be harder than the workpiece material so that it can cut the workpiece.
In machining, the tool material needs to withstand mechanical and thermal loads, and oxidation.
These factors cause gradual loss of the tool material or a change in its original shape: this is known as "tool wear". When wear reaches a certain limit, the cutting part cannot work, and the tool fails. The machining time interval, within which the tool cuts normally from its original (new) state to a failure, is known as "tool life". The tool must meet appropriate requirements of hardness, strength, and thermal and oxidation resistance to withstand wear and ensure an acceptable tool life.

Cutting tool manufacturers produce a variety of tools from different tool materials according to the desired tool application. "Which material is more suitable for my specific needs? Is the material of one producer better than another?" Customers often ask themselves these questions when selecting the tool or choosing their cutting tool supplier.

Industry utilizes the following tool material groups to produce cutting tools: high speed steel (HSS), cemented carbide (hard metal, HM), ceramics, cermet, and ultra-hard materials such as cubic boron nitride (CBN) and polycrystalline diamond (PCD). Each group features various types within the group; these are referred to as "tool material grades" or simply "grades".

Classification

International standard ISO 513 classifies tool material based on their reasonable applicability with respect to the materials. ISCAR adopted this standard and uses the same approach in tool development. In accordance with the standard, the tool material grades are characterized by a class of engineering materials, to which a tool produced from the grade can be applied successfully. Each class has a specific identification letter and color:

P	steel and cast steel except stainless steel with austenitic structure	aluminum and other non-ferrous metals and materials	N
M	austenitic and duplex (austenitic/ferritic) stainless steel and cast steel	high-temperature superalloys and titanium	S
K	cast iron	hard materials like hardened steel and cast iron, chilled cast iron	H

A classification number follows the letter to show the hardness-toughness ratio of the grade according to a conventional scale. Higher numbers indicate an increase in grade toughness, while lower numbers indicate an increase in grade hardness. Higher numbers represent increasing feed and lower numbers represent increasing speed.

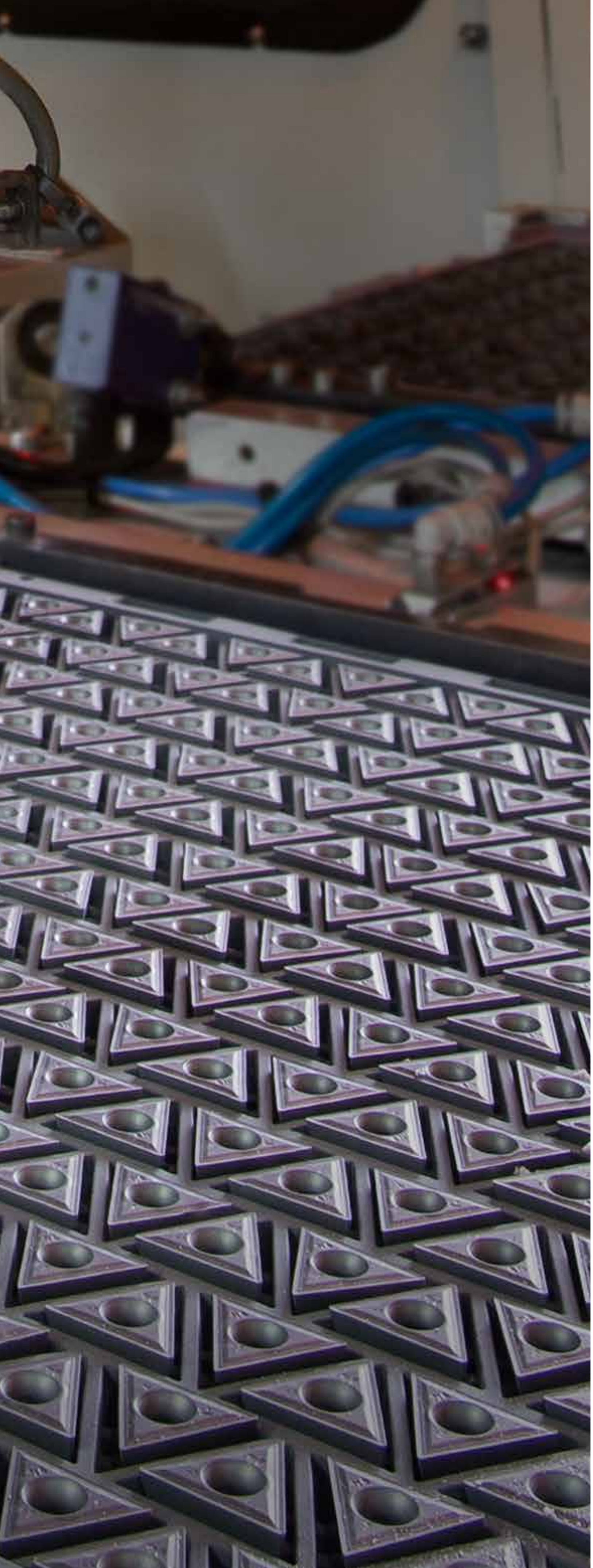
Cemented carbide

Cemented carbides are very hard materials and can cut most engineering materials, which are softer. Some carbide grades demonstrate better performance than others when applied to machining a specific class of materials.

A carbide grade is the result of combining cemented carbide, coating and post-coating treatment. Carbide is an essential component of the grade, while integration of integration of coating and post-coating elements depends on the grade application's main field. Produced by powder metallurgy technology, cemented carbide is itself a composite material and comprises hard carbide particles "cemented" by a binding metal, which is principally cobalt.

Main types of cemented carbide include tungsten (wolfram) carbide (WC), tungsten carbide and titanium carbide (TiC), and tungsten carbide, titanium carbide and tantalum carbide (TaC). Mixed binders, containing not only cobalt but additional elements such as ruthenium, may significantly improve grade performance.

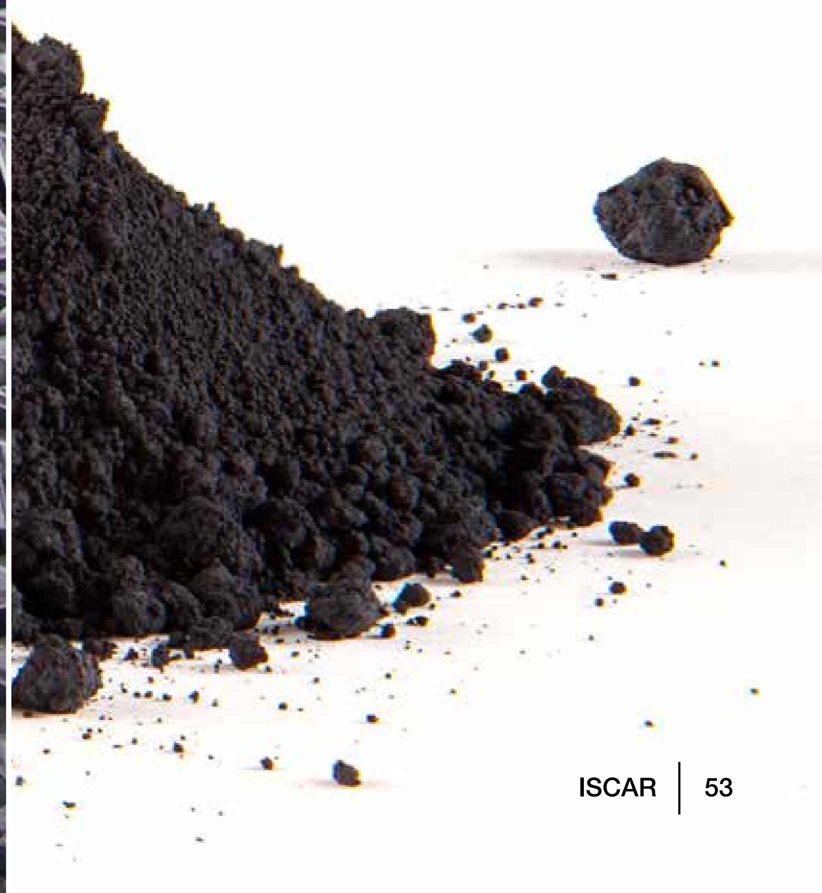
A carbide grade is the result of combining cemented carbide, coating and post-coating treatment



Most cemented carbides used for producing cutting tools integrate wear-resistant coating and are known as “coated cemented carbides”. Applying a thin-layer coating to a cemented carbide considerably improves the carbide’s working characteristics and the coating may be one- or multi-layer, depending on the number of coating materials. These include TiC, alumina (Al_2O_3), titanium carbo-nitride (TiCN), and titanium aluminum nitride (TiAlN). Post-coating treatment processes are applied to already coated cemented carbide, for example, to the rake surface of an indexable insert.

Coating Processes

Two methods may be utilized for coating: Chemical Vapor Deposition (CVD) and Physical Vapor Deposition (PVD). CVD coating is based on chemical reactions in a vaporized medium and PVD uses material sputtering. Technology development allows both methods to be combined for coating cemented carbides, as a means of controlling coating properties. For example, ISCAR’s carbide grade DT7150 features a tough substrate and a dual MT CVD (Medium Temperature CVD) and TiAlN PVD coating. The grade was originally developed to improve machining special-purpose hard cast iron.



A New Level of Productivity

Nano layered PVD coating

PVD coatings were introduced during the late 1980's. Applying advanced nanotechnology, PVD coatings performed a gigantic step in overcoming complex difficulties. Scientific developments resulted in a new class of wear-resistant nano layered coatings - a combination of layers with a thickness of up to 50 nm (nanometers) that demonstrate significant increases in coating strength compared to conventional methods.

Applying SUMO TEC technology

SUMO TEC is a specific post-coating treatment process developed by ISCAR to improve both CVD and PVD coatings: CVD and PVD. In CVD coatings, the difference in thermal expansion coefficients between the substrate and the coating layers causes internal tensile stresses and micro cracks. PVD coatings produce surface droplets. These factors negatively affect the coating and shorten insert tool life. The SUMO TEC treatment has the effect of making coated surfaces even and uniform by reducing and even removing the defects - minimizing inner stresses and droplets in the coating.

Classifying Grades

ISCAR, which produces a variety of cutting tools with cutting parts mainly fabricated from coated and uncoated cemented carbide, developed a tool material grade characterization system with designated letters indicating the material group and numbers representing identity codes. The numbers also provide quick information on the grade type - for example a two-digit number following "IC" in the designation of a cemented carbide grade means that it is an uncoated grade, while a three-digit number relates to a coated grade.

Occasionally, misconceptions occur concerning grade designation for a coating type. IC300, for example, relates to the specific grade in its entirety – including both the grade substrate and coating. Wording such as "grade IC328 but with coating IC300" is inaccurate; the correct definition would be "substrate as in grade IC328 and coating as in grade IC300".

Examples from ISCAR's material group classification system:

Letter	Definition
IB	CBN
IC	Cemented carbide and cermet
ID	PCD
IS	Ceramics
DT	Cemented carbide with dual (CVD+PVD) coating

“The best grade is a grade you have now”

When a new insert (solid carbide tool or replaceable cutting head) is developed, it is necessary to decide from which grade it will be produced. The answer to this question depends on the insert’s designated application and this represents a starting point for tool designers in their work. Grade properties and their relative hardness-toughness ratio will be the main determinants to take into consideration.
In some cases, stock availability and delivery terms may be the significant factors in the decision-making process.

As people engaged in production like to say, the best carbide grade is the grade that you have in your stock. This statement can be applied to the cutting tool as a whole; it is probably true if it relates to a production situation that requires an immediate decision. However, productive process planning - or effective tool stock management - requires a more in-depth applicative analysis of the pros and cons of the proposed carbide grades.

Selecting a grade is strongly connected with the cutting geometry of a tool and other factors. The cutting tool manufacturer should provide the customer appropriate information about grade properties to assist in their correct selection. While computerized grade selection systems are impressive and effective, often simple graphical figures, charts and tables can act as a good information "compass" to visualize a grade position in the field of application in accordance with standard ISO 513, and characterizing the grade properties compared with other grades.

ISCAR uses charts and tables to specify the cutting area of milling tools and proposes suitable grades for replaceable inserts in indexable milling cutters, solid (mainly solid carbide) endmills, and replaceable solid milling heads with Multi-Master adaptation.

ISCAR characterizes the grades as main and complementary. The main grades are more popular in machining specific engineering materials, but complementary grades can be effective as well in certain cases. When a main grade is not available for producing a certain product, a complementary grade provides an acceptable alternative.

The tables provide summary data for grade applications and the charts show “an applicative map of grades”, in coordinates of classification numbers from standard ISO 513. The figures often prioritize the main grades by numbers in brackets below the designation of a grade. Prioritizing is general in character and is intended to assist in selecting the correct grade when there is insufficient information about the application.

The basic principle for selecting the grades is that when abrasive wear is dominant, a hard grade should be used, whereas a tough grade is needed for substantial mechanical loading during cutting. For example, for finish milling with typically small machining allowance (machining stock), high cutting speed and low feed, hard grades will be more efficient. However, tough grades will be required for heavy-duty roughing that removes significant volume of material and features considerable cutting load.

Even with the myriad of digital options available today, tool manufacturers often prefer the simplicity and clear visuals offered by traditional tables and charts that provide important data in an easily interpretable and effective way, allowing optimal selection of the right tool materials for each application.

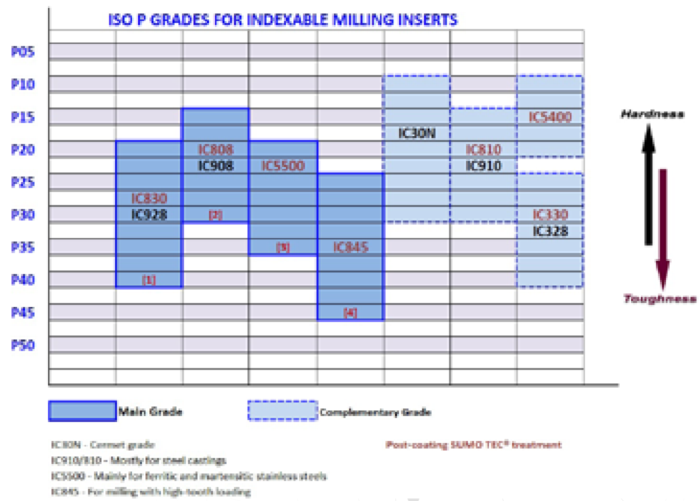
CUTTING TOOL MATERIALS FOR INDEXABLE MILLING

GRADE	ISO GROUP						NOTES
	P	M	K	N	S	H	
IC845	**P25-P45**						PVD
IC830/IC928	**P20-P40**	M25-M35			S15-S30		PVD
IC330/IC328	P25-P40	M30-M40			S20-S30		PVD
IC5500	**P20-P35**						CVD
IC808/IC908	**P15-P30**	M20-M30	K20-K30		**S10-S25**	**H20-H30**	PVD
IC810/IC910	P15-P30		**K15-K35**				PVD
IC30N	P10-P30					H10-H25	Cermet
IC5400	P10-P20						CVD
IC882*		M25-M40			**S20-S30**		PVD
IC840*		M20-M35			**S15-S25**		PVD
IC5820		M20-M35			S15-S25		CVD
IC5100/IC4100			**K10-K25**				CVD
DT7150			K10-K25			H20-H30	CVD+PVD
IS8			K01-K15				Si_3N_4
IC380					S15-S20	H15-H25	PVD
IC28				**N15-N30**			Uncoated
IC08				**N10-N20**			Uncoated
IC4				N05-N10			Uncoated

Post-coating SUMO TEC® treatment

* Post-coating treatment

Main application range of grades is emphasized by **bold**




MACHINING IN TELLIGENTLY
DUSTRY 4.0
LOGIQ 8 TANG
T890 MILLING LINE
LOGIQ 3 CHAM
THREE FLUTE
CHAMDRILL
0.8mm (.031")
LOGIQ 5 GRIP
PARTING & GROOVING
LOGIQ 4 TURN
POSITIVE
DOUBLE SIDED
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