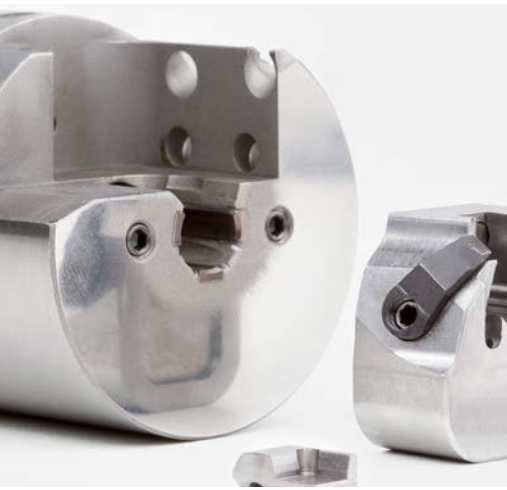




Your technology partner for machining  
**INNOVATIONS 2020**



When something exceptional develops between us:

**That's the MAPAL effect.**



**You**

don't want to do everything  
differently. But many things better.

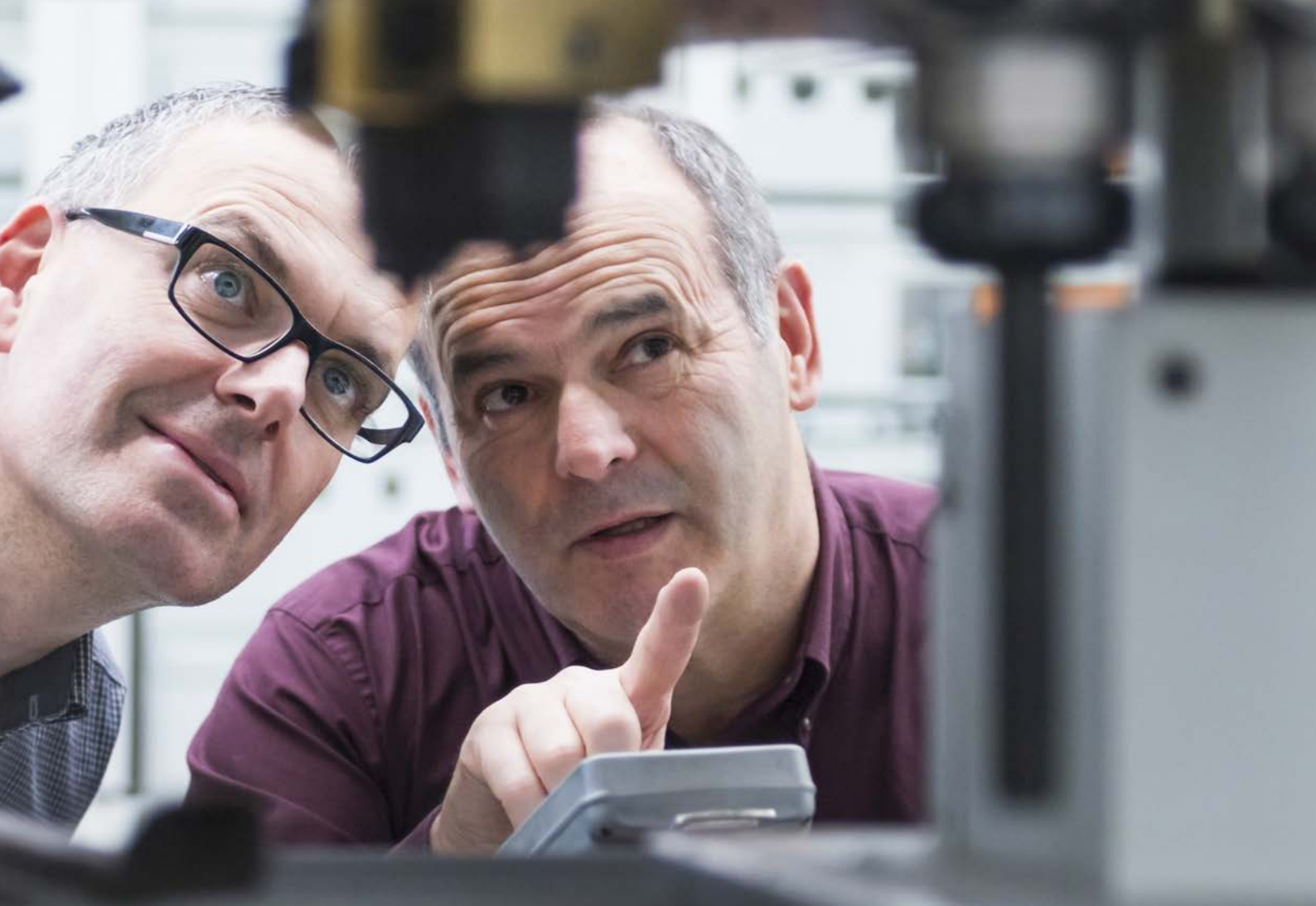
**We**

always find new ways  
to obtain more for you.

Opening  
up oppor-  
tunities

# Innovations

and product range additions 2020



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## Controlling the chip: reliable fine machining of steel materials

MAPAL will present a new chip guiding stage for steel machining to ensure reliable chip breaking. If long chips are produced during fine machining using tools with guide pads, the quality of the surface finish, the dimensional accuracy and the automated process sequence will be degraded.

If long chips wind around the tool, the tool can also be damaged. These problems are counteracted by the new chip guiding stage. Due to its special geometry, which was developed and optimised with the aid of comprehensive FEM analyses as well as practical trials, the chips are reliably broken, automated processes are not disrupted.

The chip guiding stage is compatible with all indexable inserts with AS lead as well as any coating. This means it can be integrated into the corresponding insert independent of the related application and ensures process reliability.

### AT A GLANCE

- Reliable chip breaking for steel materials
- Process reliability due to special geometry compatible with all indexable inserts with AS lead as well as any coating

### ADVANTAGES

- Reliable chip breaking
- High quality surface finish and dimensional accuracy due to short chips
- Long chips do not disrupt automated processes



## Very easy handling during the external reaming of small diameters

MAPAL has developed a new system to make the setting of external reamers with small diameters as easy as possible. The EasyAdjust system is integrated into a cassette for this purpose. The cassette can be removed to set the insert quickly and easily using a micrometer or measuring plate.

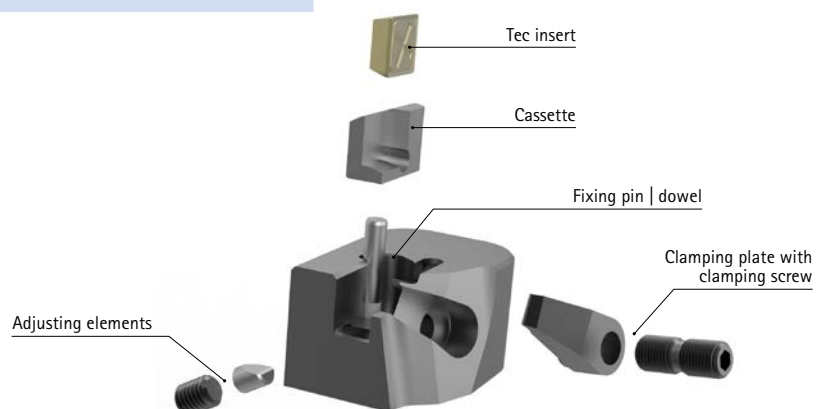
In the EA system, the back taper for the insert is already integrated into the receptacle for the insert. This feature completely eliminates the need to set the back taper on the minor cutting edge. It is only necessary to set the insert radial distance in relation to the guide pads. Thanks to greater changeover accuracy as well as the incredibly straightforward setting of the insert, reliable compliance with the required tolerances for highly accurate fits is significantly easier using the new system, even in the small diameter range.

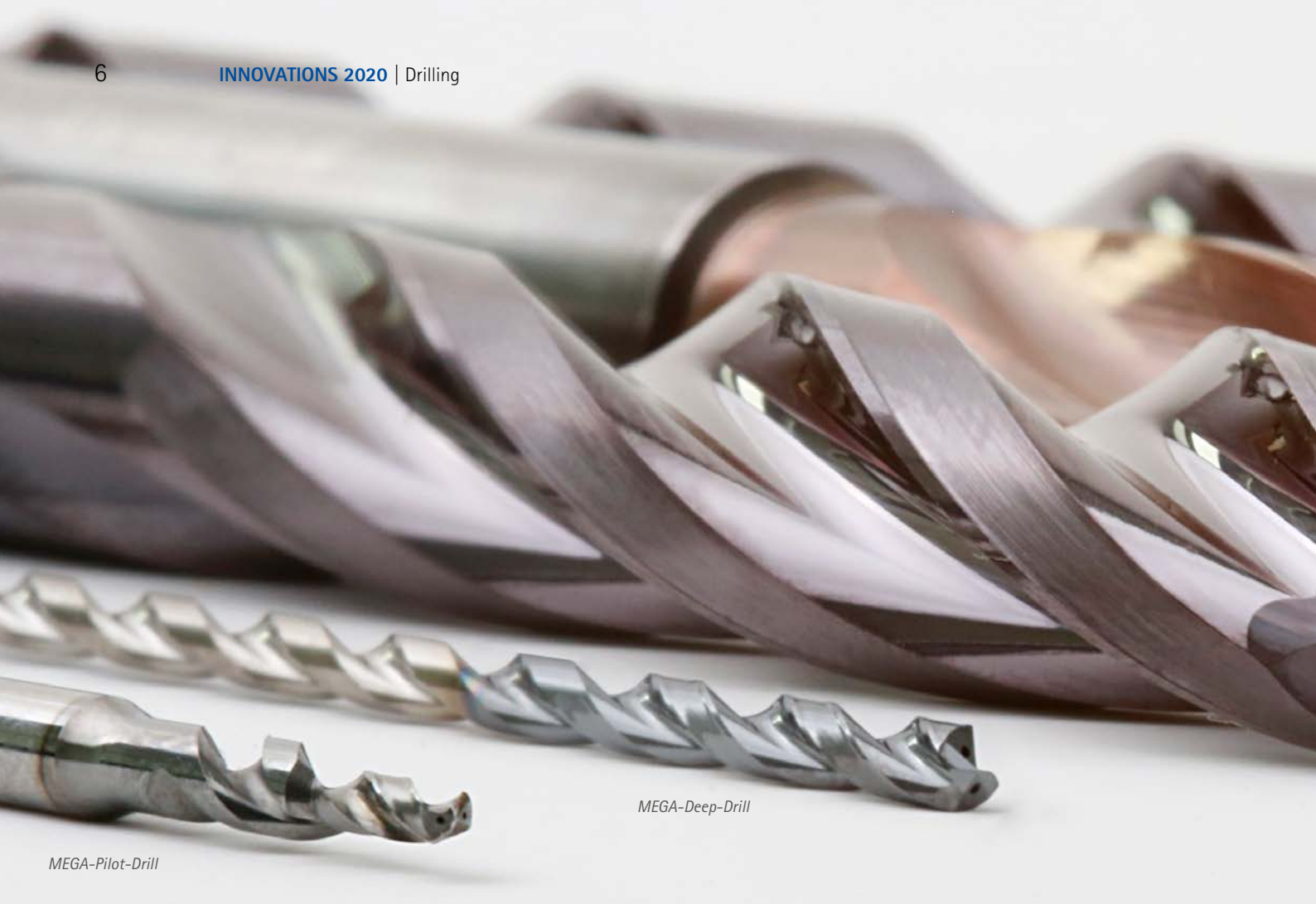
### AT A GLANCE

- New system for easy adjustment during the external reaming of small diameters
- Cassette for the EA system is integrated into another, removable cassette for this purpose
- High changeover accuracy (< 2-3 µm)
- Insert can be adjusted quickly and easily
- Back taper on the insert is integrated into the cassette that acts as the receptacle for the insert

### ADVANTAGES

- High cost-effectiveness and process reliability
- Reduced setting effort thanks to innovative cassette in cassette
- Easy handling
- Need to set the back taper on the minor cutting edge completely eliminated
- Reliable compliance with close tolerances





MEGA-Pilot-Drill

MEGA-Deep-Drill

## Better, faster, more cost-effective: drilling from solid in steel

During drilling from solid in steel, the focus is on quality, time and cost-effectiveness. And these topics are therefore also in the foreground during the development of new tools. Along with the Tritan-Drill Steel, which is the tool of choice for the highest cost-effectiveness even in difficult drilling situations, MAPAL has developed new tools for special applications with clear added value for the user.

### MEGA-Deep-Drill and MEGA-Pilot-Drill

If the deepest bores with the smallest diameters are required, MAPAL offers the optimal combination with the drills MEGA-Deep-Drill and MEGA-Pilot-Drill. The MEGA-Pilot-Drill is used as a pilot drill and is specially matched to the deep hole drill MEGA-Deep-Drill. The deep hole drill was developed specially for the small diameter range from 1-2.9 mm. Thanks to the newly designed chip flute and special face geometry, very high feeds and cutting speeds are possible. The MEGA-Deep-Drill has a head coating for optimal chip removal.

### AT A GLANCE

- For machining delicate parts
- Pilot drill and deep hole drill are optimally matched

### ADVANTAGES

- Highest feeds and cutting speeds
- Optimal chip removal

### MEGA-Drill-Hardened and MEGA-Speed-Drill-Inox

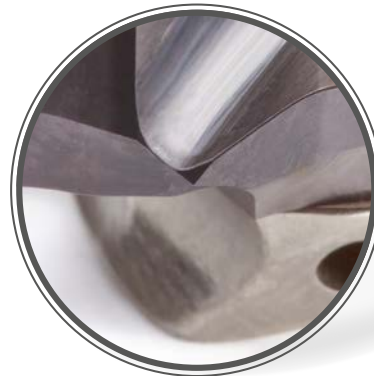
To be able to offer highly productive solutions for steel machining, also for hardened materials or for greater drilling depths, MAPAL has developed, on the one hand, the MEGA-Drill-Hardened and, on the other hand, the MEGA-Speed-Drill-Inox for machining depths of 8xD and 12xD. For the MEGA-Drill-Hardened, the macro and micro geometry of the tool was specially matched to hard machining up to 65 HRC. A new carbide substrate as well as an innovative coating ensure very long tool lives. On the MEGA-Speed-Drill-Inox, a new groove profile was developed specifically for drilling depths of 8xD and 12xD. The drill features chip spaces that become larger toward the shank; as a result the chips do not jam in the chip flute. The chip flutes are also very finely ground.



Tritan-Drill-Steel

MEGA-Drill-Hardened

MEGA-Speed-Drill-Inox



Pyramid tip  
for optimal self-centring.

### AT A GLANCE

- New MEGA-Speed-Drill-Hardened for hard machining
- Drilling up to 12xD using the MEGA-Speed-Drill-Inox

### ADVANTAGES

- Reliable machining with very long tool lives
- Optimally matched to the relevant application



### QTD indexable insert drill with pyramid tip

If steel is to be machined in unstable machining conditions while using the smallest possible amount of carbide at the same time, MAPAL offers a new indexable insert with pyramid tip for the indexable insert drill QTD. Due to the tip, the indexable insert centres itself; reliable bore entry is therefore ensured. The coating on the new indexable insert is also specially adapted to the machining of steel. In this way the wear resistance is significantly increased. The result is very long tool lives.

### AT A GLANCE

- Usage in unstable machining conditions
- Newly developed geometry

### ADVANTAGES

- Optimal centring behaviour
- Resource conservation – usage of carbide restricted to the indexable insert



## Drill-Reamer – drilling and reaming in one machining step

A proven means to manufacture cost-effectively and to reduce productive and non-productive times is to combine individual work steps.

For the complete machining of bores in short chipping materials, such as cast iron, as well as aluminium, MAPAL is announcing the new drill reamer with pyramid tip. This tool combines pilot-drilling, drilling from solid and reaming of the bore in only one pass.

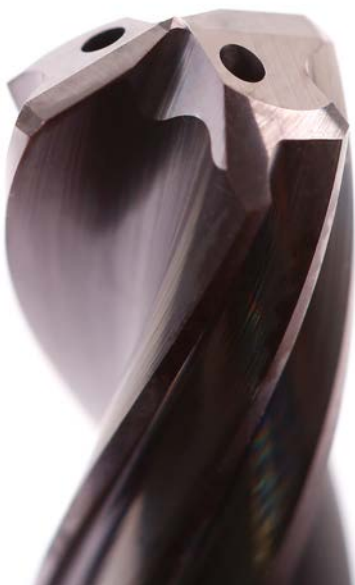
Along with optimal self-centring, the pyramid tip also ensures that the Drill-Reamer can enter the part without problems. Through the very small chisel edge with a tip angle of 140°, drilling is possible even in unstable conditions. The optimally designed reaming cutting edge produces the best surface finishes; a new coating makes long tool lives possible.

### AT A GLANCE

- Combination of drilling and reaming
- Versions with and without internal cooling
- Small chisel edge with a tip angle of 140°
- For bore tolerances > IT 7

### ADVANTAGES

- Reduced productive and non-productive times compared to machining using two separate tools
- Trouble-free entry into the material
- Optimal self-centring





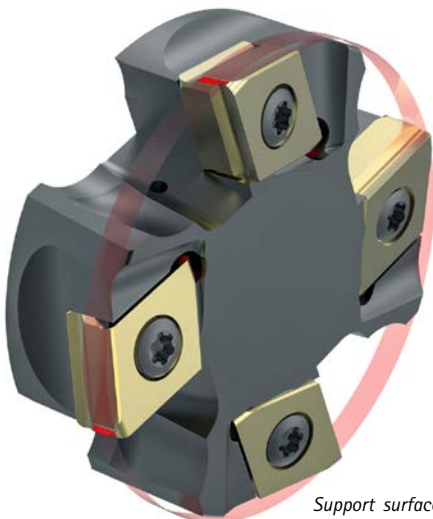


## Machining deep bores without vibration using indexable inserts

During boring processes with large depths or unstable machining conditions, vibration often occurs. This vibration degrades the quality of the bore and has a negative effect on the life of the tool.

MAPAL indexable inserts with arc shaped land have proven successful at eliminating this vibration. Very good results are obtained especially during the machining of cast materials. MAPAL is now combining the technical properties of an arc shaped land with the economic advantages of pressed inserts. The result is a highly cost-effective solution for boring processes with replaceable inserts.

Indexable inserts with arc shaped land are used for example for cylinder bores, during the machining of crankshaft bearing journals, hydraulic housings or also gearboxes for wind energy converters. The arc shaped land is in contact with the bore wall during the machining process and supports the tool. This support surface minimises the vibration that occurs. The arc shaped land is comparable with the arc land chamfer on a reaming tool.



*Support surface on the arc shaped land against the bore wall.*

### AT A GLANCE

- For large bore depths and unstable conditions
- Arc shaped land supports the tool in the bore and in this way prevents the occurrence of vibration
- From a diameter of 30 mm

### ADVANTAGES

- High quality surface finish
- High process reliability
- Increased tool life of the indexable inserts
- Reduced costs due to pressed basic geometry



OptiMill-SPM-Rough

OptiMill-SPM-Finish

## Milling from solid: high performance in aluminium and steel

MAPAL is expanding its portfolio in the area of high-performance milling cutters in the OptiMill family for aluminium and steel machining.

### Reliably machining structural parts made of aluminium

The full potential of new, powerful machines can be used with the new OptiMill-SPM milling cutters "Rough" and "Finish". They exploit their strengths especially during the machining of structural parts made of aluminium.

High infeed depths as well as the highest feeds during roughing are possible with the new OptiMill-SPM-Rough. The reason for this performance is its innovative knurled roughing geometry that ensures the power consump-

tion during machining is significantly lower compared to tools with a straight cutting edge. Furthermore, the heat introduction into the part is minimal due to the excellent plunging characteristics of the tool.

For finishing contours and pocket walls – even at large depths in one pass – MAPAL is announcing the OptiMill-SPM-Finish with newly developed geometry. It operates without problems even with large wrapping – also in the corners with enormous tool contact and a high load, the tool remains stable. The optimally designed cutting edge geometry ensures there is no vibration during the machining. The chip flutes are polished; as a consequence chip removal functions optimally.

### AT A GLANCE

- OptiMill-SPM-Finish and OptiMill-SPM-Rough for finishing and roughing
- For machining structural parts made of aluminium using new, powerful machines

### ADVANTAGES

- High cutting performance
- Vibration as well as heat introduction into the part are prevented
- Finishing large depths in one pass using the OptiMill-SPM-Finish
- Roughing with high material removal rate and high machining values using the OptiMill-SPM-Rough



*OptiMill-Uni-Wave  
extra long design*

*OptiMill-Uni-Wave  
with internal cooling*

**Optimal for slot milling in steel**

The OptiMill-Uni-Wave is the tool of choice if the issue is full slot milling with a groove depth up to 2xD in different materials. Due to its geometry, the highest machining rates are possible. Irrespective of all the advantages of the OptiMill-Uni-Wave, machinists often faced the difficulty that chip removal was not reliable, particularly in steel materials during the machining of slots with a depth  $\geq 1.5xD$ . For this reason, MAPAL now offers the OptiMill-Uni-Wave also with central internal cooling. This feature ensures optimal removal of the chips and longer tool lives. In addition, MAPAL is announcing the OptiMill-Uni-Wave as an extra long version. An efficient solution for roughing even in deep cavities is therefore now available. Despite its length, the new milling cutter is extremely stable due to its conically shaped neck.

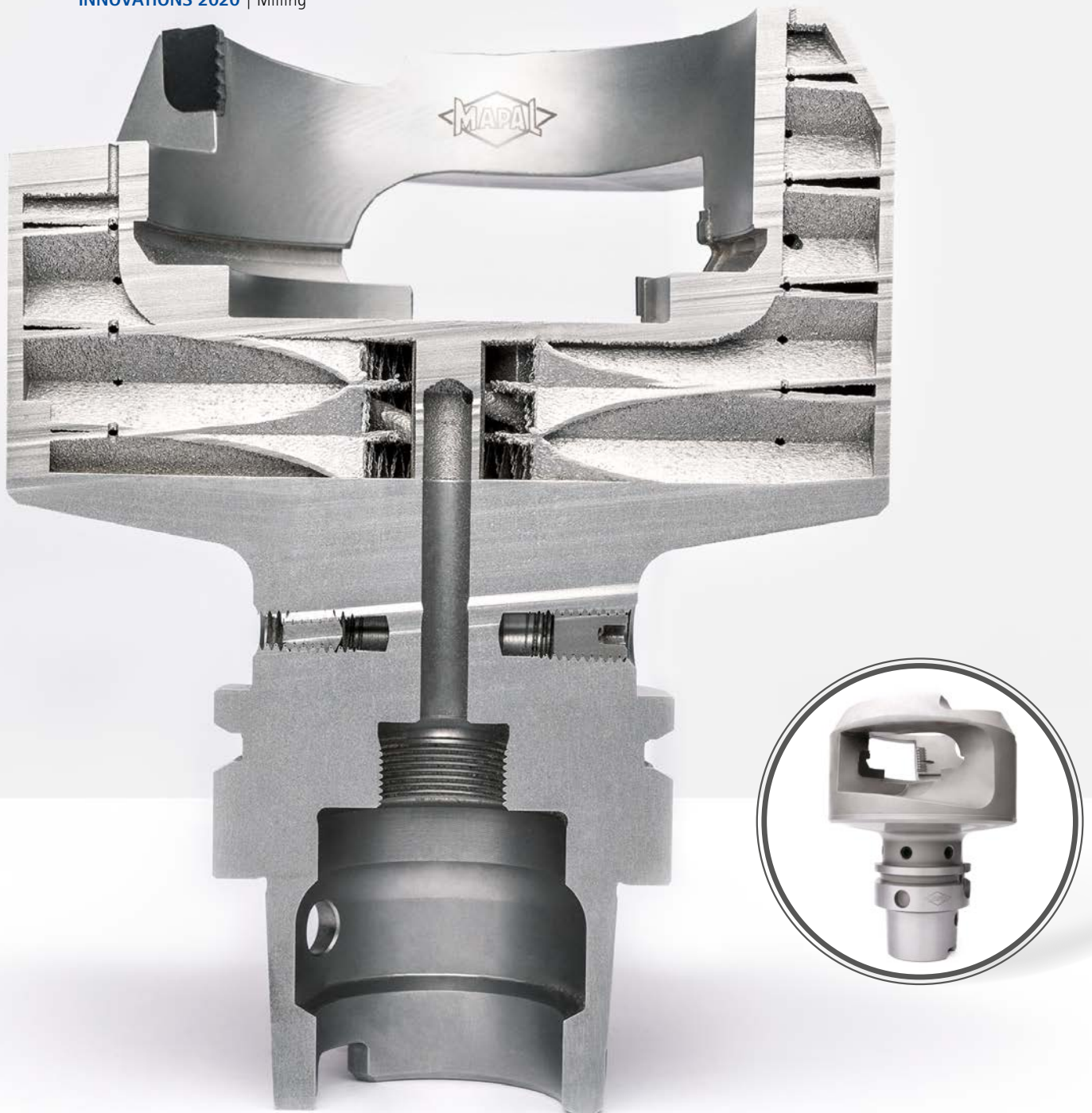
**AT A GLANCE**

- OptiMill-Uni-Wave now with central internal cooling and as extra long design
- Reliable slot milling also in deep cavities as well as in steel materials

**ADVANTAGES**

- Extremely stable also in extra deep cavities
- Optimal chip removal





## With additive manufacturing to more productivity

### **New bell tool with low weight, long tool life and best cutting data**

If the weight of PCD tools is reduced, as a rule significantly higher cutting data can be used. Along with design freedom, the possibility of weight optimisation is one of the crucial advantages offered by 3D printing. Due to the specially developed structures inside the tool, which cannot be manufactured conventionally, the weight can be reduced significantly.

An example of how MAPAL uses this advantage of 3D printing in practice is the new bell tools with brazed PCD inserts. Bell tools are used for the external machining of hose connections, among other applications. These connections, for example on turbochargers, must satisfy complex contour requirements. Manufacturing must be correspondingly precise. Existing processes are also subject to continuous improvement so that manufacturing is cost-effective and reliable in series production.

MAPAL has therefore optimised the existing, conventionally manufactured bell tool. Using the selective laser melting process, the inside of the tool has been modified – instead of solid material there is now a specially designed honeycomb structure. As a consequence the tool is 30 percent lighter and the tool life is increased by approx. 40 percent due to the damping effect. It is therefore possible to machine faster; the machining quality remains at the same high level.

In total the machining time has been reduced by 50 percent. Furthermore, the cooling channel design has also been optimised. The new bell tool is of hybrid design. Using selective laser melting, the new tool geometry is printed on a highly precise tool body with a HSK-63 connection. The additively manufactured part is subsequently machined conventionally. Then the PCD inserts are brazed in place and cut to shape using a laser.

### AT A GLANCE

- With additive manufacturing, tools can be designed with significantly lower weight
- Optimal coolant supply
- Combination of additive and conventional manufacture

### ADVANTAGES

- Significant weight saving
- Higher cutting data – reduced machining time
- Damping due to the honeycomb internal structure
- The same high machining quality

**Further examples:**

## PCD circular milling cutter in lightweight design

**Part:** Transmission housing  
**Tool:** Circular milling cutter (z=5, multi-stepped)  
**Application background:** Reliable MQL machining

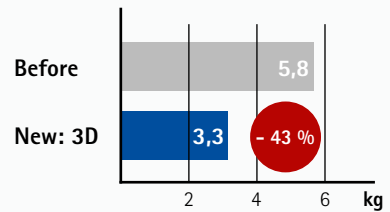


### Process improvement

- Increased tool life due to significantly better MQL spray pattern now with optimal cutting edge cooling. The chips are also removed better due to the cooling concept.
- The low weight results in smoother running. In this way chatter marks or occasional PCD chipping due to vibration is avoided.

### Weight reduction

- Sintered honeycomb



**Part:** Clutch housing  
**Tool:** Circular milling cutter (z=5, multi-stepped)  
**Application background:** Cycle time reduction

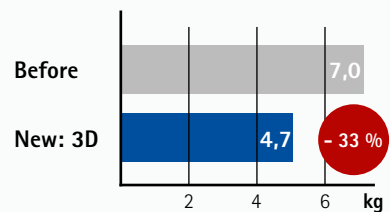


### Process improvement

- The reduced tool weight and as a result more favourable moment of tilt allows significantly higher spindle speeds.
- The number of teeth is also higher. As such significantly higher cutting speeds can be used.

### Weight reduction

- Sintered honeycomb





## OptiMill-Composite-Speed-Plus

### Highest process reliability during the machining of CFRP

The new milling cutter OptiMill-Composite-Speed-Plus is the logical further development of the OptiMill-Composite-Speed in relation to tool life and fracture strength. The diamond-coated solid carbide milling cutter with eight cutting edges is designed for the reliable machining of carbon fibre reinforced plastics. Due to a new high-performance substrate in combination with a reinforced core diameter, the fracture strength has been increased by 50 percent. The optimised groove profile ensures fast, reliable removal of dust and process heat even with extremely high machining volumes. The cutting edge geometry has been optimised for the requirements of brittle materials. Overall the tool life of the OptiMill-Composite-Speed-Plus is 20 percent higher than for the previous model. The unique face geometry with double point thinning also provides significantly improved plunging characteristics.

In particular, the significant increase in the fracture strength ensures a particularly high degree of process reliability during the machining of CFRP. As a result the OptiMill-Composite-Speed-Plus is optimally suited to usage in the aerospace industry. Thanks to the high-performance teeth, it is possible to rough or finish in one machining step. High feeds and cutting speeds ensure particularly cost-effective machining.

#### AT A GLANCE

- New high-performance substrate
- Optimised groove profile
- Double point thinning
- Cutting wedge for brittle workpiece materials

#### ADVANTAGES

- Fracture strength increased by 50 percent
- Tool life increased by 20 percent
- Improved plunging characteristics
- Increased process reliability





## UNIBASE-S – time saving and short distances due to storage close to production

MAPAL has developed the single automatic dispenser UNIBASE-S and optimised the aspects of ergonomics and ease of use for storing and managing frequently required consumables in a decentralised and space-saving manner. The display is now on the top of the device making operation easier. The software has been changed to the general UNIBASE software. The device can be coupled to existing UNIBASE systems and also used as a standalone solution.



Thanks to the compact dimensions, the dispensing system UNIBASE-S can be installed directly on the workbench. For example, the 96 or 192 compartments are ideal for storing indexable inserts, tools, chucks or personal production-related article procurement.

Article removal is quick and uncomplicated in just a few steps. For this purpose, the employee logs in directly to the device via the touchscreen. Optionally, logging in is even quicker via RFID chip or fingerprint. Only registered employees can remove articles. If an employee is not logged in, it is not possible to turn the dispensing drum and the dispensing compartments are closed. After the desired article has been selected via the software UNIBASE, an LED identifies the compartment with the corresponding article. The dispensing drum is rotated manually so that it is at the withdraw-

al position. After opening the dispensing compartment, the system automatically registers the removal of an article. As such the stock levels in the system are always up-to-date.

### AT A GLANCE

- Stock-controlled dispensing system
- 96 or 192 compartments, individual dispensing
- Central locking
- Employee login on the device including logging
- Pre-installed software UNIBASE

### ADVANTAGES

- Production-related article procurement
- Inexpensive
- Compact dimensions – installation directly on the workbench



## Function meets design – industrial design with added value

Up to now, industrial and product design have played a rather less significant role during the development of chucks at MAPAL. The focus was primarily on reliable function. As a result the developers have gradually built up a broad portfolio that, however, did not have a uniform appearance. To change this situation, MAPAL involved experts in industrial design.

### Carefully considered design taps potential

Not only the appearance of the chucks was to be revised, above all added value for the customer was to be generated by means of carefully considered industrial design. Why? An in-

genious design is not only a visual highlight, it also taps economic and ecological potential. Starting from this point, the product designers prepared, together with those responsible for the products at MAPAL, a new concept that is also based on function and FEM analyses.

The chucks designed according to this concept shine proverbially with a new brilliance. One of the elements in the new concept is the brilliant surface finish. This surface finish, produced by a specially developed polishing method, ensures that the chucks are more resistant to corrosion than in the past.

### Easy, self-explanatory "foolproof" handling

A further requirement on the new design was so-called "foolproof handling"; that is the easy, self-explanatory handling of the chucks. Controls were to be identifiable as such more quickly, handling information directly understandable. These requirements were addressed, on the one hand, by the blue colour for the controls, such as the actuating screw on a hydraulic chuck and, on the other hand, by internally developed symbols that contain corresponding information, independent of the related language.



**NEW**  
design  
concept



Last but not least the shape of the chucks, their weight and use of material were studied and optimised. The new shape addresses the requirements for the greatest possible stability with optimal usage of resources. Even the smallest weight savings on chucks have major effects that become apparent in use over the long term. Among other aspects, the lighter the chuck, the less energy is required during the acceleration and braking of the spindle.

**Corporate design creates recognition**

Due to the new corporate design, the complete clamping technology range can be immediately identified as stemming from MAPAL – everything clearly comes from the same place with a promise of quality and function. This is all the more important for the company because historically MAPAL is not often perceived as a manufacturer of chucks.

**AT A GLANCE**

- New design concept for chucks with added value
- Brilliant surface finish and clear handling information
- Expansion to the entire chuck programme planned

**ADVANTAGES**

- Corrosion-resistant chucks
- Self-explanatory, straightforward handling - foolproof
- Greatest possible stability with optimal usage of resources

## Digitalising in small steps with c-Connect

The complete delivery chain is networked using the open cloud platform c-Com. Data are available to all involved. Data on tools and machines in production reach the cloud automatically via RFID chips and DNC servers. There is no manual transmission of data.

This or a similar concept is the ideal scenario for networked production. However, only rarely is this the scenario in reality. Complete networking mostly involves major investments. For businesses that want to get started in digitalisation without high costs, c-Com has developed the "c-Connect" module including the box of the same name.



The usage of c-Connect pays off for customers several times over. On the one hand, c-Connect makes it possible to transmit the tool data digitally from the setting fixture to the machine including the registration of the inventory movements. It is also possible to monitor, among other aspects, the machine status using the c-Connect Box by means of various sensors.

For this purpose, a c-Connect Box is mounted on each machine and connected to the machine using the USB port – quick and easy. In this way production facilities with entirely different machines can be networked quickly and without complications. c-Connect is independent of the machine controllers and therefore a low-cost entry model for digitalisation in the area of machining. No channels are closed with c-Connect, the digitalisation can be expanded gradually. For instance, all advantages offered by the other c-Com modules can be integrated.

### Directly transferring measured data

Where in large-scale series manufacture RFID chips and DNC servers are normally used, in smaller companies relevant measured data are often transferred from the setting fixture to the machine tool by means of manual entry. This procedure is not only time-consuming, it is also susceptible to errors and can, in the worst case, result in damage to the tool, machine or part. Such manual errors during data transfer are completely excluded using c-Connect. The setting fixture measures the tool and the measured data are then transferred automatically to the c-Com platform. The tool is scanned at the machine, the c-Connect Box retrieves the measured data from c-Com and transmits them to the machine tool at the press of a button. Not only are errors excluded, unnecessary non-productive times are saved. In addition, the inventory movements are registered in the c-Com platform. Furthermore, on the removal of the tool it is possible



to add tool data such as tool life or reason for replacement to c-Com. This feature makes it possible to digitalise the tool card.

#### Monitoring of the machine

With the c-Connect Box it is also possible to monitor all values that can be acquired using sensors. In this way the c-Connect Box checks and measures, for example, the temperature, the atmospheric humidity or the status of the machine signal lamp. If a defined value is exceeded or dropped below, a push message is sent immediately to the operator or the person responsible, for example in the form of an SMS, Twitter message or e-mail. The same applies if there are malfunctions. As soon as, for instance, the machine signal lamp switches to red, notification is immediate and the fault can be rectified. In this way, among other aspects, long downtimes during unmanned production, for example overnight, are prevented.

#### AT A GLANCE

- Most cost-effective machine networking on the market
- Tool data transfer to the machine and back to the cloud platform c-Com
- Transfer and evaluation of tool lives and reasons for replacement
- Monitoring and evaluation of states of the machine
- Notification issued about machine standstill
- Independence of machine controller and manufacturer

#### ADVANTAGES

- Manual errors while entering the tool data in the machine controller excluded
- Machine standstill minimised
- Effectiveness of the tools can be analysed
- Unnecessary non-productive times are saved, the machine can be set-up more quickly
- Simple, quick installation and commissioning of the system
- All data is available transparently to all involved in real time

OptiMill-3D-CS

OptiMill-3D-HF-Hardened



## New solid carbide milling cutters for tool and mould making

Under the product name OptiMill-3D, MAPAL is announcing a new high-performance programme of solid carbide milling cutters specially developed for tool and mould making. Along with extremely heat-resistant coatings and special carbide substrates, these tools are characterised in particular by the dimensions and geometries specifically adapted to mould making.

### High-feed machining with high material removal rate

Suitable for milling hardened parts with a hardness of 45–66 HRC, with the OptiMill-3D-HF-Hardened with four or six cutting edges MAPAL is announcing two new high-feed milling cutters for hard machining. So that the tools also work reliably even in difficult application conditions such as an interrupted cut, MAPAL has developed a special face geometry.

The milling cutter with four cutting edges is used above all for roughing as well as for pre-finishing. Due to the fewer number of cut-

ting edges and the related more generous dimensioning of the chip flutes, reliable removal of the chips is ensured. This milling cutter is also the tool of choice for machining with long projection lengths and in deep cavities.

The milling cutter with six cutting edges can be used optimally for roughing and pre-finishing, as well as for finishing flat surfaces with a high feed rate. It produces the best surface finishes and flatness. The equivalent, the OptiMill-3D-HF, with three and four cutting edges is available for soft machining. The dimensions here are matched to the OptiMill-3D-HF-Hardened.

### Highly accurate corner radii for maximum precision

The corner radius milling cutter OptiMill-3D-CR-Hardened is used for finishing 3D moulds up to a hardness of 66 HRC. It produces very good, smooth, high-gloss surface finishes with maximum feed rate. Crucial here are the highly





OptiMill-3D-HF

OptiMill-3D-CR-Hardened

You will find ISO tools for tool and mould making on the next page

accurately manufactured corner radii. The OptiMill-3D-CR-Hardened is available in the diameter range 4-12 mm with different lengths and corner radii.

**Efficiency in pre-finishing and finishing on 5-axis machines**

The new circular radius milling cutters OptiMill-3D-CS are predominantly used in mould making in deep cavities, for complex free-form shapes as well as for the manufacture of turbine blades and impellers. The special feature of the tools is the optimal geometric combination of radius and form cutter that makes a larger path spacing during pre-finishing and finishing possible. The machining time can be significantly reduced and the quality of the surface finish on the parts significantly improved. For machining deep, difficult-to-access cavities, the OptiMill-3D-CS in droplet shape is the first choice. Large surfaces and surfaces with tool restrictions are machined highly efficiently using the milling cutter in the tapered shape.

**AT A GLANCE**

- High-feed milling cutters with special face geometry for high-feed machining with high material removal rate
- Corner radius milling cutter with highly accurately manufactured corner radii for finishing 3D shapes
- Circular radius milling cutters with large effective radius for finishing complex free-form surfaces and complex workpiece geometries
- Broad standard programme with different lengths and corner radii
- Extremely heat-resistant coatings as well as special carbide substrates

**ADVANTAGES**

- Very high cost-effectiveness and performance thanks to high feed rates and long tool lives
- Broad standard programme for high availability
- High process reliability due to geometries specially adapted to the application



## Comprehensive ISO milling cutter programme for tool and mould making

MAPAL announces a new programme of milling cutters with ISO indexable inserts. This programme includes round insert milling cutters, high-feed and 90° shoulder milling cutters, ball and toric end milling cutters as well as finishing milling cutters for machining cast iron, steel, stainless steel, non-ferrous metal as well as hardened workpiece materials up to 65 HRC. Depending on the material to be machined and the requirements, different cutting materials and coatings are used.

Included in the programme is a round insert milling cutter that is ideally suited to roughing and pre-finishing. The round inserts are installed in a neutral position. It is thus possible to machine contours highly precisely. The soft cutting behaviour ensures low vibration machining.

For roughing with very high removal rates and extreme feeds, MAPAL is announcing a milling tool with a tool body that can be equipped with indexable inserts both for high-feed milling and also for 90°-shoulder milling. They are optimally suited to roughing in deep cavities and for use on less stable machines.

A further tool body in the new programme can be used as a universal milling system both with ball and toric inserts for pre-finishing and finishing. Thanks to the highly accurately manufactured insert seats and the vibration damping in the tool body, the milling cutters produce perfect surface finishes.

The new finishing milling cutter has been developed specially for 90° surfaces, face surfaces and contours. Due to the small corner radii it exploits its strengths particularly in steep areas if there is a high radial pressure acting on the tool.

### AT A GLANCE

- Round insert milling cutters, high-feed and 90° shoulder milling cutters, ball and toric end milling cutters as well as finishing milling cutters are available as standard
- For roughing and finishing machining cast iron, steel, stainless steel, non-ferrous metal as well as hardened workpiece materials up to 65 HRC
- CVD and PVD-coated cutting materials
- Arbor, end and screw-in milling cutters are available

### ADVANTAGES

- Cost-effective, efficient machining high
- Process reliability and flexibility
- Very smooth running
- Very long tool lives



1

**Round insert milling cutters**

- Ideal for roughing and finishing
- Cutting materials and chip guiding stages available for soft machining as well as for hard/finish machining
- Highly precise contours due to neutral installation position of the indexable inserts
- Soft cutting behaviour for low vibration machining
- Chip discharge protection
- Available as arbor, end and screw-in milling cutter
- Diameter range: 10-160 mm

2

**High-feed and 90° shoulder milling cutters**

- Universal tool system for the highest productivity
- One tool body with indexable inserts for high-feed and shoulder milling cutters
- Highest removal rates due to extreme feeds and large cutting depths
- Indexable inserts with two and four cutting edges
- Available as arbor, end and screw-in milling cutter
- Diameter range: 16-200 mm

3

**Ball and toric end milling cutters**

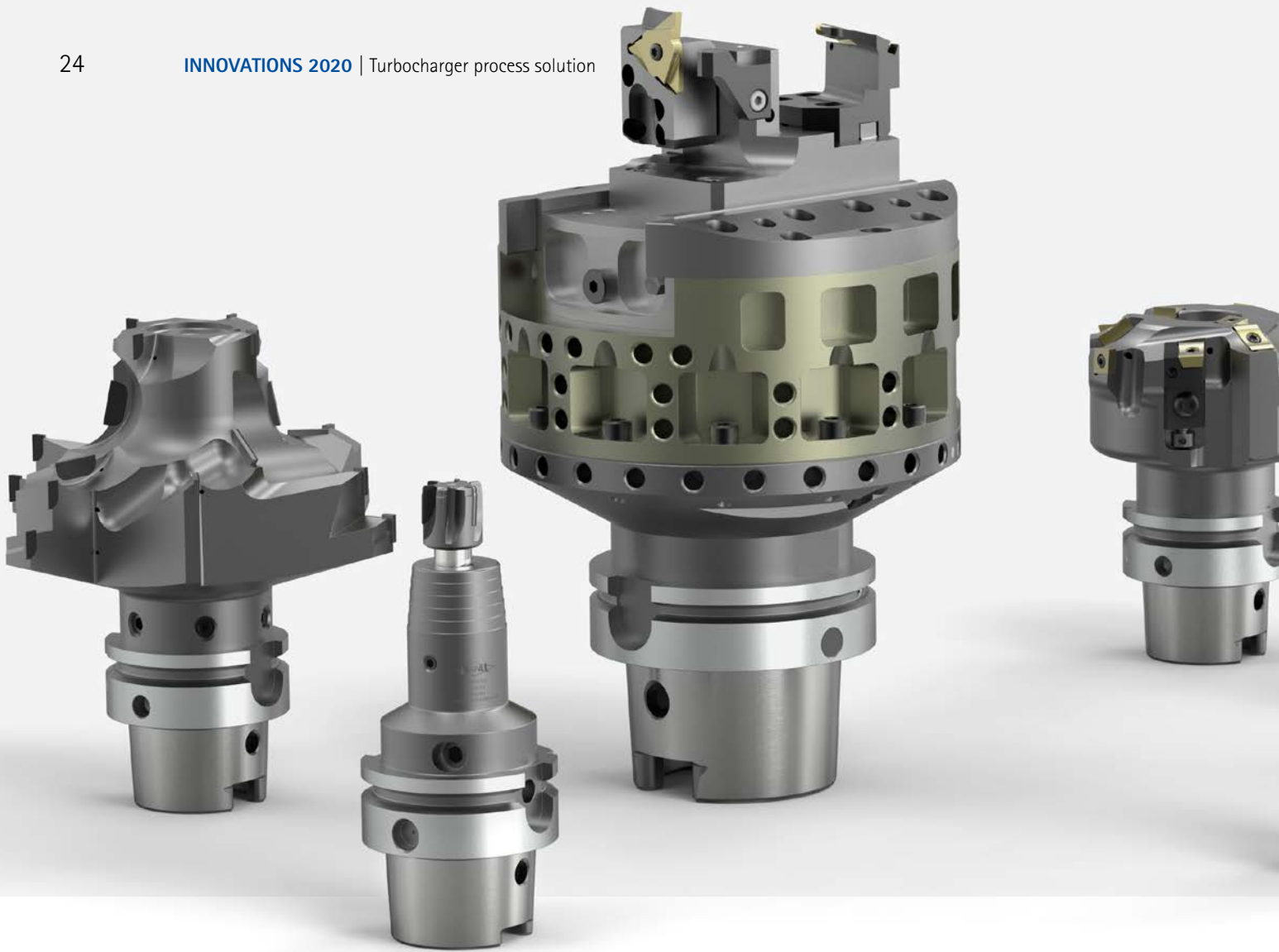
- Universal milling system for the highest productivity
- One tool body with ball and toric inserts for pre-finishing and finishing
- Highly accurate rotational tolerances
- Perfect surface finishes due to vibration-damped carrier tools made of solid carbide
- Increased process reliability due to the use of ultrafine grain carbide
- Available as end and screw-in milling cutter
- Diameter range: 8-32 mm

4

**Finishing milling cutters**

- Ideal for finishing 90° surfaces, face surfaces and contours
- Axial and radial wiper indexable insert for excellent surface finishes
- Vibration-free machining with long projection lengths
- Available as screw-in milling cutter
- Diameter range: 16-42 mm





## Reliable, cost-effective series production manufacture of turbochargers

MAPAL offers the complete process for machining exhaust turbochargers. As an example, four tools for machining the hot side demonstrate, on the one hand, the different machining tasks on a turbocharger and, on the other hand, show the variety of tools and know-how available from MAPAL in this area:



1

### Pre-machining V band and turbine internal contour

Along with the material, the interrupted cut is a challenge. MAPAL relies on a complex boring tool with ISO indexable inserts. The tool machines internally and externally at the same time. Multiple steps are machined. The tool operates counter-clockwise to transport the chips out of the component and to prevent damage to the internal contour of the turbine.

#### Machining example:

Material: 1.4837  
 Cooling: MQL  
 Diameter: 49; 70.5; 73; 90 mm; chamfer 10°  
 Cutting speed: 70 m/min  
 Feed: 0.4 mm  
 Tool life: 75 parts

2

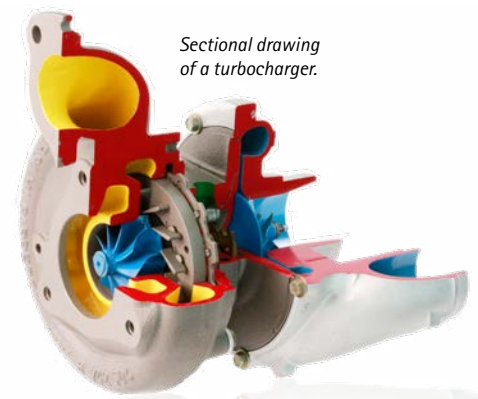
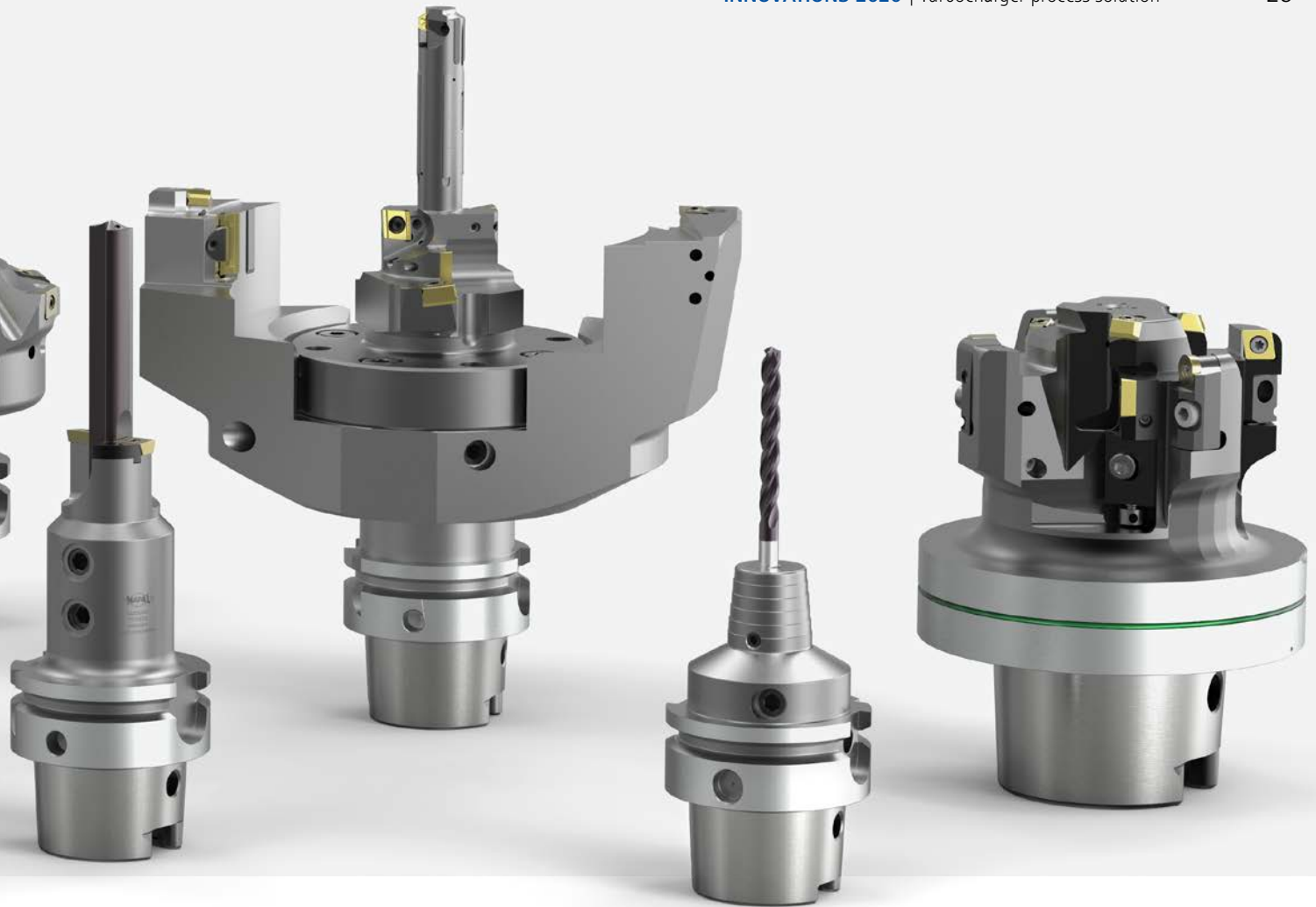
### Pre-machining and fine machining of the turbine main bore

Close tolerances in relation to shape, position and surface finish make the machining of the trumpet-shaped turbine main bore a challenge. For this purpose, MAPAL offers the TOOLTRONIC with LAT attachment (linear actuating tool). In this way the turning operation can be implemented on the machining centre. The mounting tool is fitted with three inserts, one for roughing and two for finishing.

#### Machining example:

Material: 1.4837  
 Cooling: MQL  
 Diameter: 40.5-57.295 mm  
 Cutting speed: 140 m/min (roughing),  
 120 m/min (finishing)  
 Feed: 0.15-0.4 mm  
 Tool life: 50 parts





Sectional drawing of a turbocharger.

3

**Face surface on the turbocharger housing**

MAPAL recently announced a milling range with pressed, radial ISO indexable inserts. The milling cutter for roughing the face surface on the turbocharger housing comes from this range. The ISO indexable inserts with 16 usable cutting edges are the highlight of this face milling cutter. As such the usage of the tool is particularly economical.

**Machining example:**

Material: 1.4849  
 Cooling: Dry machining  
 Diameter: 125 mm, 14 inserts  
 Cutting speed: 80 m/min  
 Feed: 0.12 mm  
 Tool life: 125 parts

4

**Pre-machining the catalytic converter flange**

The new tool from MAPAL for pre-machining the catalytic converter flange is also particularly cost-effective. Tangential technology is used on this diameter turning tool. Due to the upright and horizontal installation of the LTHU inserts, in effect eight cutting edges can be used per indexable insert.

**Machining example:**

Material: 1.4837  
 Cooling: MQL  
 Diameter: 119 mm  
 Cutting speed: 80 m/min  
 Feed: 0.3 mm  
 Tool life: 100 parts

**AT A GLANCE**

- Complete process including tools and chucks for the complete machining of exhaust turbochargers
- Matched to the related geometry of the turbocharger

**ADVANTAGES**

- Processes particularly cost-effective
- Guaranteed process reliability
- µm-accuracy

# E-mobility - individual solutions for e-motor housing

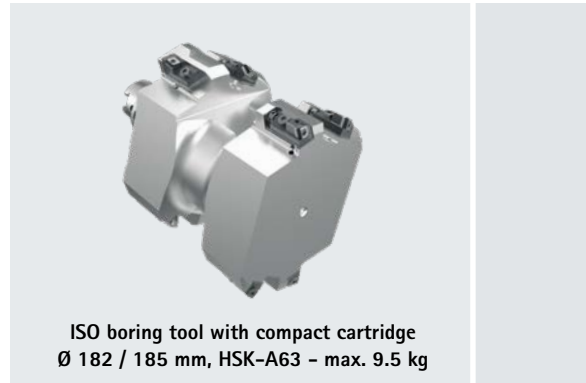
Different e-motor housings are used in vehicles with electric drive. Here it is possible to differentiate between three basic types. MAPAL offers, for example, innovative tool solutions for the machining tasks on the housing types.

## 1 Stator bore

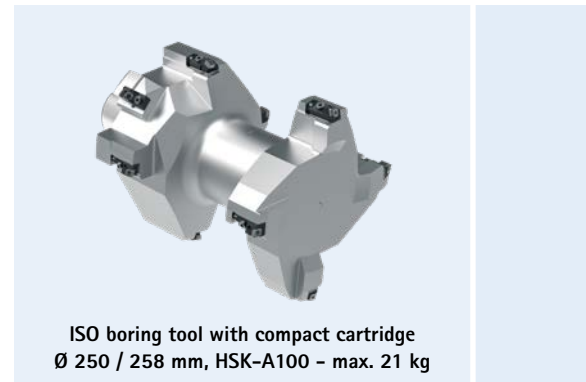
### Pre-machining



Boring tool with PCD-tipped indexable inserts Ø 210 mm, HSK-A63 - max. 3.5 kg



ISO boring tool with compact cartridge Ø 182 / 185 mm, HSK-A63 - max. 9.5 kg



ISO boring tool with compact cartridge Ø 250 / 258 mm, HSK-A100 - max. 21 kg

1 3 4

### Tube-shaped housing

**Characteristics:**  
 Tube-shaped housings that are open at both ends. Rotor bearings with two bearing covers. Positioning of the two bearing covers via dowels or surface fits, as a result concentricity in relation to the stator bore. Cooling channels integrated into the housing or as ribs on the outside.

1 2 3 4

### Pot-shaped housing

**Characteristics:**  
 Pot or bell-shaped stator housing and stator carrier, to some extent mounted in a complete housing. One rotor bearing integrated into the housing. Second bearing with bearing cover. Positioning of the second bearing cover via dowels or surface fits.

1 2 3 4

### Highly integrated housing

**Characteristics:**  
 Highly integrated, complex housing with stator receptacle, gearbox receptacle and power electronics. Stator bore with steps and face surfaces as function surfaces. One rotor bearing bore integrated into the housing. Coaxial to the stator bore. Bearing bores for gearbox stages integrated into the housing. High degree of parallel alignment and positioning accuracy required.

## ULTRA-LIGHTWEIGHT DESIGN & FLEXIBILITY

### 1 Focus: Flexibility

#### Flexible in the diameter

The usage of a helix milling cutter makes pre-machining with different diameters possible. The internal contour can be flexibly machined using an LAT actuating tool. Both solutions significantly reduce the cutting forces.



Flexible pre-machining with reduced cutting force, ISO helix milling cutter with PCD-tipped indexable inserts, HSK-A63

Fine machining



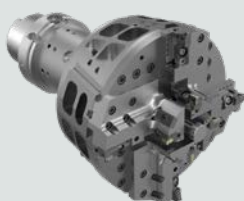
Fine boring tool with indexable insert system in beam shape Ø 210 mm, HSK-A63 - max. 5.5 kg



Fine boring tool with EA system with TEC indexable inserts Ø 70 / 185 mm, HSK-A63 - max. 11.5 kg



Fine boring tool as welded design with protection shield Ø 68 / 258 mm, HSK-A100 - max. 20 kg



Flexible machining of the internal contour, LAT actuating tool, HSK-A100

2 Bearing bore



Pre-machining of diameter, boring tool with ISO cartridges



Fine machining of face surfaces and radial recess, multi-stepped ISO circular milling cutter



Fine machining of diameter, fine boring tool with guiding stage and floating holder



External machining of bearing bore, external reamer with EA system

3 Sealing/contact surfaces



Face milling cutter with PCD milling cartridges (also for the production of defined surface profiles)



Monolithic face milling cutter with PCD milling cartridges for long projection lengths

4 Position bores



Triple edge step drill made of solid carbide



PCD boring tool with hydraulic chuck

1 Focus: Ultra-lightweight design

Ultralight thanks to additive manufacturing

Additively manufactured lightweight tools have a significantly reduced tool weight and moment of tilt compared to conventional tools.



Fine machining of stator bore, additively manufactured, HSK-A63



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