



# ISCAR'S MACHINING SOLUTIONS FOR **ELECTRIC VEHICLES**





## Electric Motors

# ISCAR drives you to the next generation

Public awareness of global warming, together with a pressing concern to create and maintain a clean environment, has led to a series of legislations worldwide that is forcing automakers to decrease CO<sub>2</sub> emissions. Many countries have already declared a ban on sales of internal combustion vehicles in the near future. Apart from improving fuel consumption, downsizing engines and making lighter vehicles, automakers must turn to new technologies in order to cope with these emission limitations. A rapid increase in battery electric vehicle development, manufacture and implementation, shows that electric vehicles are not only the future but are, in fact, the present. The automotive industry is on the brink of colossal changes and soon our perception of cars and transportation may alter completely.

ISCAR, a company with many years of experience in the production of metal cutting tools, offers unique solutions for the new generation. As a leader in providing productive and cost effective machining solutions, we strive to be up to date with all the new trends and technologies and be a part of a brighter, greener future.







## Electric Motor Housing

# Motor Housing Complete Machining Solution

One of the main components of an electric motor is the motor housing (stator housing), which is made from aluminum.

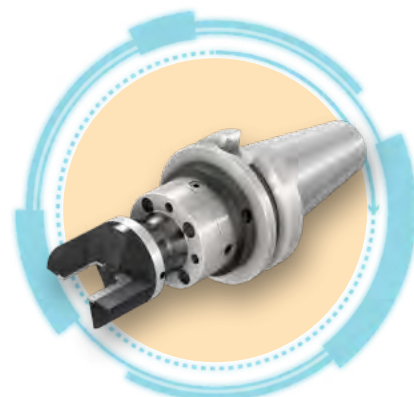
A special approach needs to be taken to achieve this part's critical key characteristics of light weight, durability, ductility, surface finish and precision, including geometrical tolerances.

The partially hollow form represents an additional challenge and maintaining low cutting forces is essential for roughness and cylindricity requirements.



### ISCAR PCD LINE

ISCAR's PCD line comprises top performance tools with high machining parameters, minimum weight and long tool life. Equipped with adjustable PCD blades or brazed tips and guiding pads, these tools can hold the most demanding tolerances and geometrical requirements. Combined tools with various profiles decrease the number of tools required to make the part, which reduces cycle time.

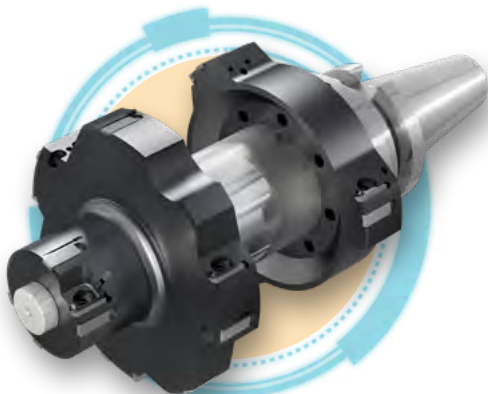
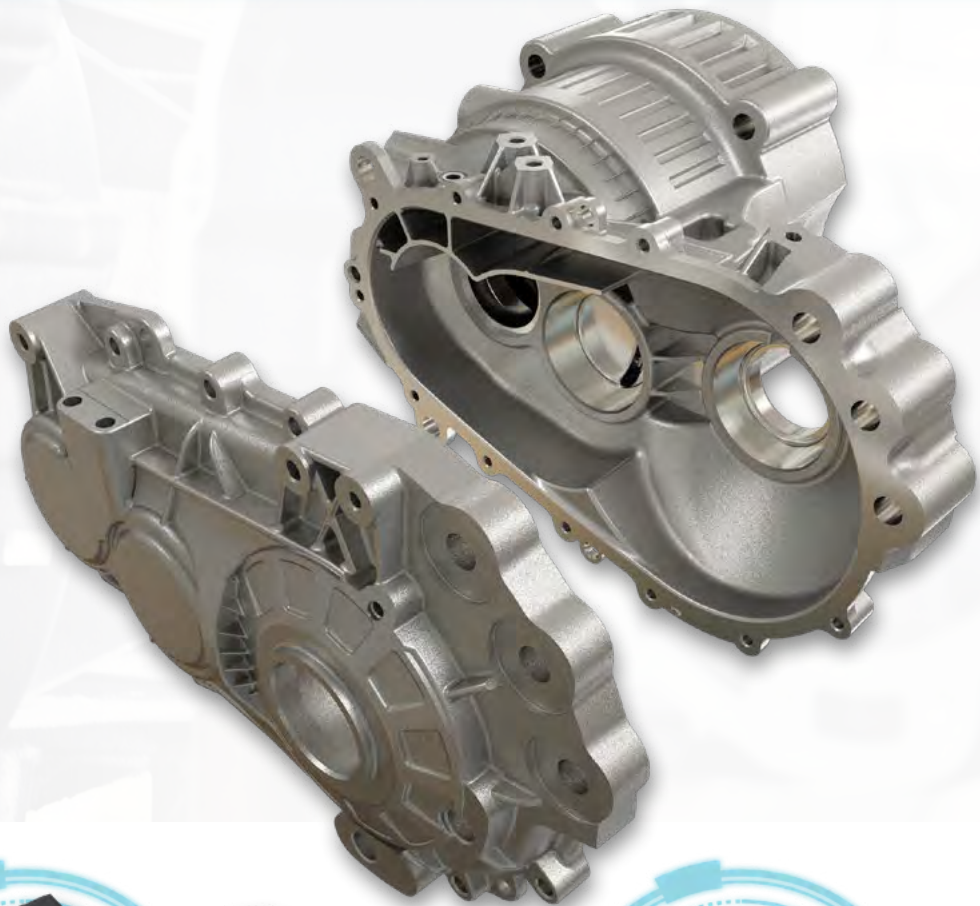


Brazed PCD tool  
for external contouring

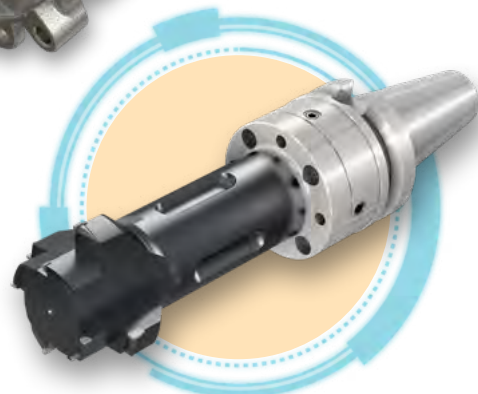


Combined tool for external reaming with adjustable PCD blade and guiding pads and interchangeable head for milling with PCD brazed cartridges

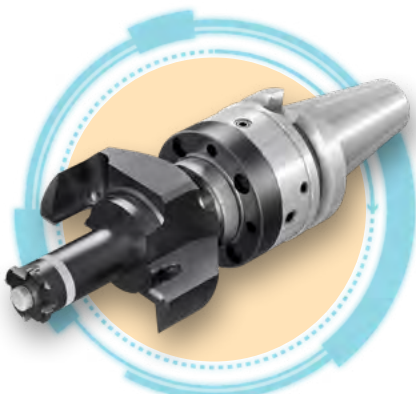




Reamer with adjustable PCD blades  
and guiding pads



Combined tool with PCD brazed  
tips for spot facing and grooving



Combined PCD brazed tool for internal and  
external reaming and interchangeable head  
for grooving



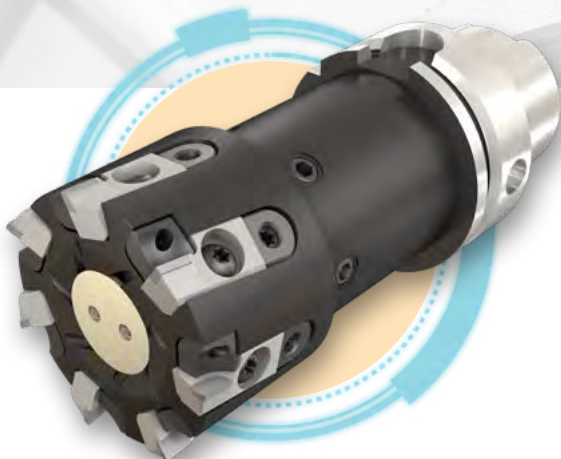
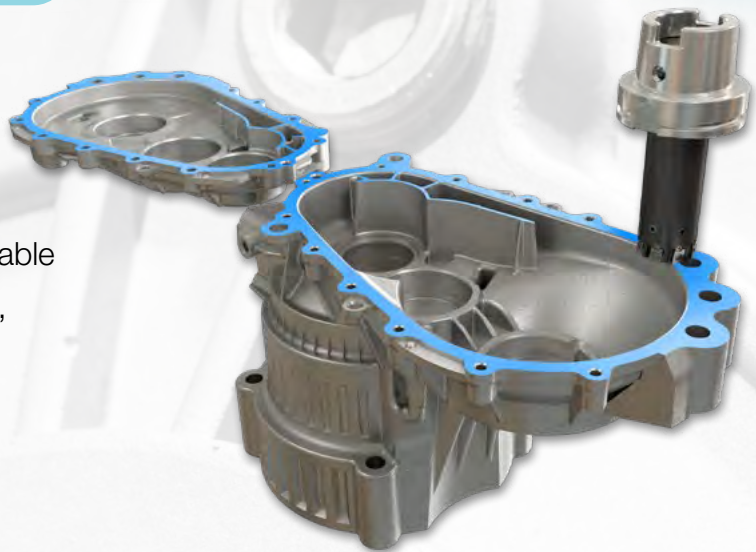
Combined tool with brazed PCD tips  
for milling and boring



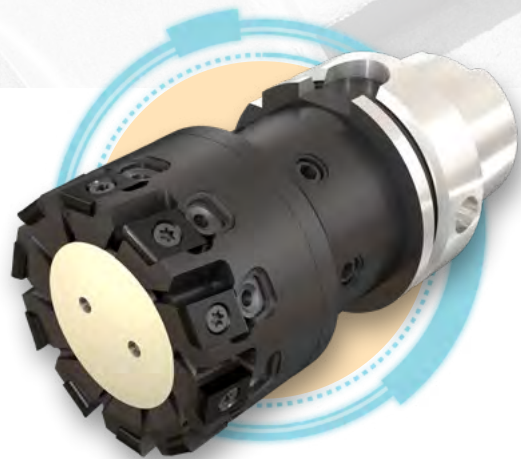
## Electric Motor Housing

### Face Milling

A wide variety of PCD/CBN face mills is available to provide optimal solutions for surface finish, machining time, stability and price.



Adjustable PCD cartridges with extra rigid clamping



Adjustable PCD inserts with variety of edge types



Brazed PCD tips for high productivity

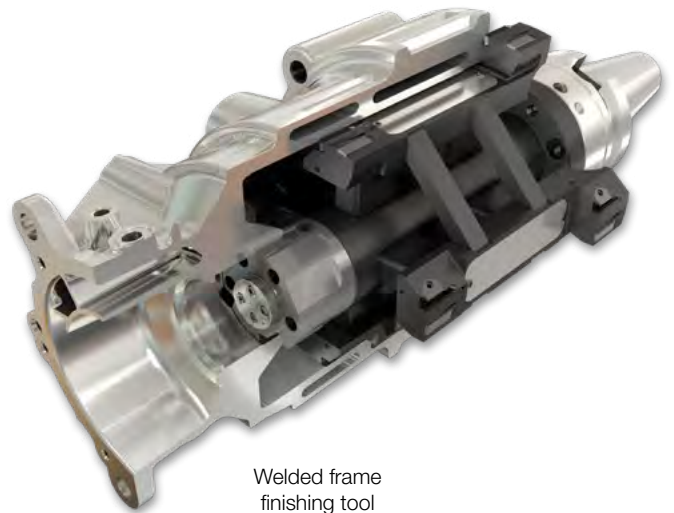


## Main Diameter Reaming

The tool's large diameter requires creative thinking in order to minimize weight and spindle load while maintaining rigidity. Exotic materials such as titanium and carbon fiber are used for the tool body, as well as a welded frame design.



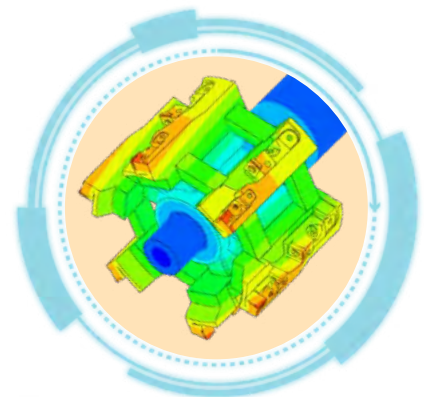
Welded frame  
roughing tool



Welded frame  
finishing tool

## FEM Analysis

Finite Element Method (FEM) analysis enables the consideration of many parameters, such as cutting forces, displacement field during machining, natural frequency, and maximum deformation. Our designers utilize FEM analysis to resolve the obstacles associated with this challenging application.

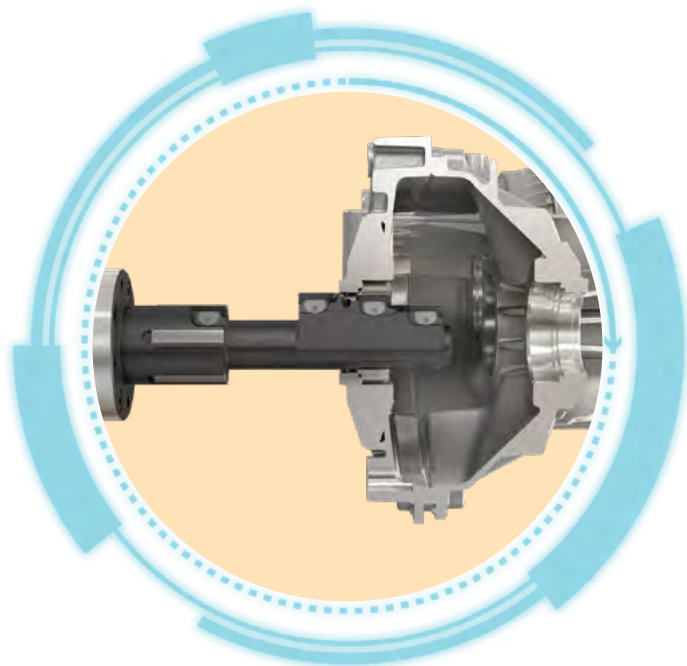




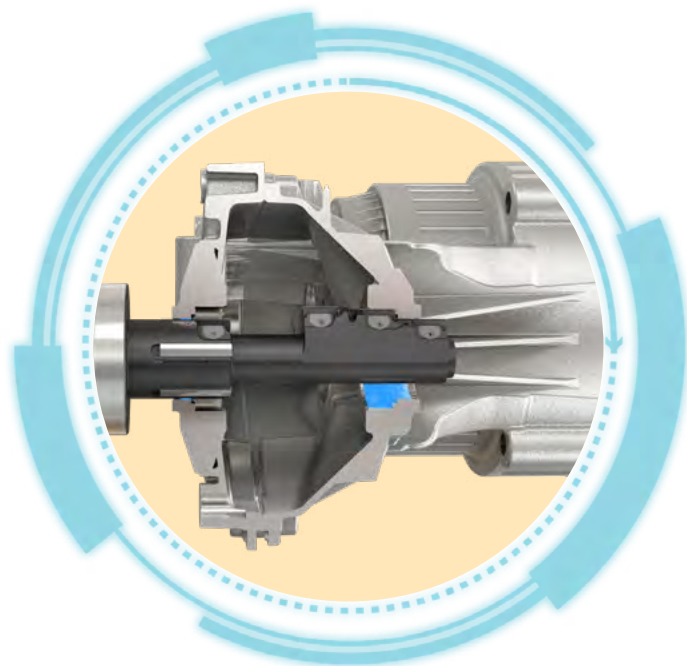
## Electric Motor Housing

# Bearing Seat Reaming After Assembly

To maintain concentricity between bearing seats of the stator and transmission housing, the reaming operation must be performed in the same machining sequence.

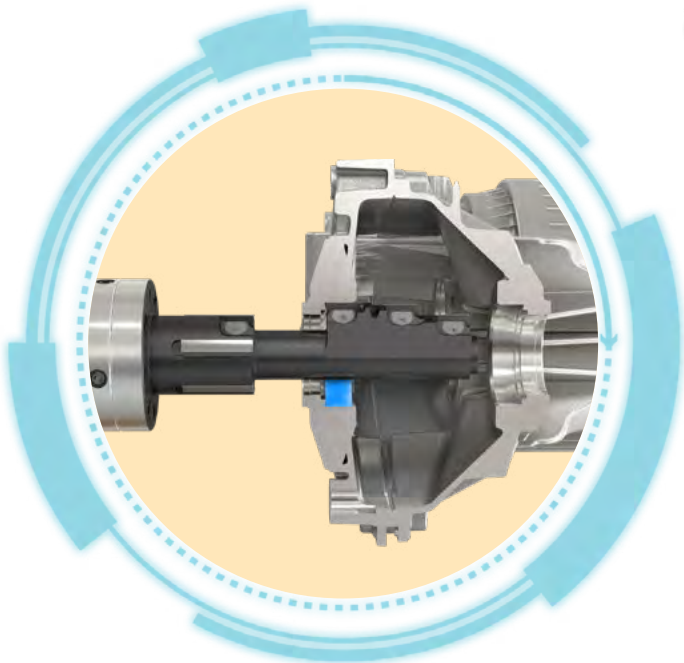
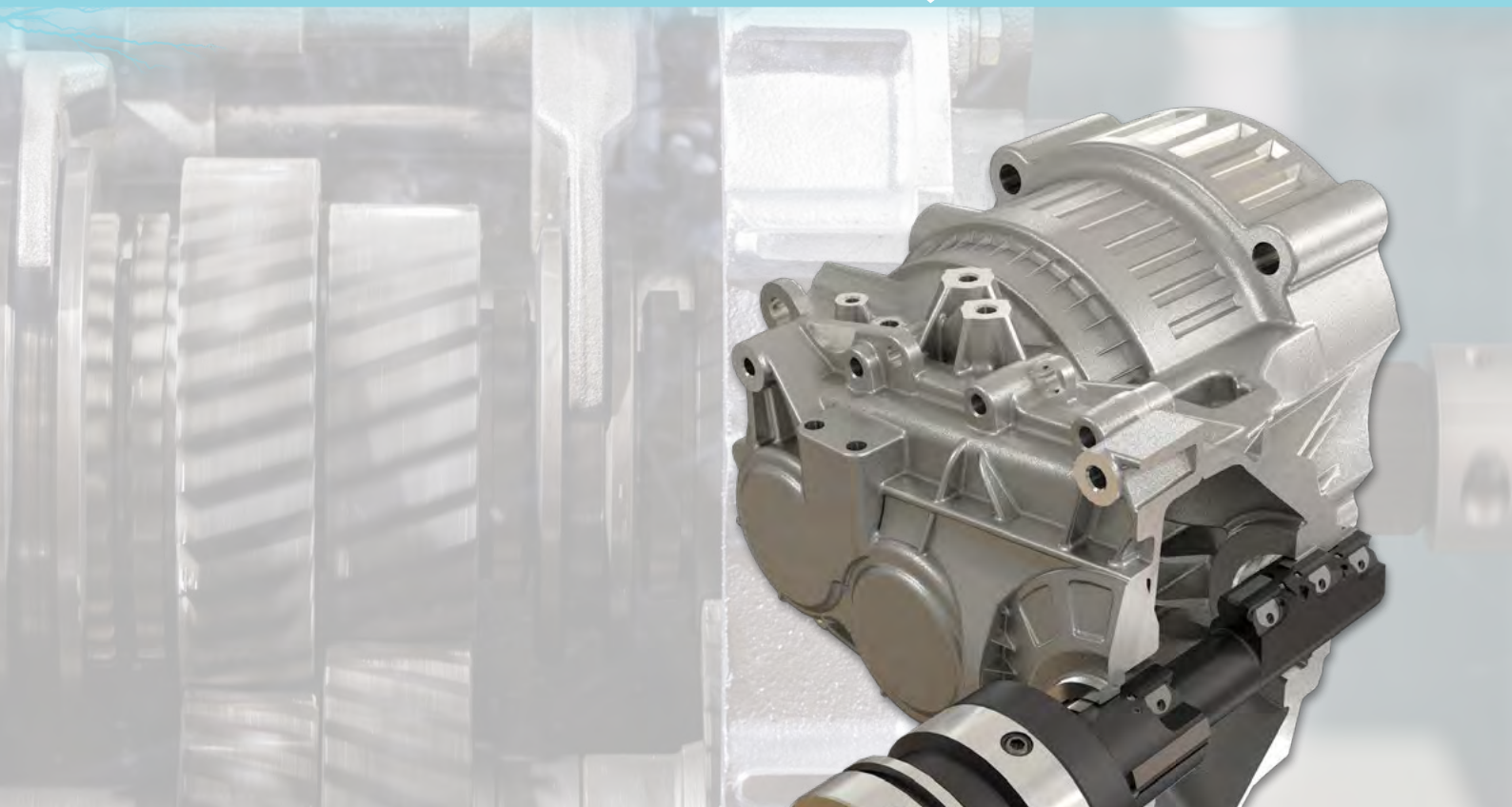


Tool positioned inside the part without rotation



Push – Reaming of bearing seat and both shaft diameters





Pull – Back reaming of the gear  
cover bearing seat

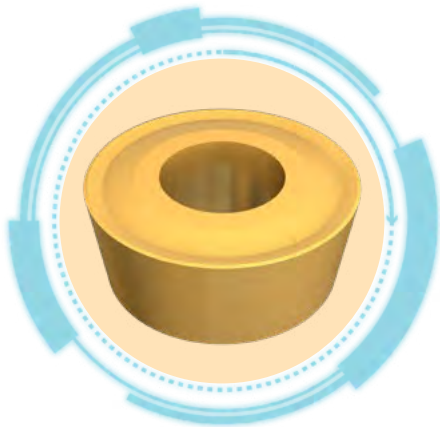
The complex push and pull type tool with adjustable PCD blades manages to retain the geometrical tolerances required on the part.



## Rotor

### Turning

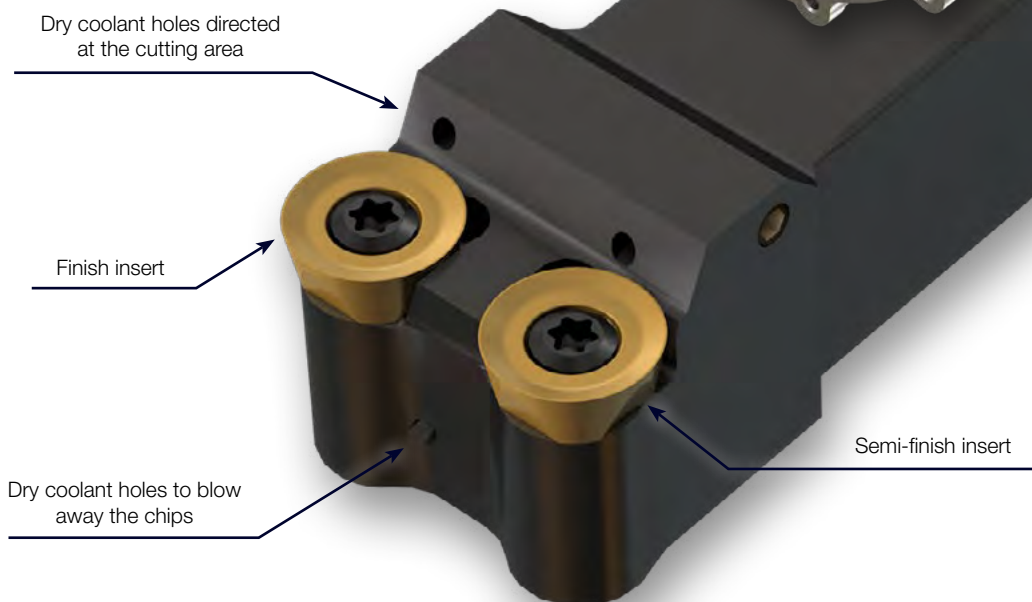
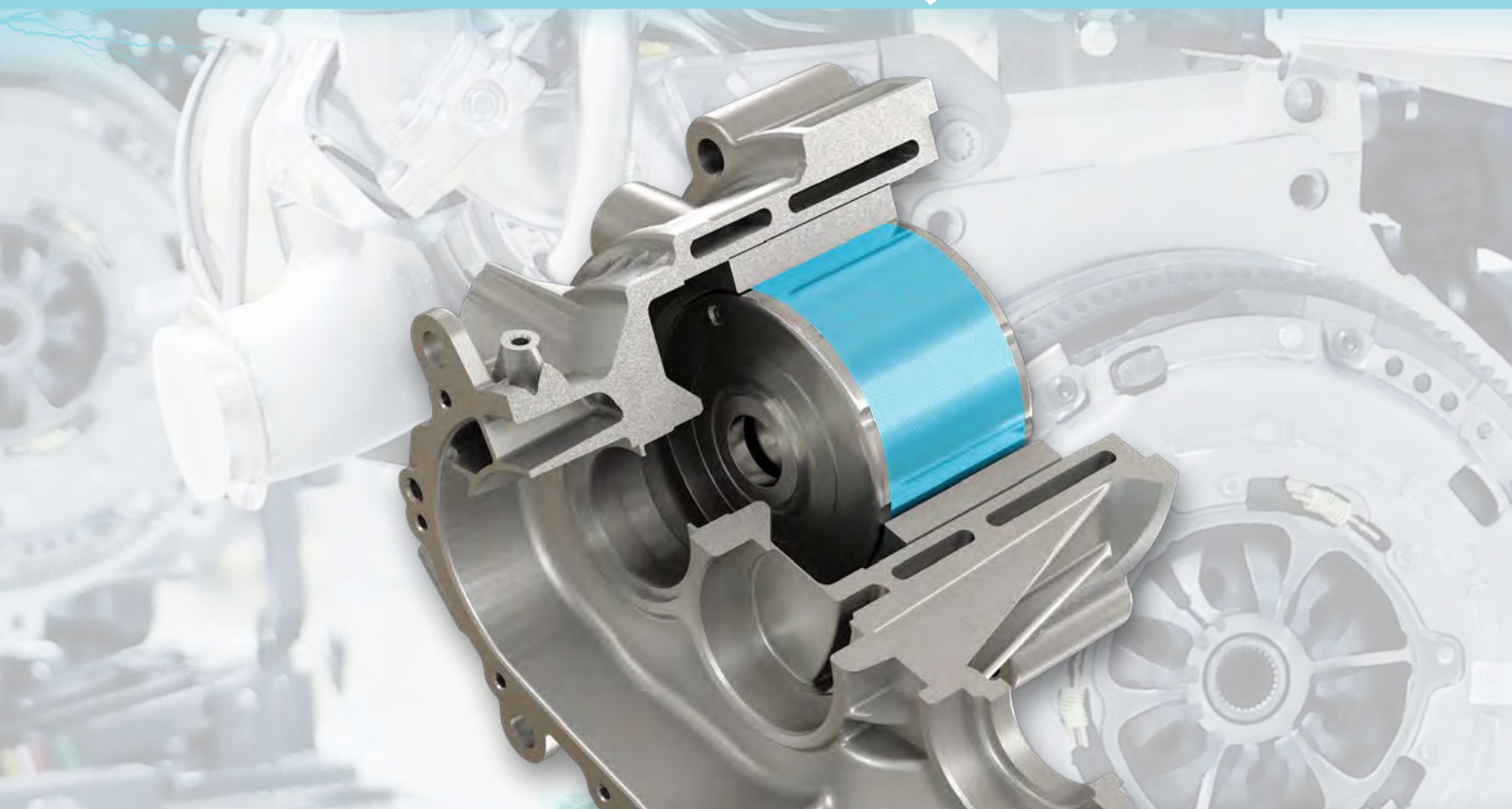
The rotor consists of many stacked plates of electric steel. Lamination sheets are used instead of a solid body to reduce current loss. The surface must be completely clean of chips, oil, water, dust or dirt, and coolant fluid cannot be used, only air. This is a challenge as a lot of heat is generated on the cutting area and the fragmented chips stick to the surface. Surface finish requirements for this interrupted turning operation remain strict.



**CHAMTURN**

ISCAR has overcome these challenges by developing a combined tool with coolant holes both on top and bottom of the cutting edge to cool and blow away the chips. The two round inserts are positioned for semi finish and finish operations, generating an Ra 1.9. surface quality.



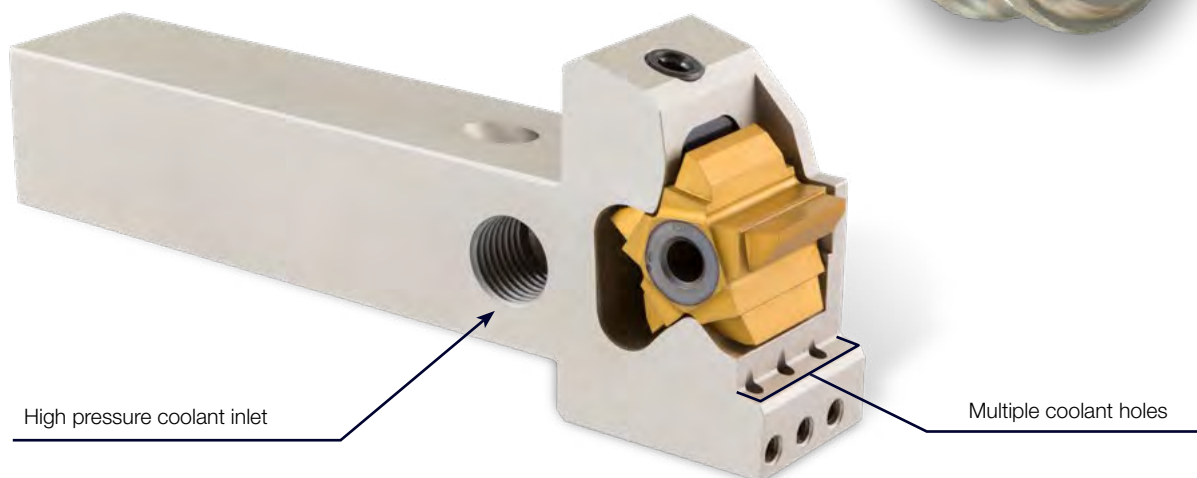




## Bearing

# Bearing Grooving

The PENTA 20 mm width blank insert enables grinding of complex profiles while maintaining the advantage of 5 cutting corners. In the application of grooving the internal bearing ring, ISCAR replaced single edge inserts with this 5-edge solution and doubled the tool life per edge.







## **PENTACUT**

The PENTA 27-20FT blank insert features 5 cutting edges that can be ground according to end user specifications for up to 20 mm profile width.

ISCAR offers standard PCHR/L-27-JHP tools in 20 and 25 mm shank sizes. The tools feature rigid clamping and channels for efficient high-pressure (up to 340 bar) edge cooling. Specially tailored tools can be provided on request.





## Shaft and Gear Parts

### Shaft Machining

The shaft is located inside the rotor and, as in traditional internal combustion engines, its purpose is to transfer rotation and torque to transmission parts.

As an electric motor generates maximum torque at zero rpm, there is no need for a complex transmission system and a simple single speed transmission is sufficient. Shaft and gear parts are made from alloy steel, machined both before and after hardening.



**TRIDEEP**  
DEEP DRILLING



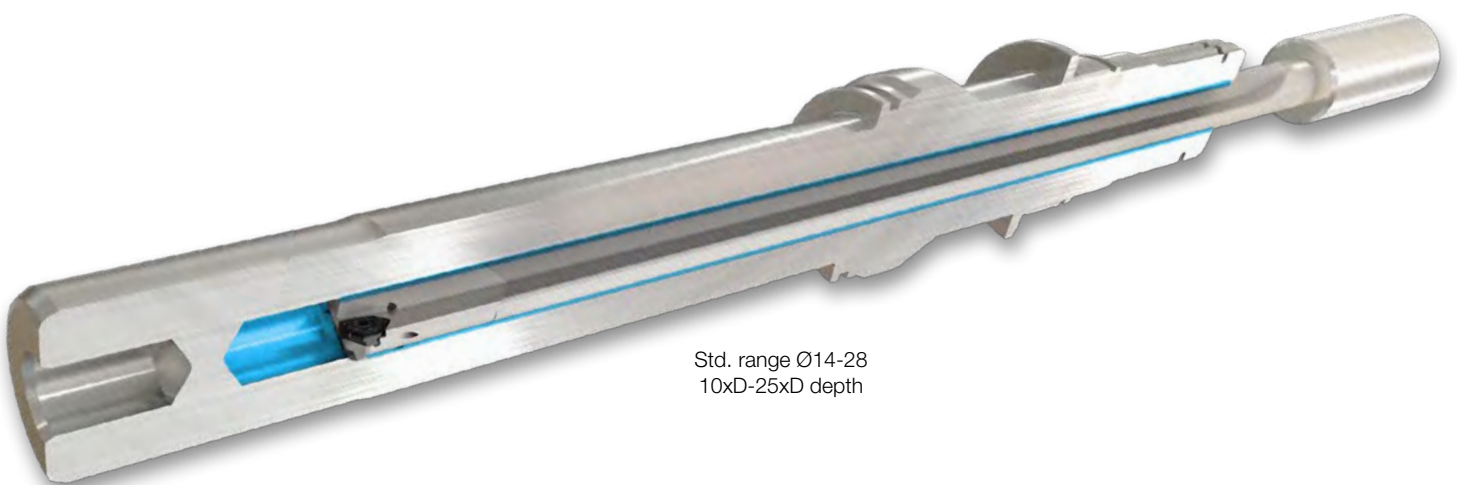
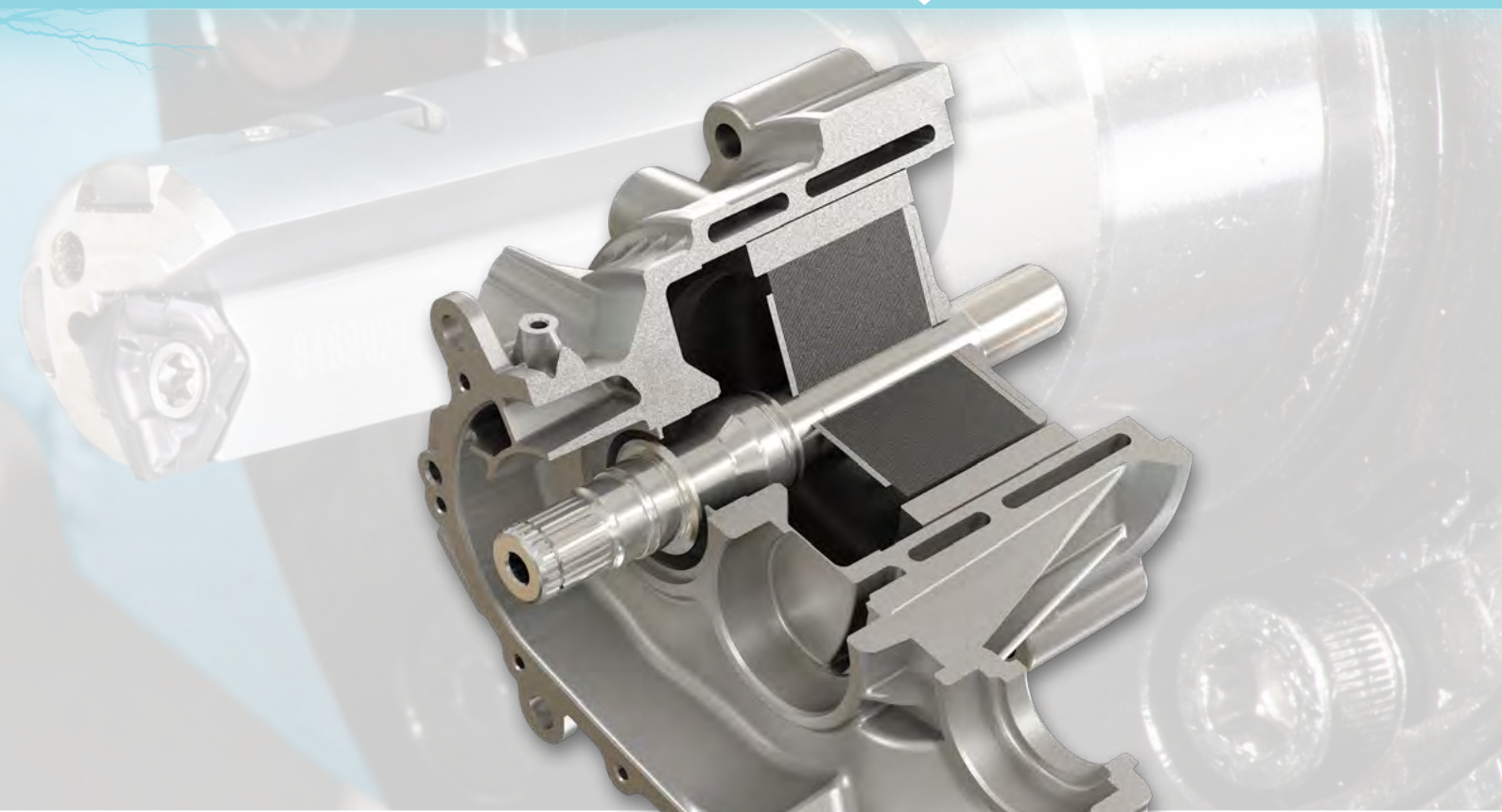
TOGT



### Shaft Deep Drilling

The TOGT insert features 3 chip splitting cutting edges to produce narrow chips for efficient chip evacuation, which requires special consideration in alloy steel machining. Designed with a positive rake chip breaker and a wiper for high hole surface quality, the insert is suitable for dedicated deep drilling machines or machining center and lathes.





Std. range Ø14-28  
10xD-25xD depth



## Shaft and Gear Parts

### Grooving

Featuring 5 cutting edges, a variety of chip formers, precise profile, and durability, the PENTACUT insert is a popular choice for grooving operations. The JETCUT tool holders with two high pressure coolant holes guarantee optimal chip breakage.



**PENTACUT** • **JETCUT**  
PARTING & GROOVING LINE

### Computational Fluid Dynamics (CFD)

ISCAR has the ability to simulate both internal and external flow of coolant. This enables many features, such as:

- Optimization of coolant holes
- Optimization of volumetric flow rate and pressure
- Calculation of coolant velocities at exit of the coolant holes
- Coupling with heat transfer

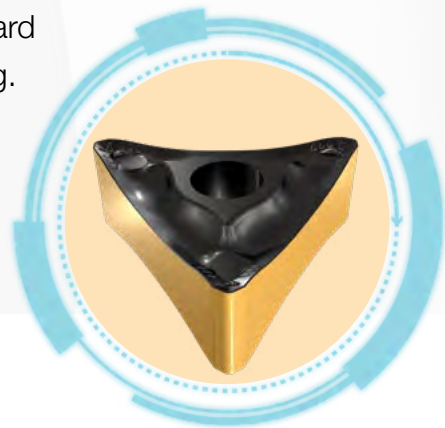


Dual coolant holes  
directed at the  
cutting edge



# Soft Turning

Coolant plays a major role in assisting with chip breakage in turning operations, especially in alloy steel. For this reason, ISCAR designed the JETCUT line that puts emphasis on providing high pressure coolant directly to the cutting edge. In the soft preparation stage, it is very important to machine close to the final dimensions, leaving a smooth contour for hard machining, which is why a wiper insert is used for soft turning.



**HELITURN LD • JETCUT**

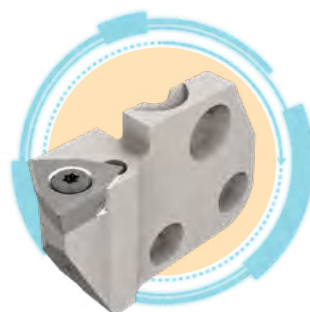
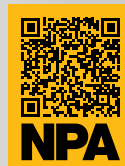




## Shaft and Gear Parts

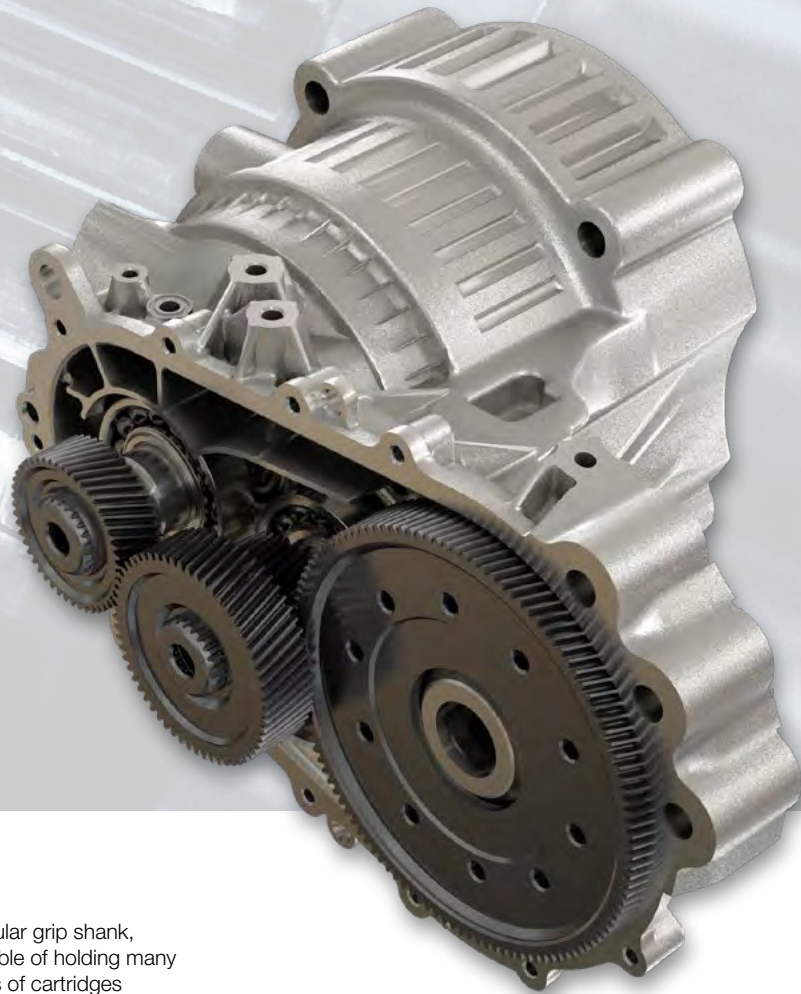
# Soft Face Turning and Grooving

The MODULAR-GRIP line offers a large variety of interchangeable cartridges for various applications such as turning, grooving, threading, parting and more. They can be mounted on square shanks and CAMFIX/HSK/ISO 26622-1 adaptors.



**MODULAR-GRIP • JETCUT**





Modular grip shank,  
capable of holding many  
types of cartridges  
Internal high-pressure  
coolant system



HFPR/L: Utility double-ended  
face machining inserts



## Shaft and Gear Parts

### Hard Machining

For hard machining applications, ISCAR offers a variety of ceramic and CBN tipped inserts, in a range of grades and edge preparations, that are capable of working with high cutting parameters and generating excellent surface finish.

Double sided insert  
with 4 CBN tips

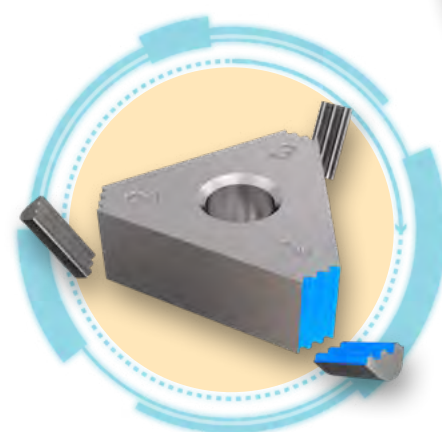


CBN  
CATALOG



### New Brazing Technology

ISCAR has expanded its CBN line by introducing a new innovative technology for brazed CBN tips. Excellent for deep depth of cut and interrupted operations.

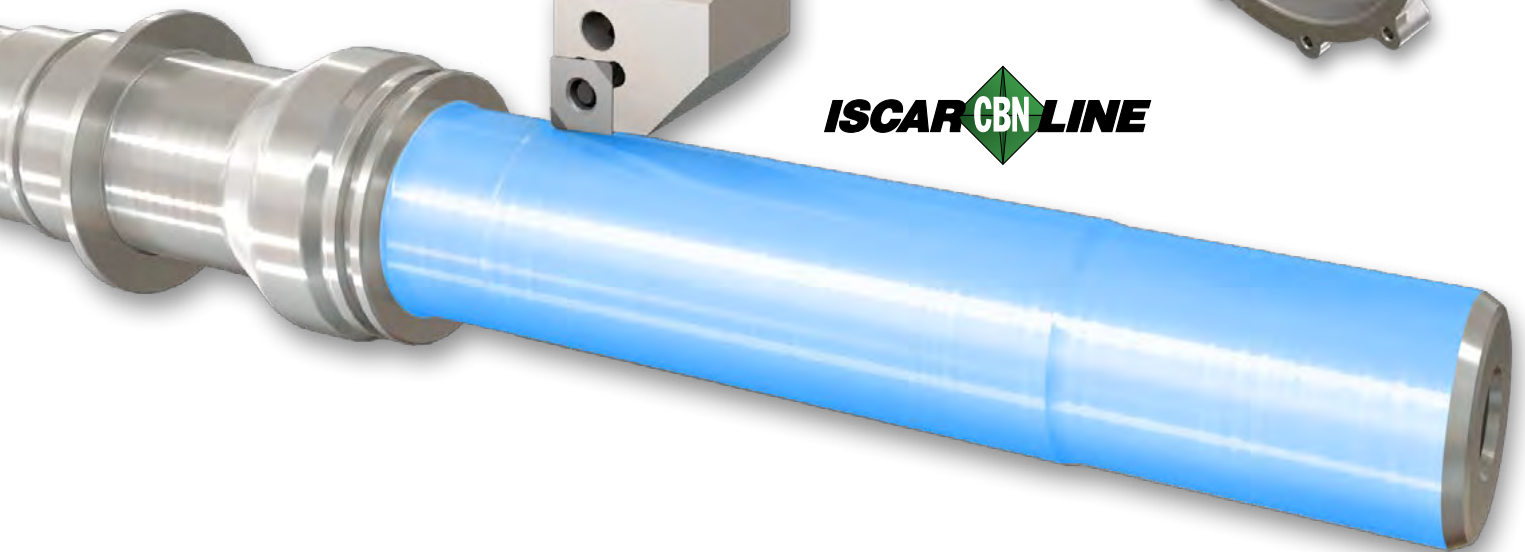


**ISCAR CBN LINE**





**ISCAR**  **LINE**





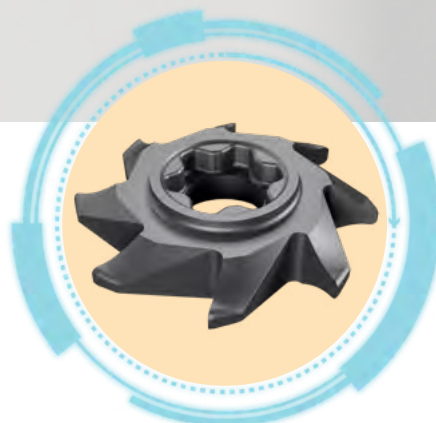
## Shaft and Gear Parts

# Spline and Gear Machining

For low quantity production volumes, interchangeable solid carbide MULTI-MASTER milling heads, solid SD connection type tools and tools with indexable inserts are used to machine each spline or gear profile one by one.



**MULTI-MASTER**  
INDEXABLE HEADS



**T-GEAR**  
GEAR MILLING



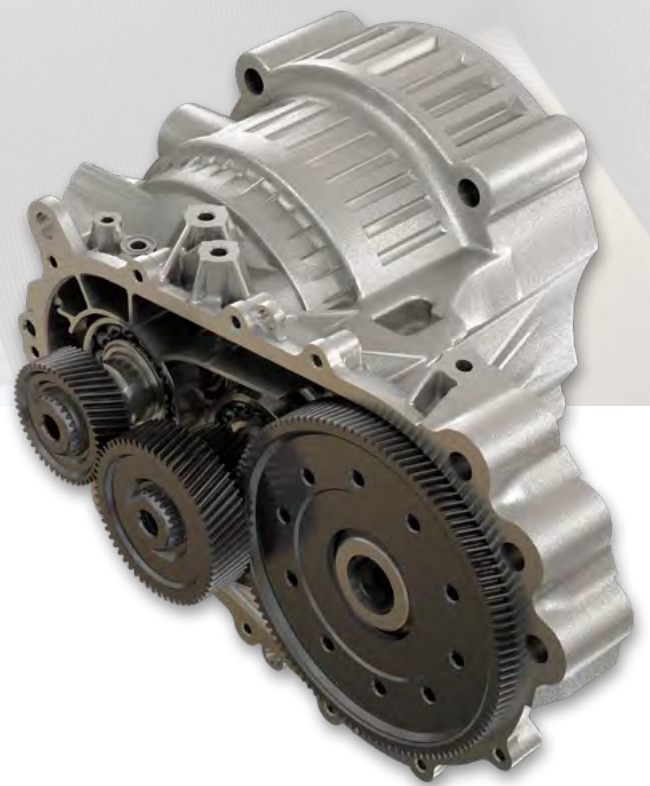
**MODUGEAR**  
INDEXABLE GEAR MILLING







**T-GEAR**  
GEAR MILLING



## Power Skiving

For this application, ISCAR developed a special exchangeable milling head with rigid clamping, which ensures stable and accurate machining of the spline profile. Power skiving is becoming more relevant as a growing number of automakers prefer the use of multifunctional CNC centers over designated machines.







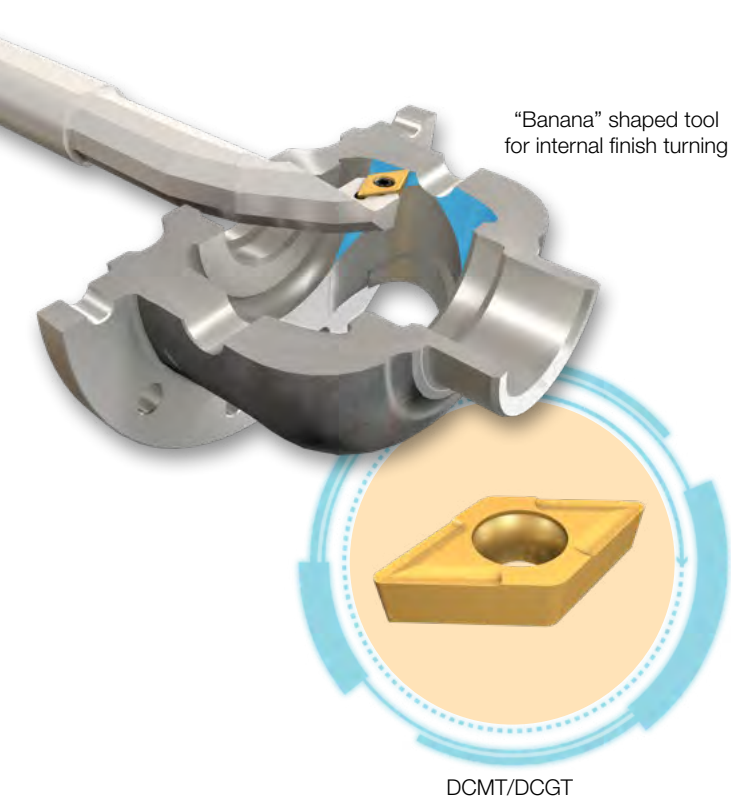
## Differential Housing

As long as the car has only one electric engine, it will need a differential to enable driving wheels to rotate at different speed.

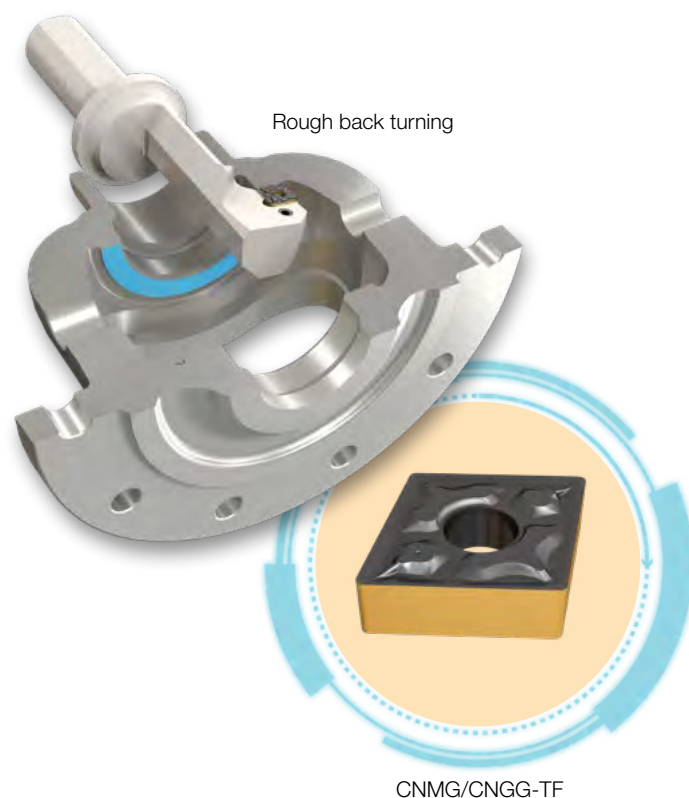
**ISO***TURN*

## Internal Turning

As the reach of the turned area is difficult due to a long overhang and narrow entering diameter, the tool body is weakened significantly. This may result in vibrations during machining. ISCAR resolved this issue with special shanks made from tungsten, to compensate for the thin tool body with more rigid material. Another option is to insert carbide rod inside the tool body.

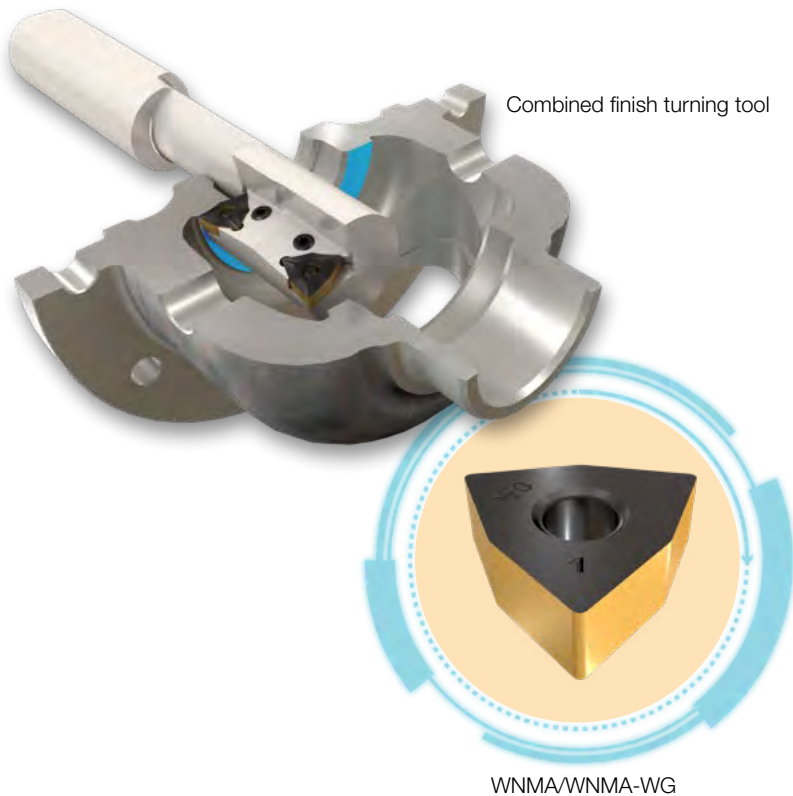
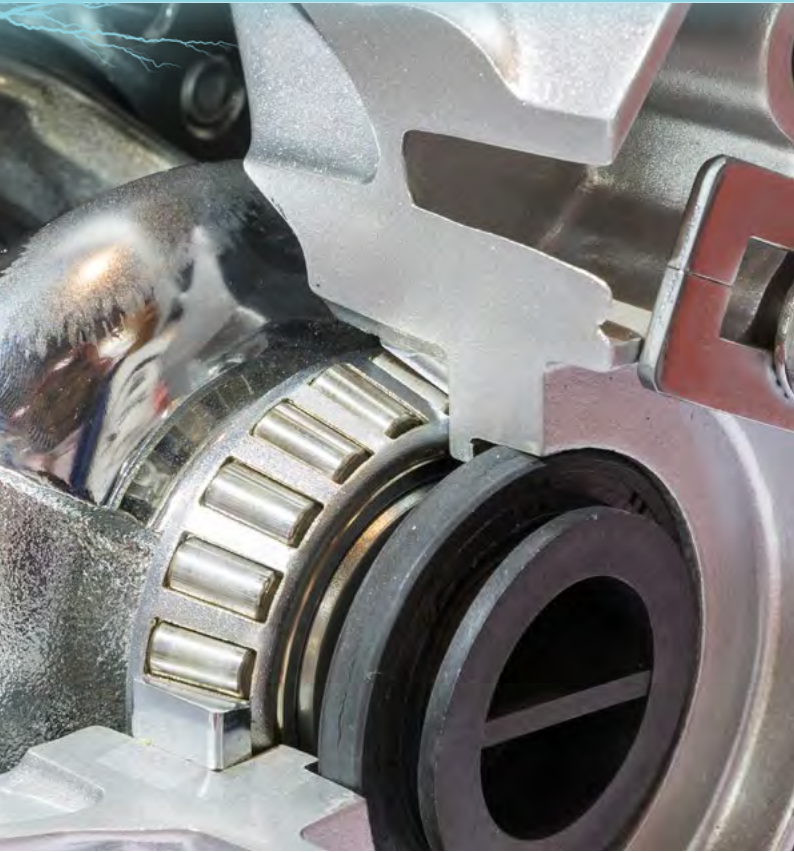


DCMT/DCGT



CNMG/CNGG-TF





Combined finish turning tool

WNMA/WNMA-WG



## Differential Housing

# Special Milling Tools for Dedicated Machines

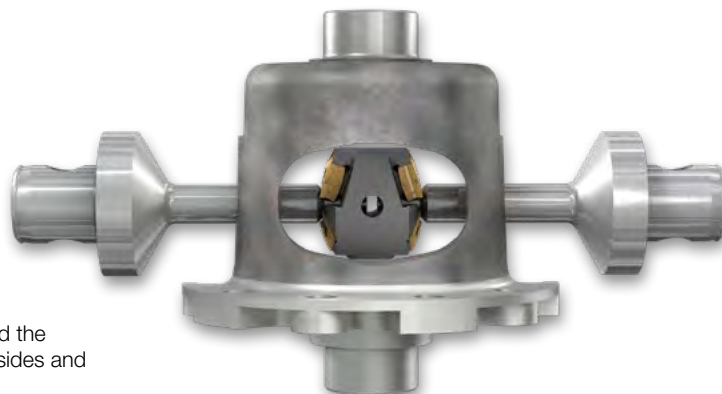
For mass production of differential housings, some customers invest in dedicated machines that enable machining the internal area of the part with milling tools.

*SPECIALLY TAILORED*



### Step 1

Tool inserted with robot arm into the housing



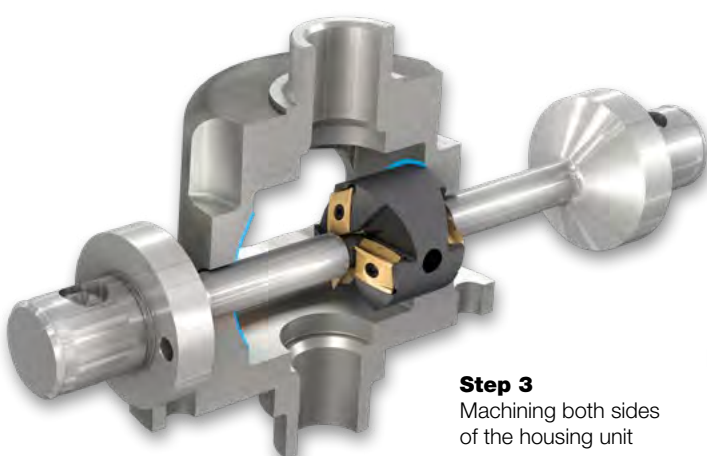
### Step 2

Two drivers hold the tool from both sides and transfer torque

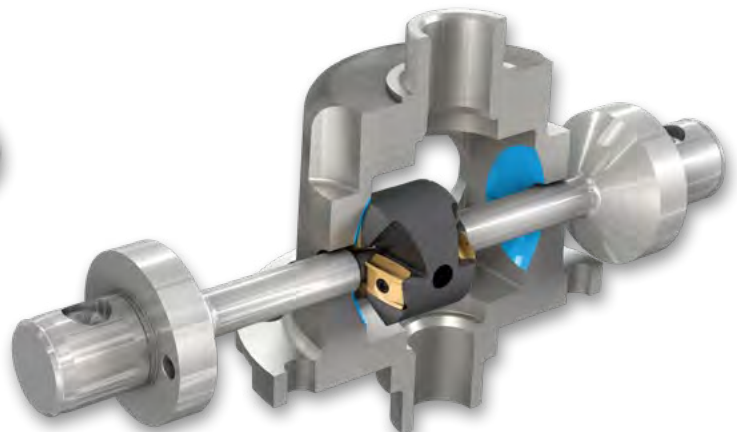




Special tangential insert  
with 2 RH and 2 LH cutting edges



**Step 3**  
Machining both sides  
of the housing unit





## Differential Housing

**SUMOCHAM** CHAMDRILL LINE **LOGIQ3CHAM** THREE FLUTE CHAMDRILL

### Drilling

SUMOCHAM drills with coolant holes and equipped with ICK drilling heads are specially designed for cast iron. The SUMOCHAM drilling heads require no setup time during change due to their high accuracy. Special combined drills with indexable chamfer inserts eliminate the need for additional chamfer tools, or for re-sharpening solid carbide tools and reprogramming due to dimension changes. Standard indexable inserts and drilling heads are always available in stock.



**NPA**

**NEW**



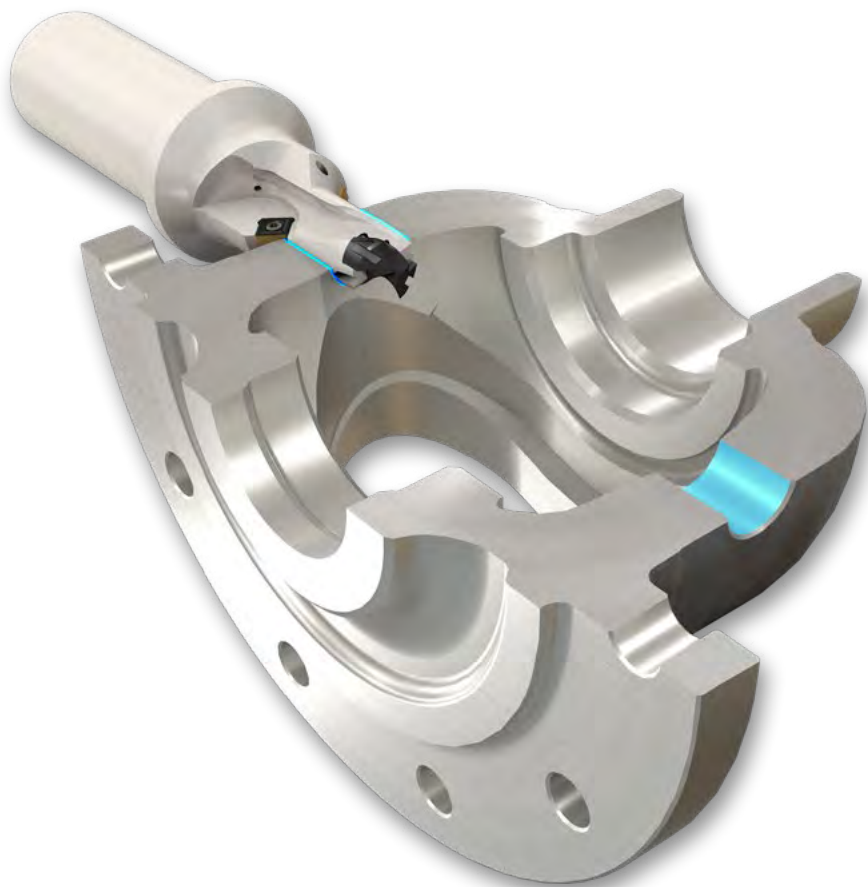
H3P - 3 flute drilling head  
Std. new range Ø12 – 25.9



HCP - Self-centering drilling head  
Std. range Ø6 – 32.9



ICK - Drilling head for cast iron  
Std. range Ø5 – 32.9







## ***BAYO-T-REAM***

# Reaming

The BAYO-T-REAM line is designed for high feed reaming applications. Its quick-change bayonet mechanism requires no setup time; users simply change the reaming head and proceed with machining using the 6 to 8 cutting edges. Internal coolant supply for each cutting edge results in excellent surface finish, while the rigidity of the system and its repeatability ensures perfect concentricity between the two holes.



RM-BN - Std. range Ø11.5-32



## Battery Case

As batteries are replacing fuel as an energy source for vehicles, the battery case is an integral component of car design. Large size and light weight requirements make aluminum a natural choice for manufacturing this part. ISCAR has an arsenal of tools specially designed to machine aluminum and provide productive and economical solutions for any application.

**SUMOCHAM**  
CHAMDRILL LINE

## Drilling

ISCAR offers a number of options for drilling aluminum, including ICN heads designed with a sharp cutting edge and polished rake face, and ICG heads with a chip splitter for better chip removal when working with a long overhang.



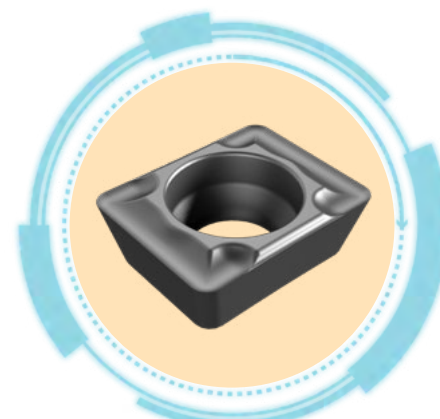
Fig. 1



ICN - Std. range  
Ø10-19.5

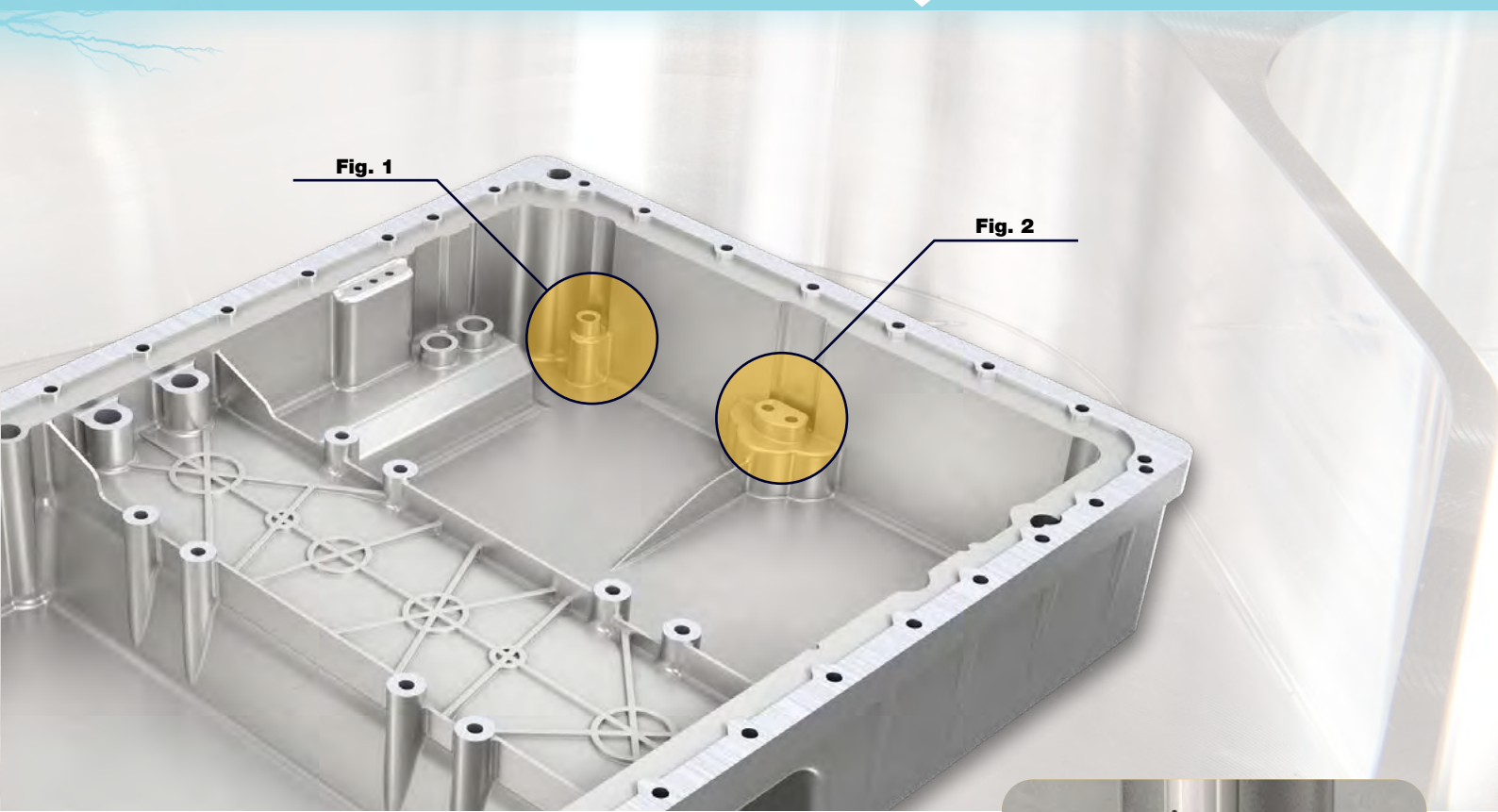


ICG - Std. range  
Ø14-25.9



AOGT - Small sharp  
polished insert





**CHATTERFREE**  
MULTI-MASTER LINE

## End Milling

MULTI-MASTER interchangeable solid carbide heads are dedicated for machining aluminum and may be used for both roughing and finishing. The design features 4 super polished flutes for optimal chip evacuation and excellent chatter dampening ability, easy tool change capabilities and no setup time.



**Fig. 2**



MM EA-CF  
Std. range Ø8-20



MM ERA  
Std. range Ø8-25



MM EA  
Std. range Ø8-25



## Battery Case

**BAYOT-REAM**

### Reaming

For machining aluminum, a special DLC coating for higher cutting conditions and longer tool life, can be applied.  
Special reaming heads with PCD tips can be made on request.



Spc. PCD Brazed

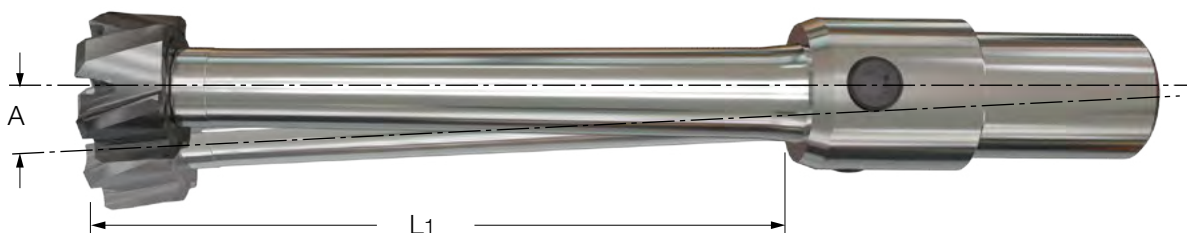


RM-BN - Std. range  
Ø11.5-32



Fig. 3

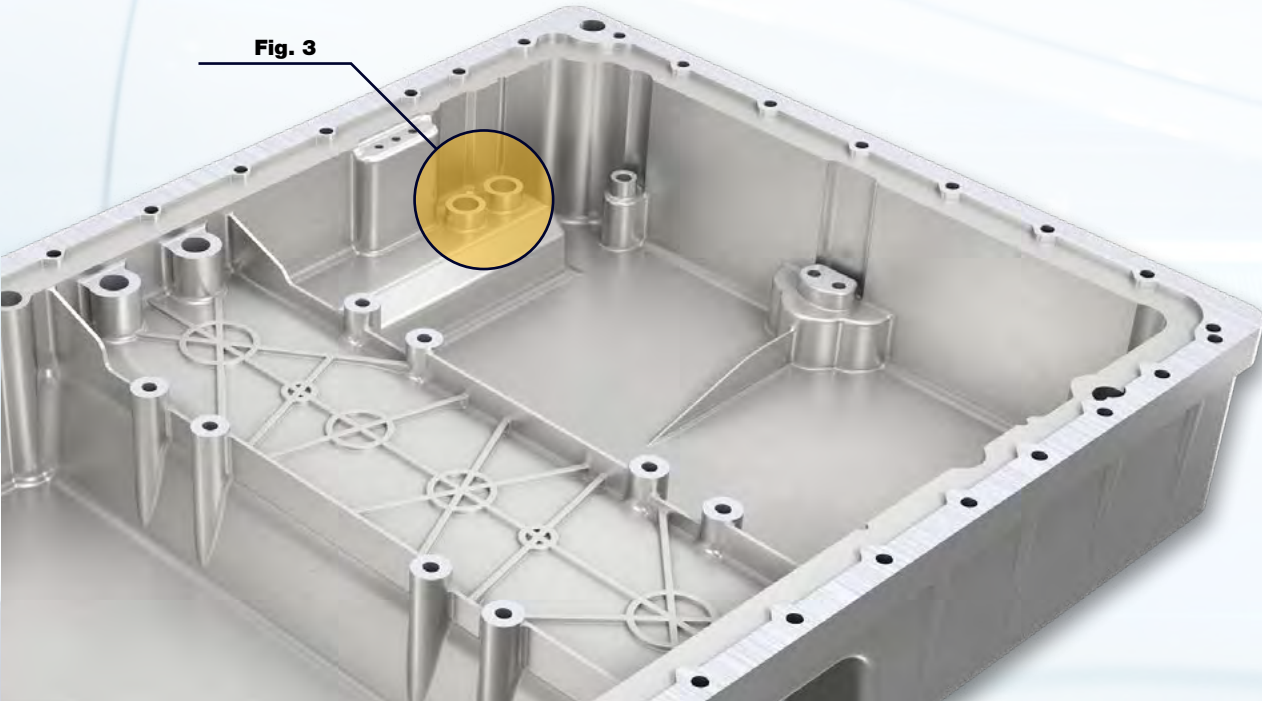
RM-BN-RC-RING adjustment rings for BAYO T-REAM holders solve tool runout caused by the machine spindle, holder weight (in horizontal applications) or long overhang.



Runout Compensation Rings for BAYO T-REAM Reamers



**Fig. 3**



## Chip Formation Analysis

ISCAR's capability to simulate how the chip develops and flows aids in optimizing chip gullets on tool bodies and chip splitter rake faces in inserts.

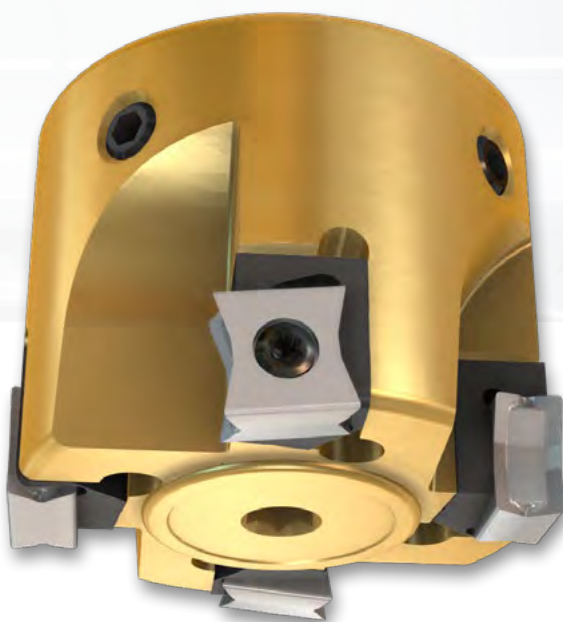
Go to the QR link above to see how a customer's chip breakage issue was solved. The analysis facilitated the design of a special chip breaker in a BAYO T-REAM reaming head.



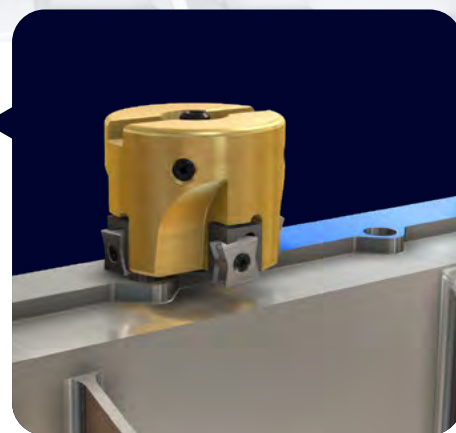
## Battery Case

### Face and Shoulder Milling

The axially adjustable face mills carry indexable tangential inserts, to ensure crystal clear surface finish and even wear on inserts. Balancing screws allow comfortable balancing adjustment instead of machining the tool body, enabling operations with high rpm.



**ALUTANG**



**Fig. 4**



LNAR 1106  
Polished carbide insert



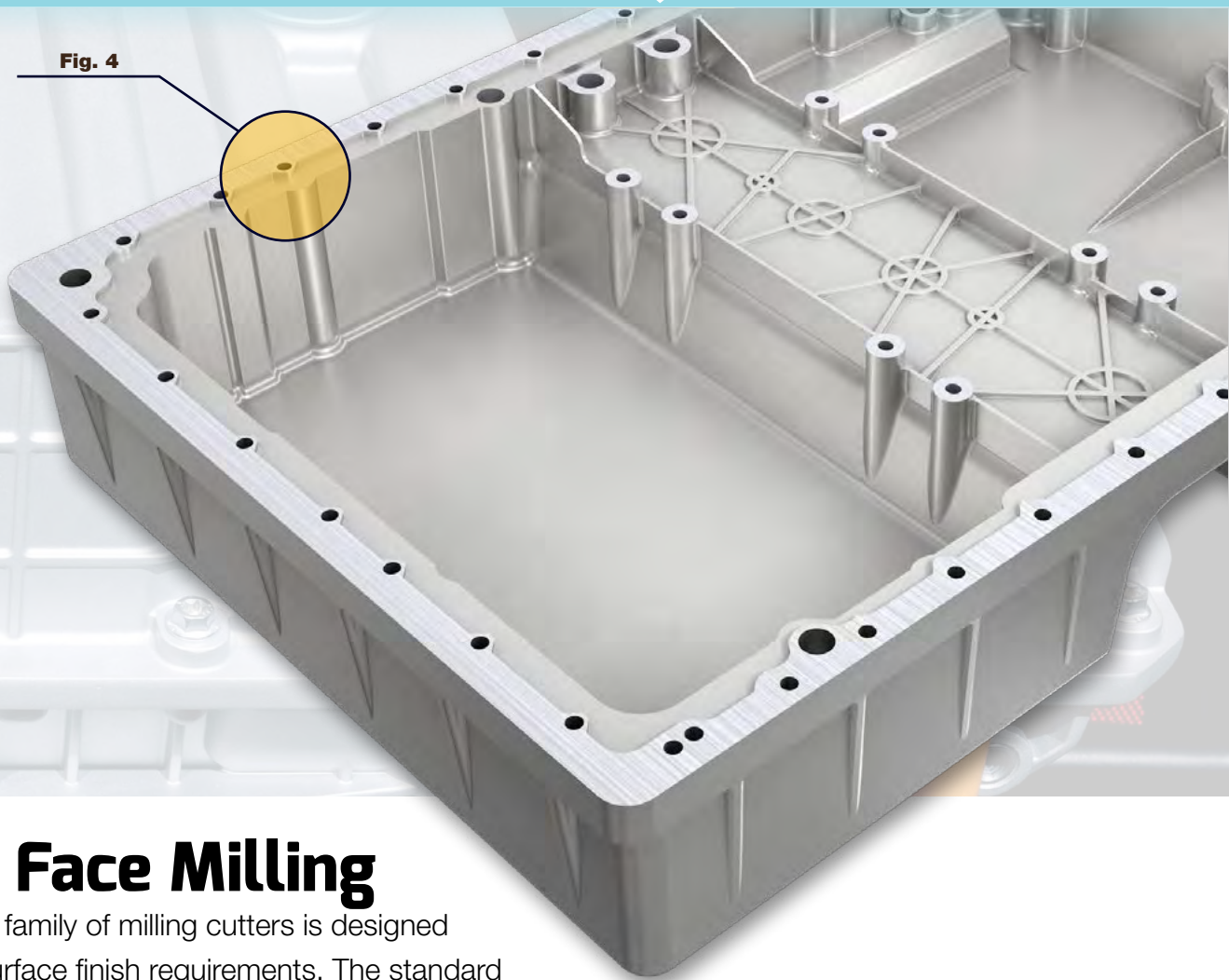
LNAR 1106 (PCD)  
PCD tipped insert



LNAR 1106PN-R-S-W (PCD)  
PCD wiper insert



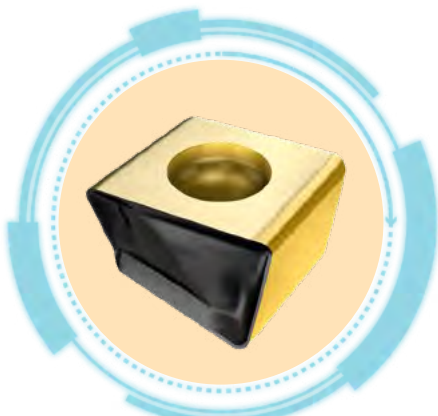
Fig. 4



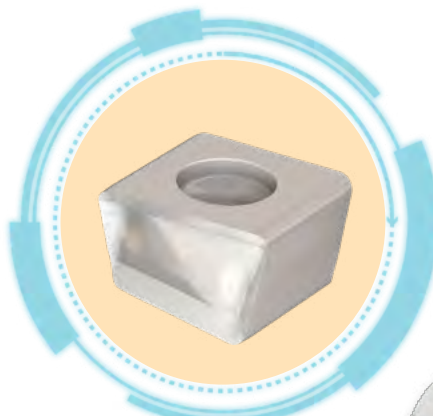
## Finish Face Milling

The TANGFIN family of milling cutters is designed for extreme surface finish requirements. The standard HTP inserts are positioned in such way that small portions of material are removed both in radial and axial directions. The long wiper cutting edge of the insert and its rigid clamping helps achieving extra fine surface finish up to Ra 0.1, with no need for adjusting.

**TANGFIN**  
FINISH MILLING



HTP...ER/ETR  
for cast iron and steel



HTP...FR-P  
Sharp uncoated and polished  
for aluminum





## Composite Materials

Composite materials, such as CFRP (Carbon Fiber Reinforced Polymer) can be used in body and chassis parts to lower weight without compromising strength and rigidity. Currently, the use of composite materials in the automotive industry is mostly reserved for sport and supercars. This is due to the high production cost. However, as manufacturing techniques improve, prices for composite materials keep dropping. So it is possible that in future we will witness use of CFRP in mass produced cars.

Whether you are making low budget vehicles or supercars, ISCAR has the tools for you!



Variety of carbide and PCD products for CFRP





## Special SUMOCHAM ICF Geometry

Available with diamond coating, this drilling head is designed to overcome all the typical CFRP machining failures and allow you to enjoy all the benefits of the SUMOCHAM drills.







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