

# Aerospace & Defence

CERATIZIT is a high-technology engineering group specialised in cutting tools and hard material solutions.

**Tooling a Sustainable Future**

[ceratizit.com](http://ceratizit.com)



**CERATIZIT**  
GROUP



## Industry Solutions

### Industry-specific applications and bespoke solutions

In every industrial sector, tools need to offer maximum cutting performance, wear resistance, precision and quality. And that goes for all materials that need to be machined, whether aluminium alloys, cast materials and high-alloy steels, titanium or even super alloys.

We draw upon our extensive know-how and portfolio as the leading supplier of numerous industry solutions to provide you with perfect support even for the most challenging of applications. No matter what your requirements, together we will find a successful and innovative solution to optimise your production processes.



As our customer, you will benefit from one of the largest ranges on the market, an efficient sales operation and our leading expertise worldwide!

# Tooling a Sustainable Future

## CERATIZIT: Your specialist in sustainable cutting tools and hard material solutions

Are you looking for a reliable partner for your tooling and machining-process needs? Then look no further! CERATIZIT is not just a tool supplier. Our experts are also on hand to advise you with extensive industry knowledge and decades of experience.

What's more, anyone concerned about their carbon footprint will find us a sustainability-conscious partner with a concrete strategy and target: to become the number 1 sustainable company in our industry.

For more than 100 years, CERATIZIT has been a pioneer in the field of sophisticated hard material solutions for machining and protection against wear. This allows us to guarantee our customers the highest levels of quality and access to the latest developments in the carbide sector – all-round cutting tools expertise from a single source.



# Aerospace

## A light touch - the formula for success for pioneering first-class tooling solutions

Low weight and maximum safety are the two most sought-after properties in modern aviation. Thanks to the latest materials such as fibre-reinforced composites, aluminium, titanium alloys and super alloys, manufacturers are placing their aircraft on a structural diet. However, these materials are extremely difficult to machine, which can only be carried out economically using the latest tool and machining concepts. As one of the leading suppliers of cutting tools and machine equipment, CERATIZIT is a partner you can rely on when it comes to machining challenging components.



## Structural components

We deploy powerful tooling solutions to achieve optimum parameters in the machining of engine mounts, formers and wing ribs. Due to their high material removal rates, these solutions keep costs down and use the latest cutting material grades to achieve very long tool life figures and fast processes.

- Wing rib → pages 8–9
- Former → pages 10–11
- Engine mount → pages 12–13

## Aircraft engine

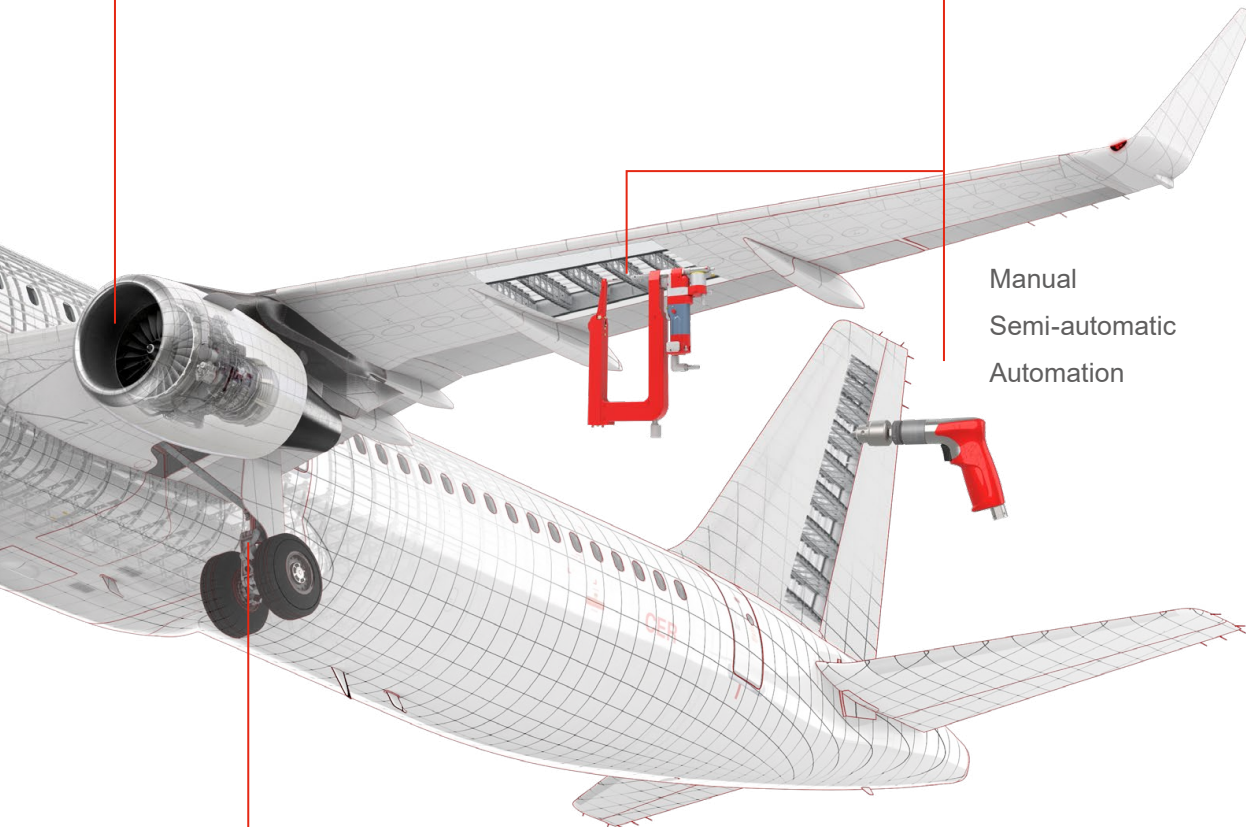
Turbines provide the thrust required for the aerospace & aeronautical industry. The same applies to the cutting tools, so we are now delivering solutions that enable even the most innovative materials to be machined to the highest levels of accuracy, quality and efficiency.

Fan case	→ pages 14–15
Blisk	→ pages 16–17
Combustion chamber	→ pages 18–19
Turbine blade	→ pages 20–21

## Assembly

Even the most modern aircraft assembly line contains elements of bespoke craftsmanship. In order to optimally map the diverse material combinations and manual production steps, we design individual solutions that are tailored to each process step in terms of carbide, geometry and coating and are reproducible at any time.

Manual	→ pages 26–27
Semi-automatic	→ pages 28–29
Automation	→ pages 30–31



## Landing gear

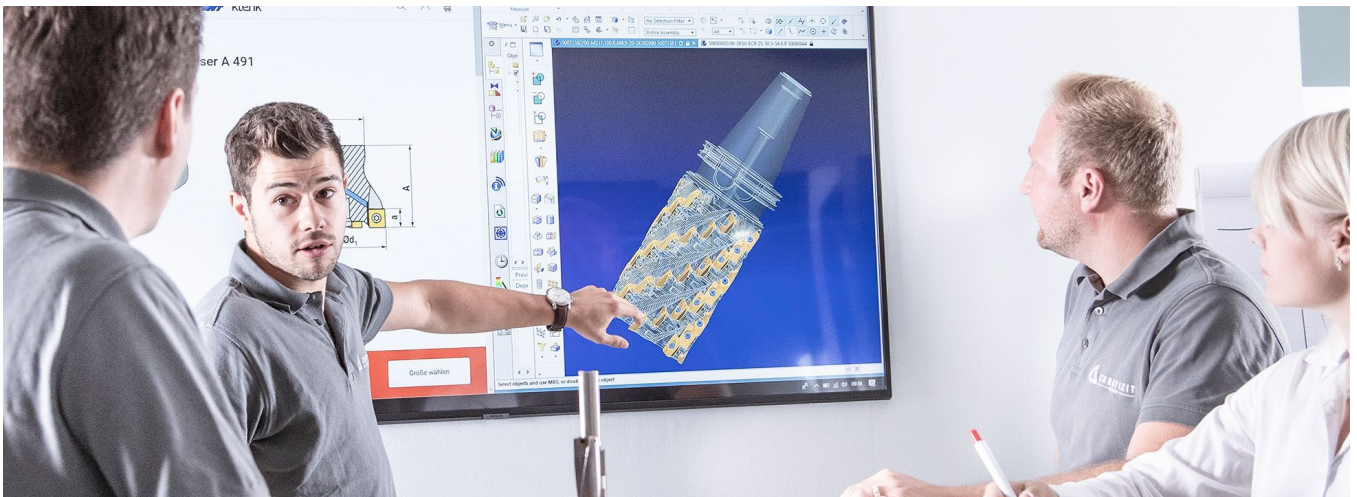
High-alloy steels and titanium materials are frequently found in landing gear. In our role as a full-service provider, and to ensure every operation ends as planned, we offer a vast range of tooling solutions for turning, milling and drilling applications, not to mention a selection of controllable tools.

Main cylinder	→ pages 22–23
Landing gear struts	→ pages 24–25

# The competitive advantages of our service

## Benefit from our bespoke service solutions

At CERATIZIT, we offer the latest technical standards, plus innovative materials and coatings, special tools designed specifically for the aerospace industry, and, above all, integrated service offerings. We adapt our offer to suit your individual needs. A unique offer that gives you a decisive competitive advantage. Take a closer look at our impressive range of services that will elevate your processes to an entirely new level and support you in the challenges you face.



## Solutions for efficient machining processes

From expert advice and detailed project development to smooth implementation, our project engineering service will provide you with the ideal solution to meet your specific needs. Let our interdisciplinary expert team implement a customised solution for your projects.

More information → pages [32–33](#)



## Keep track of your processes with our digital solutions ToolScope and Cockpit

The fundamental components are the ToolScope tool & process monitoring system and Cockpit, which combines, visualises and analyses individual process data. These tools give you a clear overview of your production process around the clock, plus reveal hidden potential and unexpected problems in no time at all.

More information → pages [34–37](#)



## Environmentally friendly, sustainable & cost-effective

We have an ambitious sustainability mission that will affect and change the entire supply chain. But we can only achieve true sustainability together, which is why our mission extends far beyond our own horizons: we want to enable our customers to operate more sustainably with our products and services. With this mission in mind, we want to make a significant contribution to tackling the climate crisis.

More information → pages [38–39](#)

# Machining the wing rib

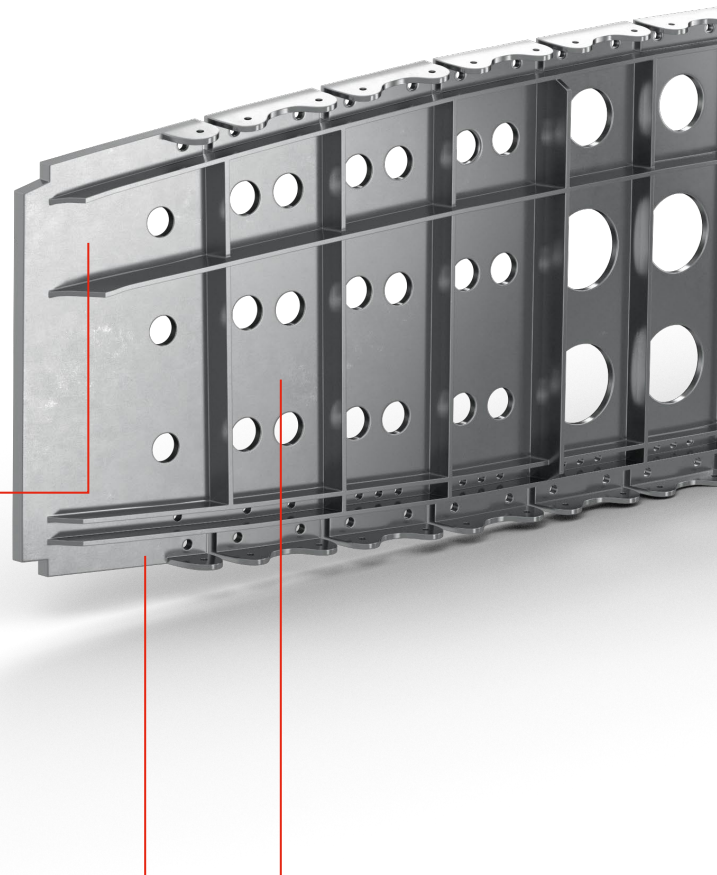
## Material removal rates and tool life reach new heights

Together with the stringers, the wing ribs form the framework of the aircraft wings and are permanently exposed to enormous stresses while in the air. To save weight and ensure a long life, aluminium wrought alloy has become the go-to material for wing ribs. Thanks to the process-secure tool solutions from CERATIZIT, high-speed machining works with outstanding parameters.

### High-speed milling

#### MaxiMill HPC/HSC indexable insert milling cutter

- ▲ 90° shoulder milling system for roughing and finishing light alloys
- ▲ Various milling applications are possible
- ▲ Various indexable insert sizes: 11 mm, 15 mm, 19 mm
- ▲  $a_p$  max. 18 mm
- ▲ Large range of corner radii up to 6.4 mm



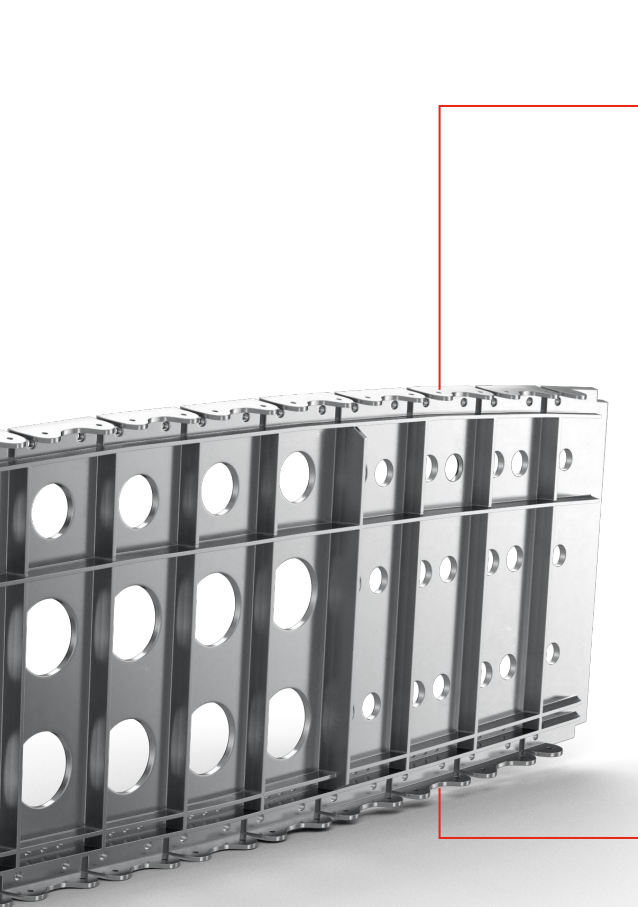
### High-speed milling

#### MaxiMill HSC-15 indexable insert milling cutter

- ▲ 90° shoulder milling system for roughing and finishing light alloys
- ▲ Various milling applications are possible
- ▲ Speeds > 30,000 rpm possible without additional positive connection
- ▲ Large range of corner radii up to 6.4 mm







## Trochoidal milling

### CCR-AL – solid carbide milling cutter

- ▲ First choice for the roughing of medium-sized aluminium pockets or slots
- ▲ Special cutting edge design perfect for trochoidal milling (CPC: circle power cutting)
- ▲ Cutting edge with chip breaker for reliable chip evacuation even at a large cutting depth
- ▲ For milling of CPC applications up to 5xD



## Conventional roughing

### AluLine WR

- ▲ First choice for the roughing of smaller pockets and contours
- ▲ The modified cutting edge geometry ensures low cutting forces, thus improving machining parameters and productivity
- ▲ Uncoated grades, DLC coated or with PVD-multilayer coating



## Universal machining

### MaxiMill 491

- ▲ Economical double-sided 90° indexable insert milling cutter system
- ▲ Ground indexable insert with eight cutting edges
- ▲ Its outstanding surface quality allows roughing and finishing to be carried out with the same indexable insert

# Machining the frame

## Rigidity from titanium

Frames and stringers give the fuselage the necessary rigidity. As a light, high-strength material, titanium is often used here, reducing the number of components needed. However, the positive characteristics of titanium come at the cost of demanding machining properties, which in turn require a corresponding level of expertise and high-performance tooling solutions. CERATIZIT can get you off to a flying start with its specialised cutting materials, which ensure reliable tool life and stable processes when roughing and finishing.



## Trochoidal roughing of medium-sized pockets and slots in titanium, super alloys and high-alloy steel

### CircularLine CCR-VA – solid carbide milling cutter

- ▲ Special cutting edge design perfect for trochoidal milling (CPC: circle power cutting)
- ▲ Cutting edges with chip breakers for reliable chip evacuation when working with large cutting depths
- ▲ For CPC milling up to 5xD

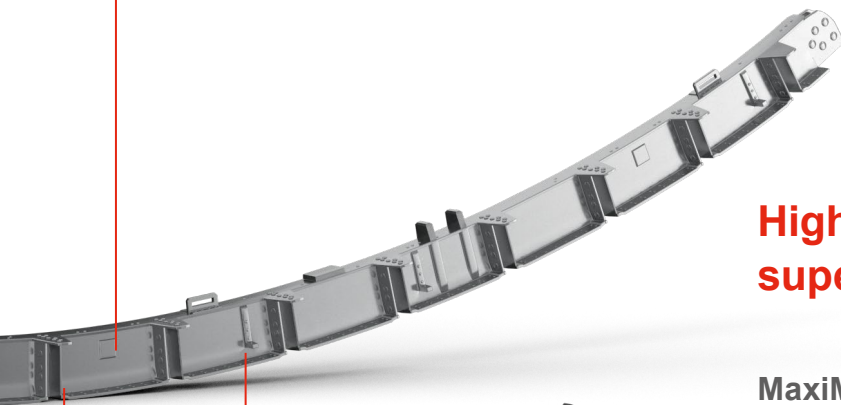




## 90° shoulder, pocket or slot milling with high ap on medium and large structural components

### MaxiMill RadX indexable insert porcupine cutter

- ▲ Indexable insert system for the machining of large pockets, for universal applications
- ▲ Perfectly adapted tool holder
- ▲ Corner radius up to 4.0 mm
- ▲ Cutting material grade CTC5240 as a benchmark in titanium machining
- ▲ Economical milling system with indexable inserts with 8 cutting edges



## High-feed freeform milling with super-fast machining rates

### MaxiMill HFC-19 indexable insert milling system

- ▲ High-speed roughing and shaping of large 3D areas
- ▲ Four cutting edges per indexable insert
- ▲ Max.  $a_p$  3.3 mm (19 mm insert)



## Finishing of pockets and slots for various component areas in aircraft construction

### MonsterMill NCR

- ▲ Machining of small and medium-sized titanium areas
- ▲ Perfectly adapted geometry for machining titanium and heat resistant super alloys
- ▲ Huge range of end mills, torus and ballnose cutters



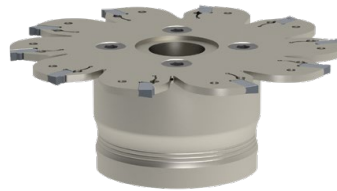
# Machining the engine mount

## Extreme forces, toughest materials and high-performance cutting tools

No tolerances are permitted when it comes to safety – especially in the development of engine mounts. They are subject to enormous stresses when taking off and landing, which is why only the most rugged materials can be used. The machining of these in turn has to be carried out to the highest levels of accuracy and process security.

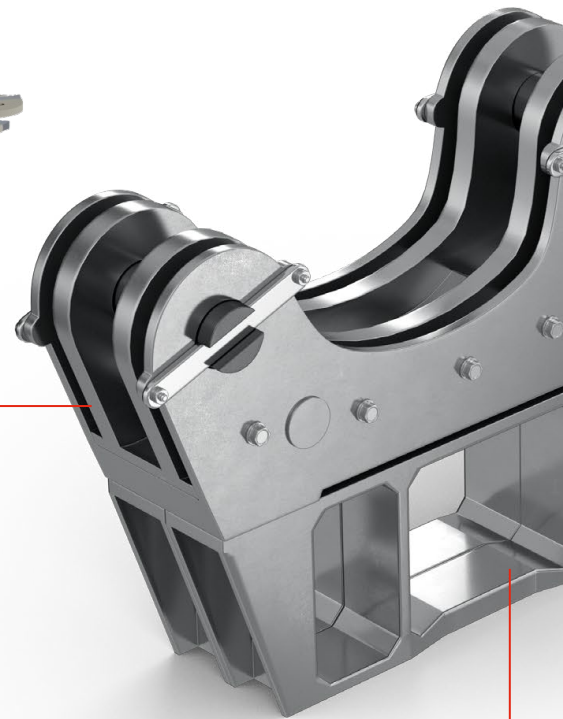
Welcome aboard – CERATIZIT already has the solutions you need.

### Side and face milling cutter for the best chip control during groove milling, slot milling and parting off



### Slot milling system with thro' coolant MaxiMill - Slot-SX

- ▲ Excellent performance and process security via internal coolant supply
- ▲ No chip jams or time-consuming removal of chips
- ▲ Reliable indexable insert range and diverse range of holders
- ▲ Easy handling through patented SX assembly key

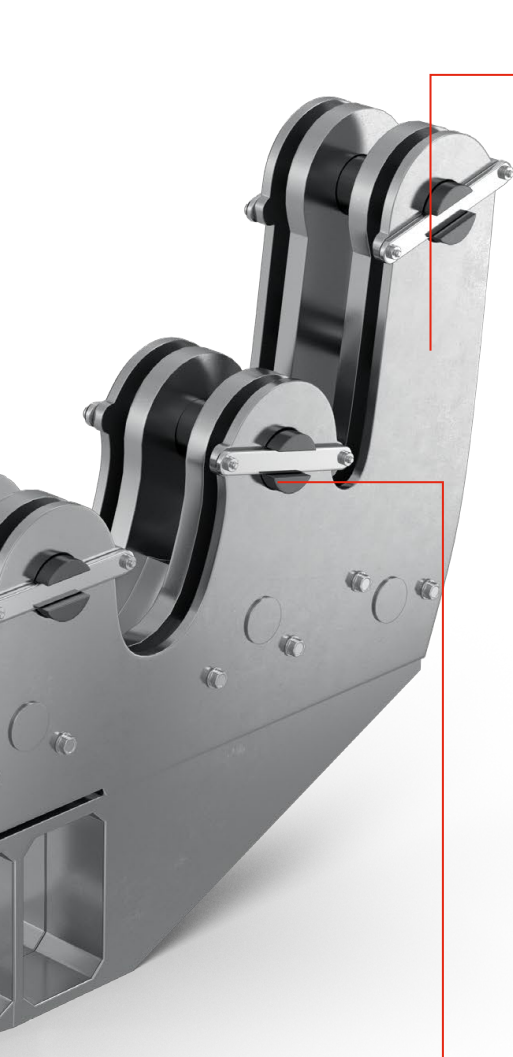


### The ideal nozzle position for decisive added value when machining heat-resistant materials

### 3D-printed shoulder milling system MaxiMill - 211-DC with DirectCooling

- ▲ Maximum process security and tool service life despite high cutting speed
- ▲ Insert geometry that is precisely tailored to the cooling for full-coverage wetting of the coolant on the cutting surface
- ▲ For reliable machining with titanium and super alloys





## Face milling cutter for cost-effective roughing with large cutting depths and reduced power consumption

### MaxiMill 271

- ▲ Eight cutting edges per indexable insert
- ▲ Max.  $a_p$  up to 8.4 mm (17 mm insert)
- ▲ Double-sided indexable insert with integrated clearance angle for reduced power consumption



## Productive drilling of large and medium diameter holes

### Indexable insert drill KUB Pentron

- ▲ Maximum performance and a long service life combined with outstanding drilling thanks to optimum base body stability and a special surface treatment
- ▲ Optimum dimensional accuracy for the most difficult drilling conditions up to 5xD
- ▲ Cost reduction during storage and easy handling thanks to identical internal and external indexable inserts
- ▲ Maximum tool life thanks to four fully usable cutting edges made from modern substrates with corresponding coatings

# Machining the fan case

## Titanium: highly stable with uncompromising safety

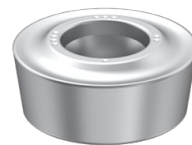
The challenges in the machining of the ring-shaped fan cases, which form the casing for the largest turbine blades of the entire engine are enormous. Highest possible levels of stability and uncompromising safety are the number one priority, which is why fan cases are also made from titanium.

If you are looking for process security and productivity as well as efficiency and excellent surface quality, the CERATIZIT range of tools offers powerful options.

## Finishing and semi-finishing of the internal and external contours of titanium casings with RCMT button inserts

### RCMT 1606MOTN-24 H216T indexable insert

- ▲ Specially adapted '-24' geometry for the copy turning of titanium
- ▲ Uncoated fine grain grade H216T
- ▲ High temperature and wear resistance



## Shank thread milling cutter for material-friendly thread production

### MonoThread - SGF the thread milling cutter with a real performance boost

- ▲ For universal application
- ▲ Available in a wide range of thread types (M / MF / G / NPT / UNC / UNF / UNJC / UNJF)
- ▲ Optimum core rounding and taper for high dimensional accuracy
- ▲ Thro' coolant for a long service life
- ▲ Particularly suitable for asymmetric, thin-walled or complex components



## Drilling of heat-resistant alloys



### WTX-Ti solid carbide drill

- ▲ Improved geometry and core diameter for maximum process security
- ▲ Unique performance due to the new high-end double coating system
- ▲ Stabilisation chamfer on the cutting edge for greater tool stability



## The ideal nozzle position for decisive added value when machining heat-resistant materials

### 3D-printed shoulder milling system MaxiMill - 211-DC with DirectCooling

- ▲ Maximum process security and tool service life despite high cutting speed
- ▲ Insert geometry that is precisely tailored to the cooling for full-coverage wetting of the coolant on the cutting surface
- ▲ For reliable machining with titanium and super alloys as well as nickel-based alloys

# Machining the blisk

## The perfect blisk – in one clamping operation

Blisk manufacturing in particular requires modified and customised tool systems. The demanding contours found on the wide variety of different types of blisk and the stringent requirements with regard to surface quality, tight component tolerances and high-quality materials can only be satisfied using specially modified tools.

The broad scope of the CERATIZIT standard product range and its expertise in devising special solutions mean that blisks can now be manufactured in a single clamping operation.

### Blisk pre-finishing and finishing with customised form cutters

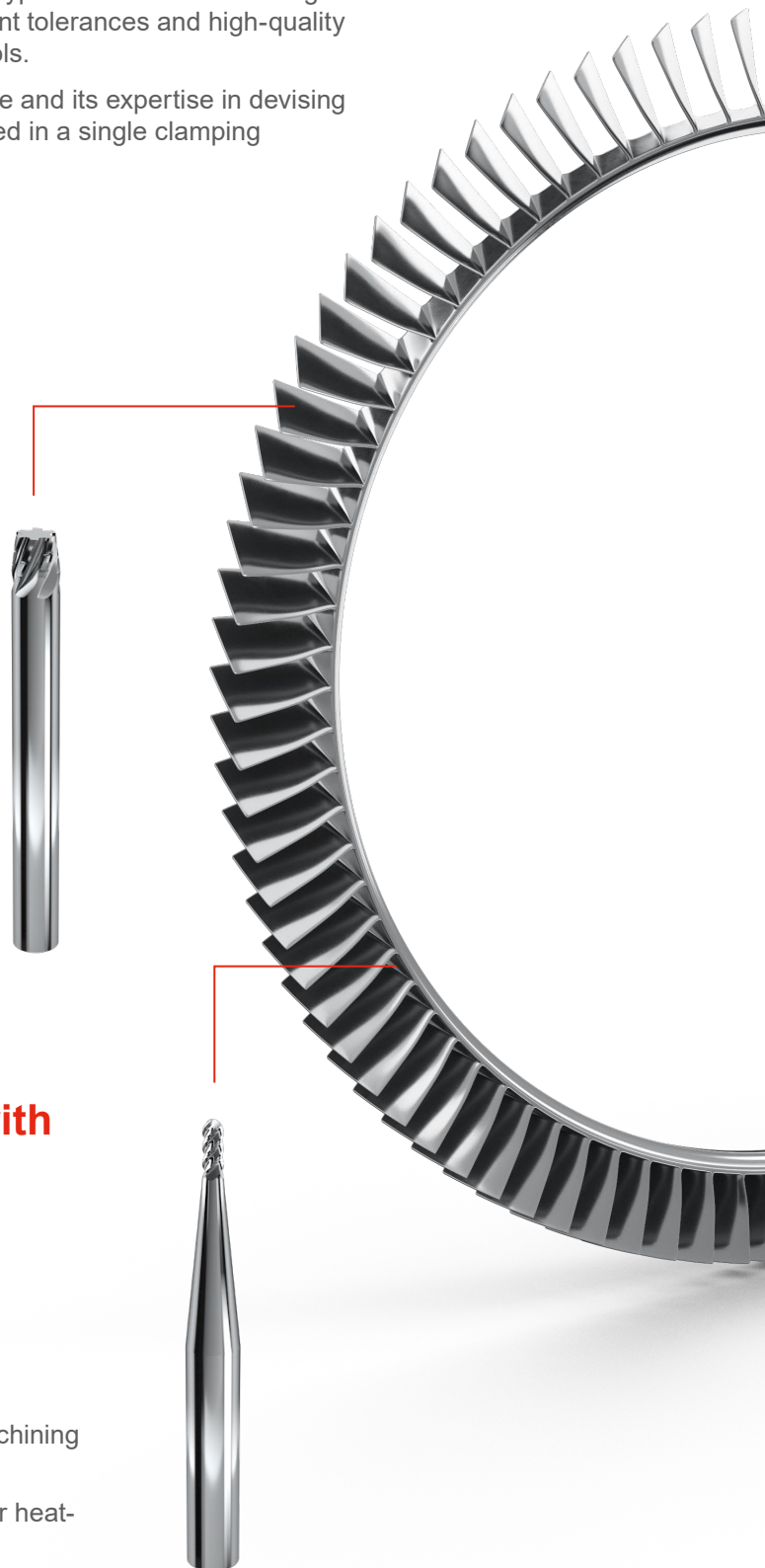
#### Solid carbide barrel milling cutter

- ▲ Ideal for flank milling
- ▲ Perfectly adapted to the customer's blisk shape and machining strategy
- ▲ Optimised geometry and grade for machining titanium or heat-resistant alloys

### Blisk pre-finishing and finishing with customised radius milling cutters

#### Solid carbide ballnose milling cutter

- ▲ Ideal for platform and fillet radius milling
- ▲ Perfectly adapted to the customer's blisk shape and machining strategy
- ▲ Optimised geometry and grade for machining titanium or heat-resistant alloys



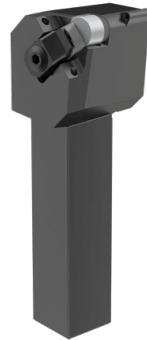




## Finish machining with low cutting forces

**CTPX710 carbide grade**

- ▲ The latest PVD coating technology for machining heat-resistant alloys, stainless steel and titanium



## Rough machining at impressive cutting speeds

**SiAlON ceramic grade 1481**

- ▲ 1481 SiAlON ceramic with excellent notch wear resistance, the first choice for Inconel718
- ▲ CTKS710 whisker ceramic as an alternative for other applications, particularly for continuous long cuts

## Monoblock or flexible MSS holder system for axial or radial grooving

**GX24 grooving system**

- ▲ Radial, axial, internal and external grooving applications are possible
- ▲ Monoblock, parting blades, and the modular MSS holder system available
- ▲ Straight cutting edge and radius plate in various geometries for a range of applications

# Machining the combustion case

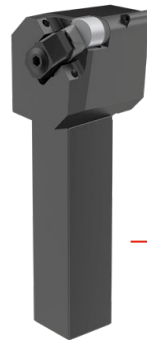
## Super alloys defy high pressure and heat

The combustion chamber in an aircraft turbine is a place of incredible temperature and pressure, which really puts the heat-resistant super alloys used to the test. These component materials can in turn only be machined with extremely tough tools. To ensure the necessary efficiency in the face of any challenge, CERATIZIT has optimised its tools for use on demanding materials.

## Roughing of Ni-based alloys at impressive cutting speeds

### SiAlON ceramic grade 1481

- ▲ 1481 SiAlON ceramic with excellent notch wear resistance, the first choice for Inconel718
- ▲ CTKS710 whisker ceramic as alternative for other applications, particularly for continuous long cuts



## Turning finish machining with low cutting forces

### CTPX710 carbide grade

- ▲ The latest PVD coating technology for machining heat resistant alloys, titanium and stainless steel





## Machining of smaller areas and pockets in titanium or Ni-based alloys

### MonsterMill NCR solid carbide milling cutter

- ▲ Perfectly adapted geometry for machining titanium and heat resistant super alloys
- ▲ Huge range of end mills, torus or ballnose cutters



## Shank thread milling cutter for material-friendly thread production

### MonoThread - SGF the thread milling cutter with a real performance boost

- ▲ For universal application
- ▲ Available in a wide range of thread types (M / MF / G / NPT / UNC / UNF / UNJC / UNJF)
- ▲ Optimum core rounding and taper for high dimensional accuracy
- ▲ Thro' coolant for a long service life
- ▲ Particularly suitable for asymmetric, thin-walled or complex components



## For precise drilling with the perfect finish

### Fullmax 52P.57Un solid carbide reamer

- ▲ Solid carbide reamer for precise drilling of heat-resistant alloys with superb surface quality

# Machining the turbine blade

## Super alloys and titanium for the highest stresses

Turbine blades are subjected to phenomenal thermal stresses and must always deliver peak performance over the entire life of the aero engine. Aircraft engineers are using super alloys or titanium alloys and a steady stream of newly developed materials to make them even tougher. However, these materials are extremely difficult to machine.

Thanks to the CERATIZIT tool systems, which are designed to deliver maximum levels of productivity, machining times remain within acceptable limits, even during the complex roughing processes used for the rhombus and blade.

## Versatile machining options with button inserts

### MaxiMill 251

- ▲ Button insert milling system for large areas
- ▲ Universal freeform milling for every application and machining strategy
- ▲ Extensive range of tools and indexable inserts



## High-feed indexable insert milling system for larger cutting depths

### MaxiMill HFC-TUR

- ▲ HFC milling with larger cutting depths than conventional systems owing to the adapted setting angle
- ▲ Coated carbide grade CTCS245 for heat-resistant alloys and CTC5240 as the benchmark in titanium machining



## Extremely productive freeform milling with positive button inserts, machining of large areas of Ni-based alloys



### MaxiMill 261 – ceramic

- ▲ Extremely productive: more than 10x higher cutting speeds possible compared to carbide inserts
- ▲ Drastically shortened machining times for roughing, regardless of the machining strategy

## Highly efficient finishing due to the patented exchangeable head system



### MultiLock for solid carbide milling heads

- ▲ Cost effective, unbeatable price-performance ratio
- ▲ Closes the gap between indexable insert and solid carbide systems
- ▲ Extensive product range for other applications

## Machining of transitions on blade root and blade tip



### Solid carbide conical ballnose milling cutter

- ▲ Adapted geometry for the machining of special contours on Ni-based alloys and titanium

**New grade CTPX245 especially for machining turbine blades**

# Machining the main cylinder

## Precision landing achieved in the machining of titanium and high-alloy steels

The entire weight of an aircraft rests on its landing gear. The main cylinder is the focal point of the landing gear. This heavily loaded component is generally constructed from titanium or high-alloy steels. However, it is not just the materials that are demanding; the components themselves are extremely complex. In addition to the tool technology, an optimum machining strategy is also needed. Just as well that CERATIZIT already has suitable solutions and concepts available for contour milling, turning and drilling.

## Indexable insert system for machining larger pockets, for plunging or for universal applications

### MaxiMill 211

- ▲ Special insert design, perfect for plunge milling
- ▲ Comprehensive product range
- ▲ Suitable for various milling strategies and applications





## High performance tool for steel machining

### HPC2 solid carbide universal milling cutter

- ▲ Small helix angle for low cutting force and large helix angle for rapid chip evacuation
- ▲ Patented core diameter and helix angle

## Roughing of large 3D areas at high feed rate



### MaxiMill HFC

- ▲ Smaller indexable insert setting angle for stable machining even with large overhangs
- ▲ Coated cutting material grade CTPP235 for reliable machining of high-alloy steel



## Standard or modified versions for customer-specific tool holders and turning strategies

### ISO turning inserts

- ▲ Coated carbide grade CTCP125 for the process-secure machining of high-alloy steels
- ▲ Different geometries for short chip formation, e.g. –SMF
- ▲ Customer-specific indexable insert versions possible for different turning strategies

# Machining the landing gear strut

## Titanium alloys ensure it works

The landing gear strut retracts the landing gear into the fuselage after take-off and extends and locks it in position prior to landing. Titanium alloys are often used here to withstand the enormous forces. The demanding machining characteristics of these alloys, together with the complex structure of the component, make the machining process anything but easy. But whether trochoidal or conventional: Tool solutions from CERATIZIT always ensure optimum performance.

## Great performance in drilling titanium materials

### WTX-Ti solid carbide drill

- ▲ Improved geometry and core diameter for maximum process security
- ▲ Unique performance due to the new high-end double coating system
- ▲ Stabilisation chamfer on the cutting edge for greater tool stability

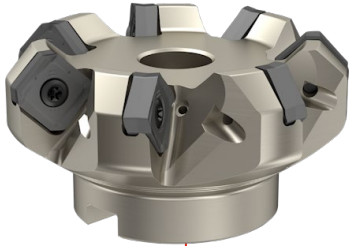
## CCR-VA solid carbide milling cutter optimised for trochoidal roughing

### CircularLine

- ▲ Special cutting edge design perfect for trochoidal milling (CPC: circle power cutting)
- ▲ Cutting edges with chip breakers for reliable chip evacuation when working with large cutting depths
- ▲ For milling in 3xD and 4xD CPC applications







## Face milling cutter for cost-effective roughing with large cutting depths and reduced power consumption

### MaxiMill 271

- ▲ Double-sided indexable insert system for pre-roughing with large cutting depths
- ▲ Eight cutting edges per indexable insert
- ▲ Double-sided indexable insert with integrated clearance angle for reduced power consumption
- ▲ Cutting material grade CTCS245 specially developed for machining Ni-based alloys



## 90° shoulder, pocket or slot milling with high $a_p$ on medium and large structural components

### MaxiMill RadX indexable insert porcupine cutter

- ▲ Indexable insert system for the machining of large pockets, for universal applications
- ▲ Perfectly adapted tool holder
- ▲ Corner radius up to 4.0 mm
- ▲ Cutting material grade CTC5240 as a benchmark in titanium machining
- ▲ Economical milling system with indexable inserts with 8 cutting edges

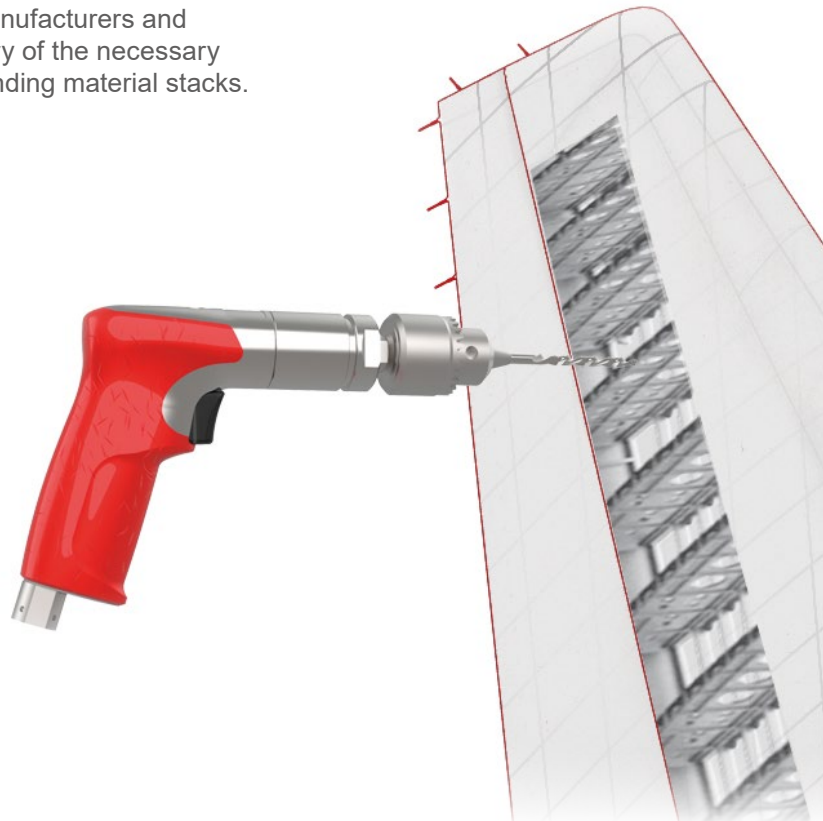
# Assembly

## Manual drilling



*Ergonomic handling and highest quality guaranteed*

Even ultra-modern aircraft production still includes some manual steps such as drilling into a variety of combinations of CFRP, aluminium or titanium. All to the good then that CERATIZIT, a renowned manufacturer of manual tools and supplier to numerous aircraft manufacturers and their sub-suppliers, sits on a repository of the necessary expertise for the machining of demanding material stacks.



*Create efficient manufacturing processes, even in titanium*

### **Titanium alloys: cool the hot chip**

Among the main reasons that titanium is such an attractive option for aircraft manufacturers are its tensile strength, its low specific weight and its resistance to corrosion. However, its low thermal conductivity makes machining more difficult, whereby modified lubrication and the right machining parameters are needed for a cool process. With decades of experience and extremely robust CERATIZIT solutions, efficient manufacturing processes are possible even with a material such as this.

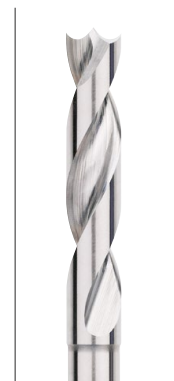
## Materials – machining options

Many years of experience with all common single and mixed material stacks in the aerospace industry, plus other combinations, e.g. with steel or Inconel.



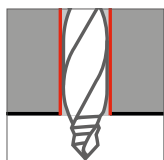
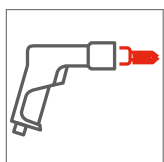
### Fibre composites: not a problem

CFRP and GFRP are on the one hand extremely tough, yet they have a very low specific weight. The highest priorities in the machining of highly abrasive fibre composites are ensuring clean fibre cutting, preventing delamination, and avoiding projecting fibres. A long tool life or tight tolerances can therefore only be achieved by using adapted geometries and high performance diamond coatings or cutting tools equipped with PCD. CERATIZIT helps you master such challenges with a high-precision tool system and experienced employees.



Top priority:  
clean fibre  
separation

### Example: manual one-shot drilling of CFRP-alu



#### Technical data

- ▲ Uncoated solid carbide drill
- ▲ Hole Ø 5.1 mm
- ▲ Drilling process:  
One-shot drilling (OSD)
- ▲ Mixed package  
CFRP-Alu (6 mm – 4 mm)
- ▲ Machine: Pneumatic manual  
drilling machine with 3,300  
rpm
- ▲ Tool life >100 holes

#### Advantages/benefits

- ▲ Fewer process steps  
→ Lower costs  
→ Increased productivity  
→ Shorter process times
- ▲ Reduction in the number of different  
tools
- ▲ Tools can be reground  
→ Save money and improve  
environmental footprint
- ▲ Adapted cutting edge geometry offers  
ergonomic handling and operative-  
independent results with exceptionally  
good tool life



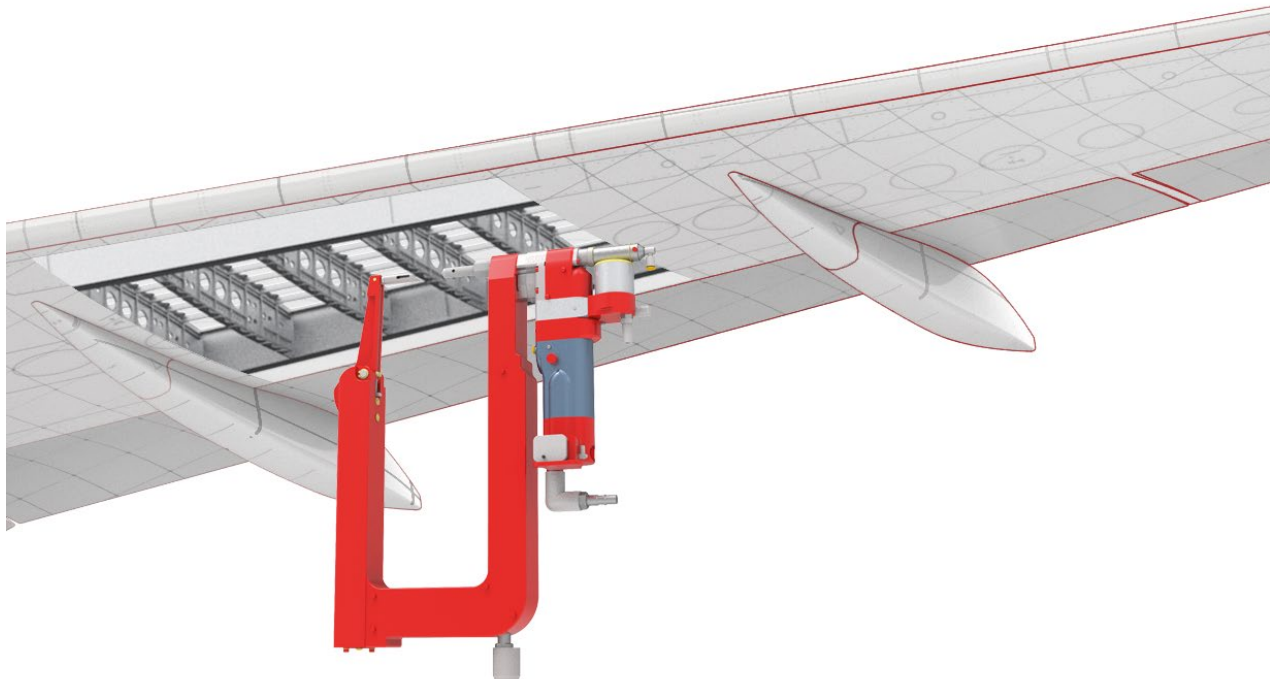
# Assembly

## Semi-automatic drilling



High process security and low costs per hole

Semi-automatic applications are carried out using hand-held pneumatic or electric machines. The cutting tools must be individually adapted to the component/template/machine situation for reasons of process security, competitive tool lives and low costs per hole. CERATIZIT develops special solutions in diameters from 2.5 to 30 mm for all combinations of CFRP/GFRP, aluminium and titanium alloys, steel, Inconel and honeycomb structures. One-shot drilling with tolerances of up to 18  $\mu\text{m}$  is possible depending on the material combination.



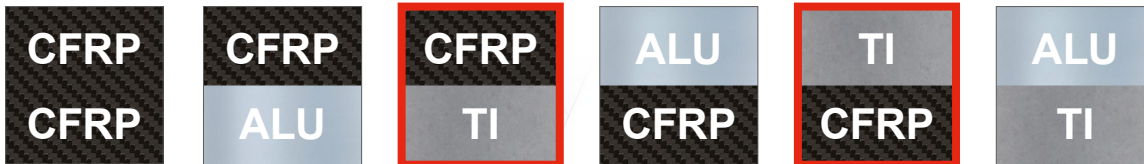
Fit tolerances down to IT8

### Technology: one-shot drilling

A reliable one-shot drilling process reduces tool change and machining times, thus helping to increase efficiency and shorten process times. Save time in advance by asking CERATIZIT to adapt the macro and microgeometry to the respective machining situation. Every one-shot tool is also an extremely precise special design capable of achieving fit tolerances down to IT8.

## Materials – machining options

Many years of experience with all common single and mixed material stacks in the aerospace industry, plus other combinations, e.g. with steel or Inconel.



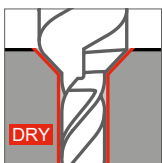
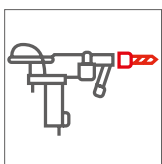
### CFRP and titanium stack drilling (almost) without lubrication – perfect burr and force control

CFRP and Titanium stacks are becoming increasingly common in the assembly of modern aircraft. Machining these materials, however, is very wear-intensive. To this end, Ceratizit has developed geometry and coating combinations designed to optimally handle these material stacks. They increase lifetime threefold, while reducing the amount of lubricant needed tenfold. Furthermore, this new generation of cutters ensures burr control and force generation, making it compatible with one-way-assembly customer processes.



*(Almost) dry machining thanks to optimised tool design*

## Example: one-shot countersinking in H7 in ALU-ALU with ADU



### Technical data

- ▲ Solid carbide drill with or without coating
- ▲ Holes  
Ø 4.1 mm – 32.0 mm  
Countersink Ø: up to 35.0 mm
- ▲ Countersinks in one-shot possible down to IT8
- ▲ Implemented in production both with lubrication and as a dry process

### Advantages/benefits

- ▲ One-shot tool: reduces tool change times and costs, increases productivity and reduces the number of different tools
- ▲ Can be used without any lubrication whatsoever in dry drilling processes: better health conditions, drastic reduction in the amount of cleaning required
- ▲ Process security for your manufacturing operations as result of reproducible premium quality with superb surface quality and tightest fit tolerances
- ▲ CERATIZIT has implemented countless special solutions across the globe and built up a wealth of experience that goes into every new application



*Dry drilling of aluminum with CVD-coated tool*

# Assembly

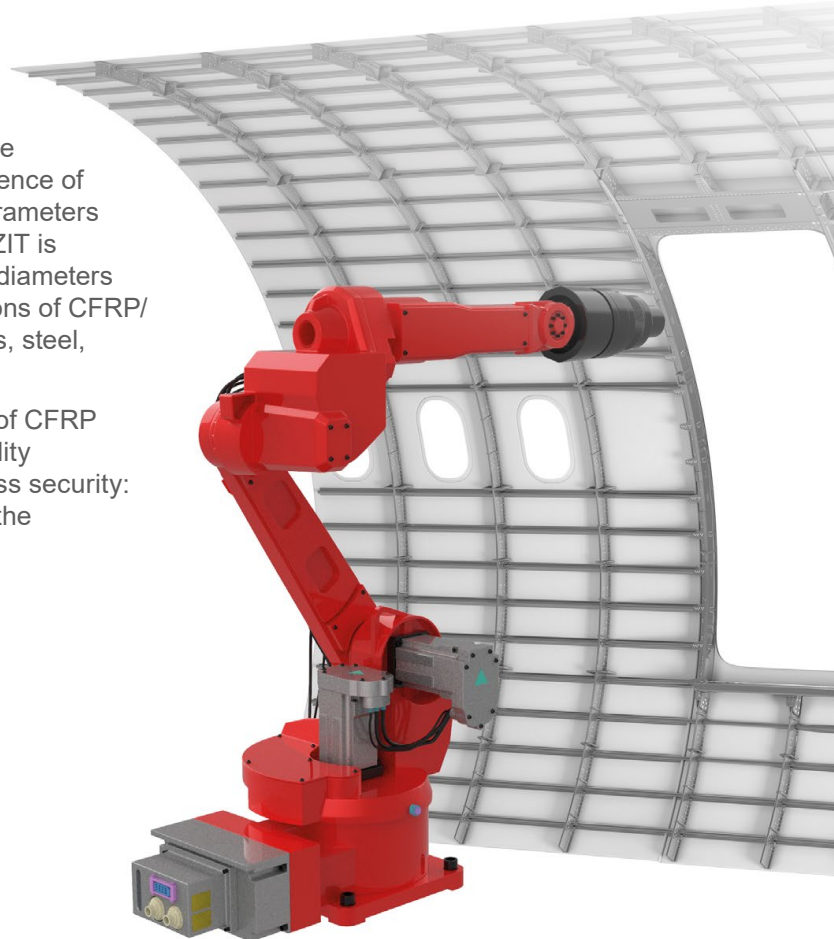
## Automatic drilling



*Top process security with customised solutions*

In future, drilling robots will be increasingly used in aircraft construction for resulting in greater efficiency, accuracy and reproducible quality. These will herald the emergence of CNC-controlled, variable cutting parameters and even vibration drilling. CERATIZIT is developing customised solutions in diameters from 2.5 to 30 mm for all combinations of CFRP/ GFRP aluminium and titanium alloys, steel, Inconel and honeycomb structures.

Whether it's the high-speed drilling of CFRP or extended tool life and drilling quality accompanied by top levels of process security: CERATIZIT is a reliable partner for the automated production of tomorrow.



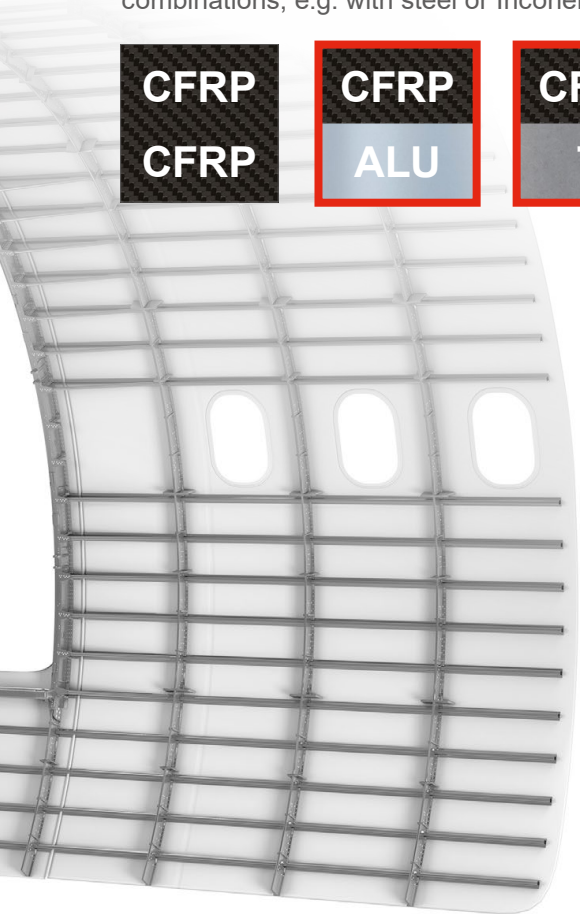
*Special geometry for dry drilling in all material combinations of CFRP-ALU-TI*

### Technology: dry drilling, one-way assembly

Dry drilling and optimised burr control enable you to produce clean aircraft components. This means less cleaning, better working conditions for production employees and compatibility with one-way assembly processes. CERATIZIT offers a range of tools for maximum performance for such applications.

## Materials – machining options

Many years of experience with all common single and mixed material stacks in the aerospace industry, plus other combinations, e.g. with steel or Inconel.



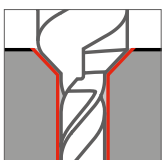
### Material stacks: stronger together

Material stacks consisting of at least two dissimilar materials present machinists with a tricky situation, one that has a number of contrasting characteristics. To keep things simple, CERATIZIT has developed individual tools that deliver the best possible results for each material while at the same time satisfying the requirements in terms of burr formation, projecting fibres, delaminations, tolerances and surface quality. If you need to maintain a continuously high level of performance, CERATIZIT manufactures high-quality tools with tight production tolerances.



Customised tools

## Example: automatic countersinking of ALU-TI



### Technical data

- ▲ Coated solid carbide countersink
- ▲ Material package ALU (4 mm – 6 mm) – TI (2 mm)
- ▲ Machine: Robot with end effector 1300 rpm and 0.1 mm/rev.
- ▲ Tool life of 5000 holes for both material combinations

### Advantages/benefits

- ▲ Special tool with adapted cutting edge geometry for optimum performance in both materials
- ▲ Uses a special carbide-coating combination with outstanding bonding properties
- ▲ Increase tool life with a special coating that reduces frictional forces during the process and prevents adhesion
- ▲ Special countersinking angle geometry prevents vibrations and helps improve countersink surfaces



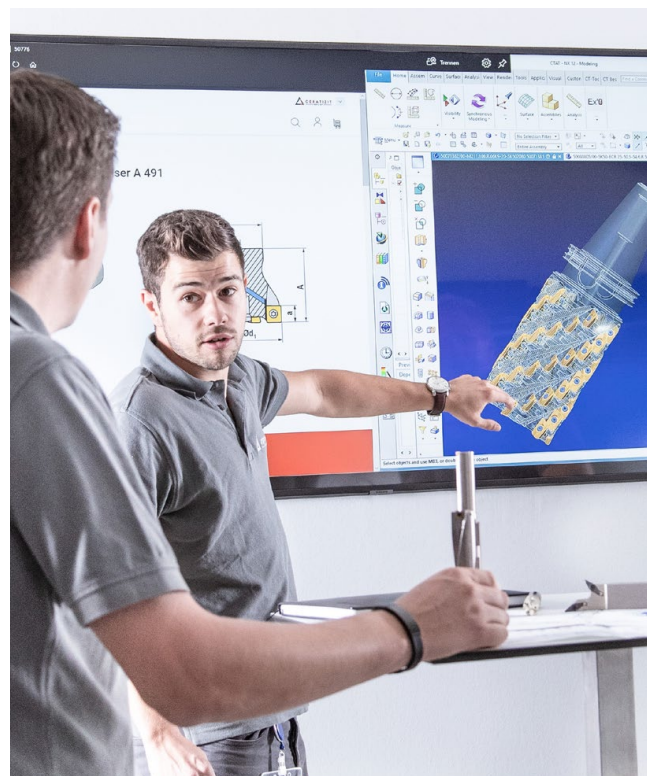
# Projects in the best possible hands

From consulting to successful completion, we realise your application-specific project goals

In order to machine increasingly complex workpieces cost effectively and to a high level of quality, all the process parameters need to be tailored to the specific task. However, the reality is that businesses often do not have the capacity to analyse manufacturing processes and optimise them to make them more efficient. There is also usually not enough time to tailor new cutting materials, tool geometries or process technologies to the individual machining operations.

This is precisely where our project engineering comes in: As one of the leading tool manufacturers, we develop ideal tool concepts for you based on key success factors such as efficiency, time and quality. We have many years of experience in the development of innovative tool solutions, can draw on sound technical expertise and provide first-rate service. What's more, we are a full-service provider for machining and offer one of the most extensive ranges of cutting tools and services.

Do you want to set the pace on an international level too? Then talk to us!



For more information about  
project engineering visit

[cutting.tools/gb/en/project-engineering](https://cutting.tools/gb/en/project-engineering)



## Project consulting

We always keep your objectives in mind and provide you with advice across all industries in all application areas. Benefit from our many years of experience and our innovative solutions.

## Project development & quotation

Our interdisciplinary project team develops the ideal machining concept for your individual specifications and objectives using high-end CERATIZIT tools.

## Project implementation

Our expert team implements the concept on your machine, working closely with you and your dedicated CERATIZIT application engineer. This on-site support guarantees you will receive a stable and cost-effective manufacturing process for your product.

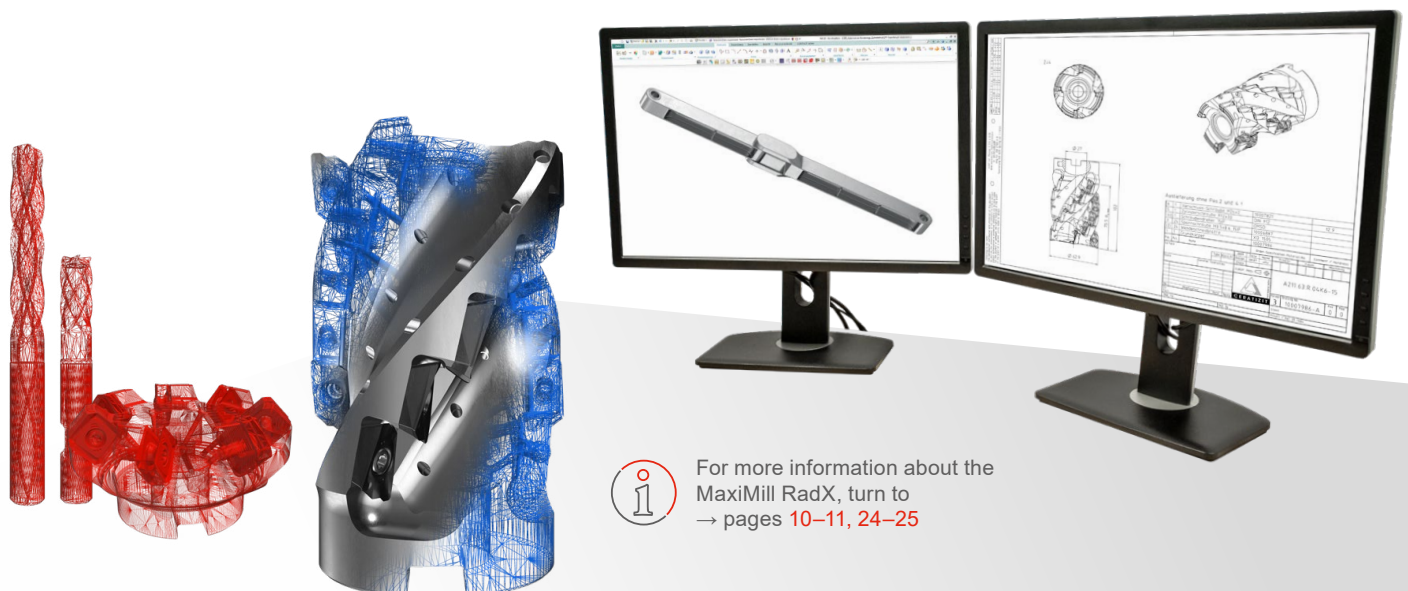
## Ongoing support

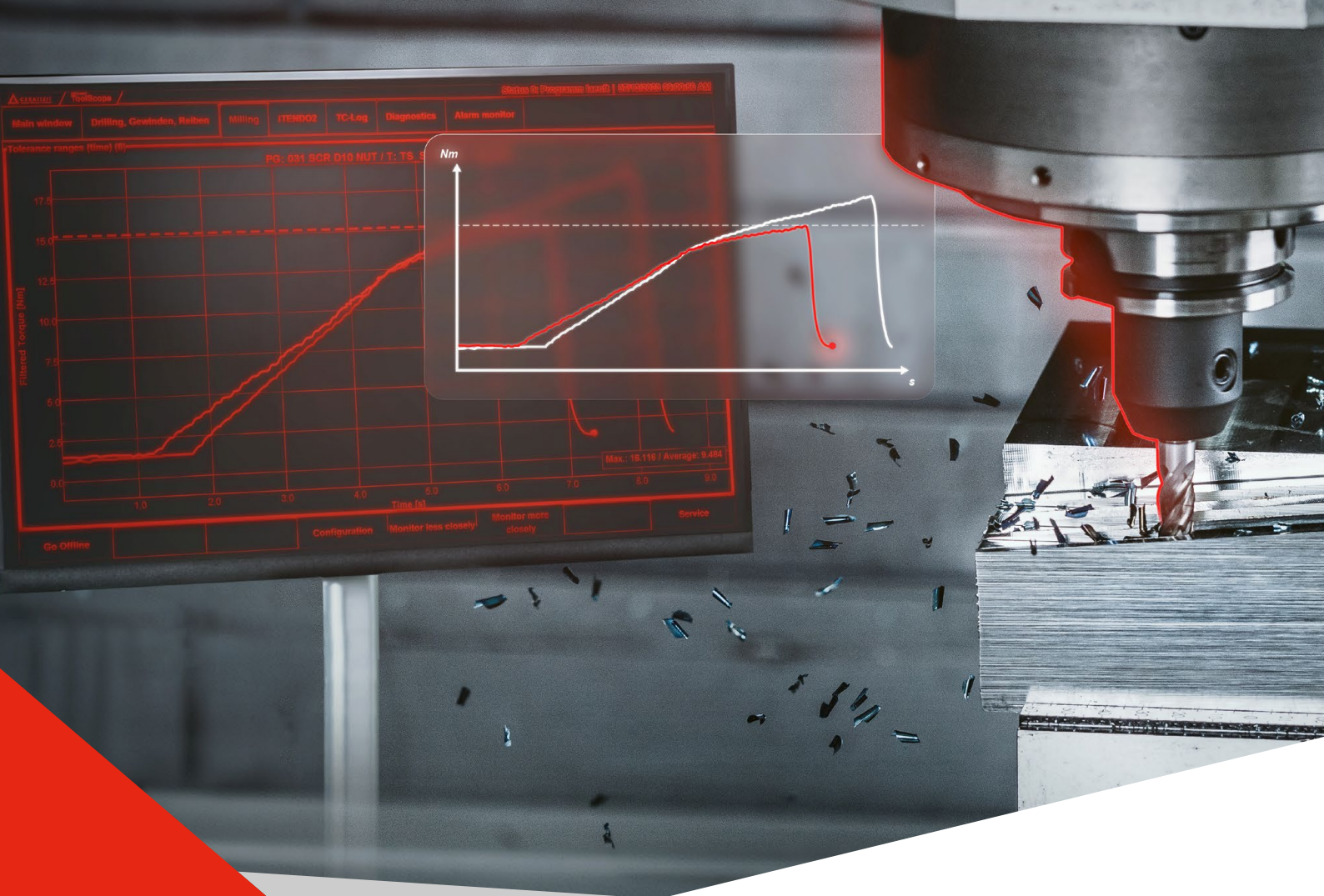
Even after successful implementation of the project, we are here for you. Your dedicated application engineer keeps an eye on your manufacturing processes, determines further potential for optimisation and provides you with ongoing support for all the challenges you face.

# The path to developing perfect tooling solutions

The more complex a workpiece, the more innovative the tool concept needs to be in order to ensure the highest level of quality and cost effectiveness. Our project engineering service is designed to develop tooling solutions of this kind.

For example, our MaxiMill 211-KN indexable insert porcupine cutter was developed in response to a specific customer request. Whether milling 90° shoulders, larger pockets or slots – the indexable insert system comfortably handles these applications with a high width of cut (ap). We know we can develop the perfect tool concept for your requirements too. Why not put us to the test?





# ToolScope

## Full process control – with digital monitoring

Fibre-reinforced composites, aluminium, titanium alloys and super alloys are part of everyday life in the aerospace industry. However, these challenging materials can only be machined in a truly economical manner using the latest tool and machining concepts. As a powerful ally to the sector, we not only provide the perfect tooling solutions and strategies to ensure your processes run smoothly, we also offer an advanced Smart Factory solution: ToolScope, the pioneering monitoring and assistance system, gives you complete transparency with regard to your machining operations so you can easily increase the efficiency of your processes.

ToolScope is a digital control system that monitors and optimises your machining processes. Its innovative functions are customised machining solutions that are integrated in the machine. CERATIZIT's 100 years of tool manufacturing expertise and in-depth understanding of digital systems make us a reliable partner for services encompassing all aspects of process optimisation.

# Keep a close eye on your processes

The machining of components for the aerospace industry is subject to extremely stringent quality requirements. Expensive materials that are difficult to machine and tight quality tolerances demand the highest degree of process accuracy. On top of that, all the machining parameters have to be recorded. ToolScope perfectly and verifiably masters the process stability and documentation disciplines.

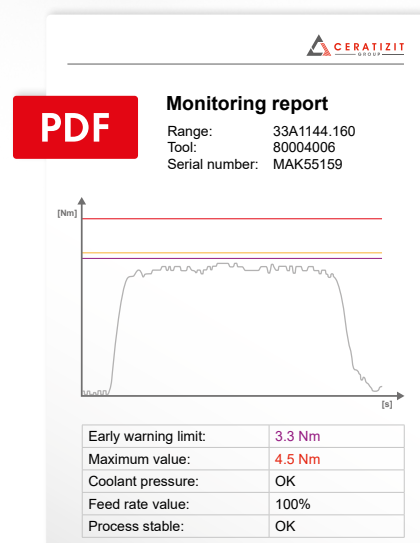
## Machining the blisk

ToolScope is an integrated solution so communicates with the machine tool. The system reliably identifies any deviations from the planned machining profile. In situations where tight manufacturing tolerances exist, the system can be set up so that a tool breakage is avoided, or at least recognised in good time. This real-time monitoring also prevents consequential damage to the workpiece and the machine tool. Customised monitoring strategies and CERATIZIT application engineering provide unique solutions to every challenge.



## Quality monitoring to customer's requirements

ToolScope offers features such as special, customised monitoring strategies for individual customer requirements, including an early warning limit. ToolScope automatically generates a quality certificate for critical parameters, producing a PDF document for every hole in a blisk.



For more information  
about ToolScope visit

[cutting.tools/gb/en/toolscope](https://cutting.tools/gb/en/toolscope)

# Optimal use of your digital production data!

With Cockpit, we combine all aspects of digital machining and provide you with a custom combination of evaluated data – from production data and machine data to tool data or even quality management data. This ensures that you have an optimum overview of your production processes at all times.

# Cockpit

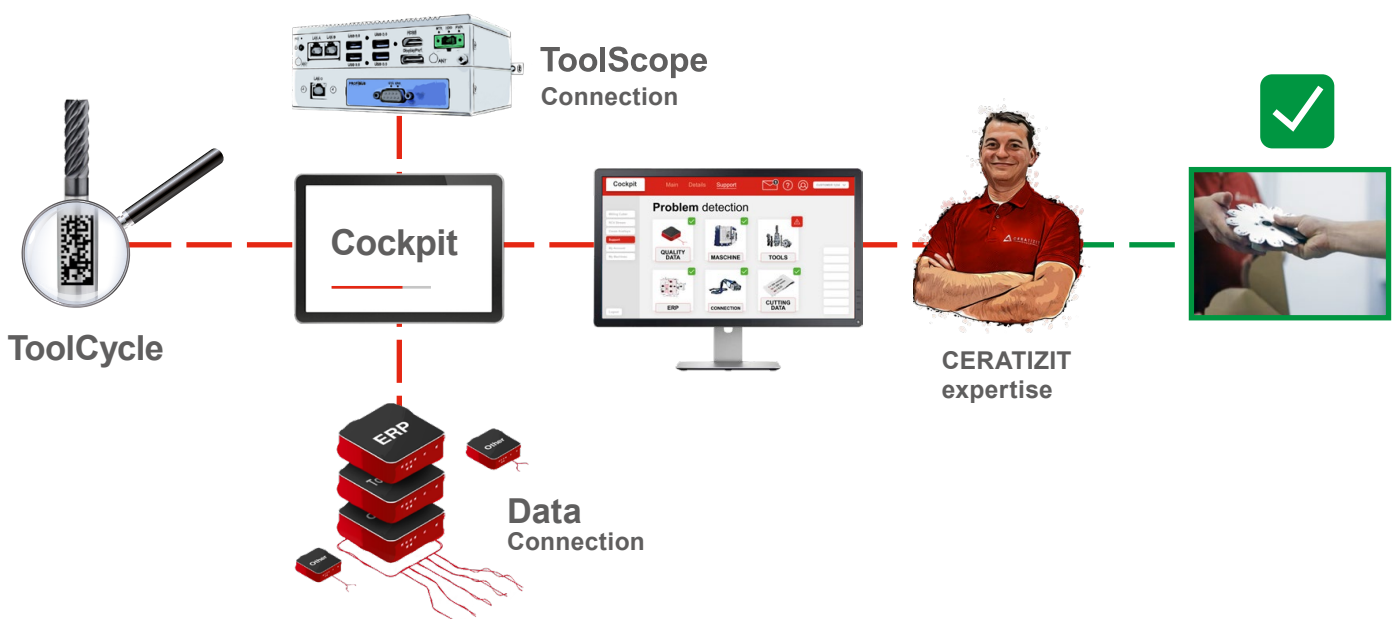
## Want to keep an eye on the entire machining process? Here's how.

The main job of Cockpit is to record measurable data from the entire production process and then visualise and analyse it logically. The aim of this is to detect process problems that are not obvious as quickly as possible, interpret them correctly and rectify them with the help of CERATIZIT. This results in significant time savings in data recording, identifying problems and troubleshooting.

## Helping you increase the efficiency of your manufacturing processes!

### Create a custom Cockpit package to meet your needs.

You can either access Cockpit via the CERATIZIT Cloud or have it installed in your own network environment. Different Cockpit modules – **ToolScope Connection**, **ToolCycle** and **Data Connection** – can be selected depending on your requirements. These modules contain defined features that provide, visualise and analyse data from different process steps.



For more information about Cockpit visit

<https://cts.ceratizit.com/en/cockpit>

## Would you like to optimise your processes too?

Then get the most out of your digital production data today!

### What your process looked like up to now:

- ▲ Manual data gathering & data evaluation
- ▲ Manual and individual problem tracking, detection and troubleshooting

### Benefits with Cockpit:

- ▲ Automated data collection & data evaluation in real time
- ▲ Automated and structured problem tracking, detection and troubleshooting

90%

time saving  
for data recording

80%

time saving  
for troubleshooting

0.5%

improvement in  
the OEE (overall  
equipment  
effectiveness)





All about sustainability  
at CERATIZIT:

[cutting.tools/gb/en/sustainability](https://cutting.tools/gb/en/sustainability)

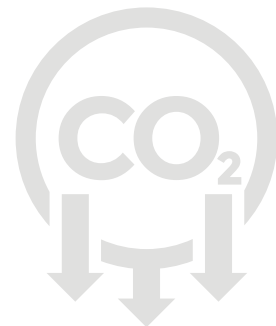


## Carbon neutral by 2025

The United Nations' Sustainable Development Goals aim to achieve net-zero carbon emissions by 2050. We think we can do better and aim to be **net zero by 2040**.

- ▲ By 2025: Carbon neutral, emissions reduced by 35%
- ▲ By 2030: Emissions reduced by 60%
- ▲ By 2040: Net zero, emissions reduced by 90%

To offer you even more transparency for the carbon footprint, we have started to classify our products.



## Product Carbon Footprint

To grasp and evaluate the footprint of a product at a glance, we were the first company to introduce a classification system that displays the PCF for carbide.

This offers you a solid foundation for integrating the CO<sub>2</sub> footprint into your purchasing decisions. Additionally, the PCF aids in calculating your own CO<sub>2</sub> footprint.



**PCF\* classification**  
in kg CO<sub>2</sub>e/kg product



\* The Product Carbon Footprint (PCF) is the specific carbon footprint in kg CO<sub>2</sub>e/kg product. It uses the cradle-to-gate approach and excludes downstream emissions.

# Recycle with CERATIZIT

By recycling worn carbide parts, we recover tungsten carbide and cobalt as secondary raw materials and significantly reduce the energy required compared to mining from ore.

The secondary raw material obtained is nearly identical to the primary raw material and is **in no way inferior to it in terms of quality**.

We aim to increase the proportion of tungsten sourced from **secondary raw materials** across our entire product portfolio **to over 95% by 2030**.

**More info:** [cts.ceratizit.com/gb/en/recycling-service](https://cts.ceratizit.com/gb/en/recycling-service)

## Over 99% sourced from recycled materials

Our **carbide grades in the upGRADE line** consist of **at least 99% recycled material**. This conserves limited resources and reduces the PCF. Additionally, the zinc recycling used is particularly cost-efficient and environmentally friendly.

**More info:** [cts.ceratizit.com/gb/en/ct-gs20y](https://cts.ceratizit.com/gb/en/ct-gs20y)

## A second life for your tools

By **regrinding or reprofiling**, you can achieve nearly 100% of the original tool life and performance of a new tool. Prolonging the use of your tools benefits the environment, and you save doubly:

- ▲ Regrinding is significantly cheaper than purchasing new products
- ▲ Outsourcing is cheaper than maintaining your own grinding machines

**More info:** [cts.ceratizit.com/gb/en/regrinding](https://cts.ceratizit.com/gb/en/regrinding)

## Packaging made from 100% recycled plastic

Currently, plastic packaging provides optimal protection against damage and reactions with other elements for our valuable tools.

**More info:** [cts.ceratizit.com/gb/en/sustainable-packaging](https://cts.ceratizit.com/gb/en/sustainable-packaging)



upGRADE<sup>♻️</sup>





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