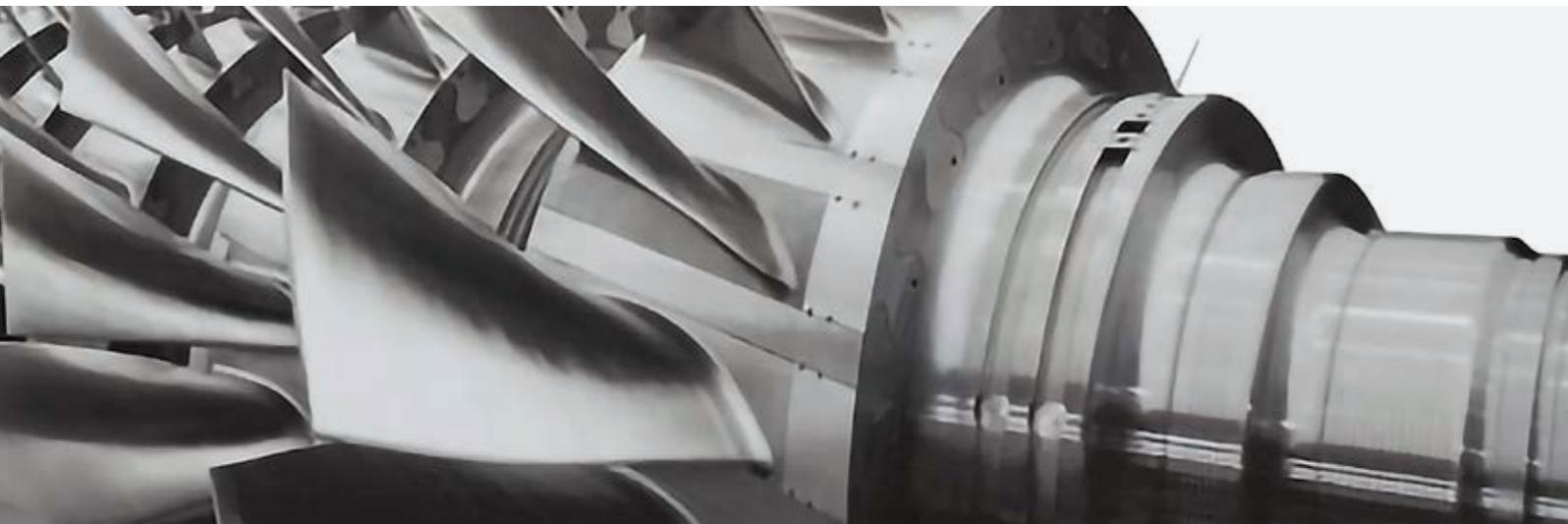


# Turbine blade machining



**Intelligent tooling solutions – cutting your costs**



**KEEPS YOU  
AHEAD**





# Your innovative partner

We aim at improving the competitiveness of our customers by reducing unit costs in the cutting processes. KYOCERA UNIMERCO does not just deliver tools. Our tooling technicians have in-depth knowledge of power generation applications, and each problem is analysed thoroughly to come up with the best possible solution for you.

In cooperation with you, we design the ideal solution for your specific application.

The tools are manufactured on advanced machinery in our four manufacturing locations.

After delivery, we offer our assistance with implementation of the tooling solution, in order to make sure that everything runs smoothly and you benefit from optimum tool performance.



## Faster machining

A result of our extensive research and development activities is high-performance tooling solutions for turbine blade manufacturing, reducing machining time considerably. This high-performance tooling solution enables you to achieve narrow tolerances much faster.



## Fewer tools needed

Using this approach, the actual number of tools needed for manufacturing a turbine blade can often be reduced. In some cases, the number of tools has been reduced by 30%. This gives you the benefits of lower tooling costs, shorter cycle time and thereby higher productivity.

## Surface finish

With the optimized tooling package, you will achieve excellent surface finish results.



## Increased tool life

The use of high-performance coated carbide tools results in increased tool life. Your benefits are less machine down time, as there are fewer tool changes, and a reduction in the number of internal measurements.

We look forward to your inquiry for a customised tooling solution for your turbine blade application.

# Tooling solutions for turbine blade machining

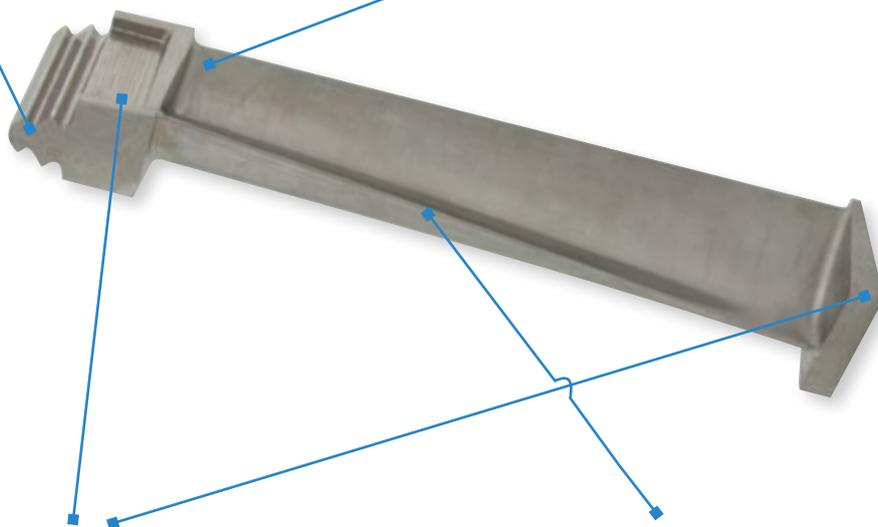
## ROOT FORM

Brazed and solid carbide tooling solutions for rough and finish machining. Cutter root form profile measuring reports are available.



## AIRFOIL TO PLATFORM TRANSITION

Ball nose and taper ballnose tooling solutions. Available for high speed machining and conventional 3-5 axis machining.



## PLATFORM & SHROUD

Custom designed parallel and conical tools for maximum performance when machining at up to 400m/min. peripheral speed.



## AIRFOIL

Ball nose, lollipop, torus and barrel form tools are designed to maximise step over and consequently maximise surface generation rates.



# **NEW** technologies to ensure optimum machining efficiency

- Power Edge™
- New NANO composite coating
- Newly developed geometry
- New and improved carbide grade

## **Giving you...**

- Superior tool life
- Uniform component quality
- Progressive feed rate
- Minimised cost per cut



Market-leading  
delivery time

# Root form

## Carbide-tipped profile tool on steel body

- Very accurate profile meets narrow tolerance demands
- Superior performance due to optimized geometry
- C5 coating for optimum tool life
- No presetting time - considerable time savings in tool room
- Tool diameters up to 180 mm
- Market-leading delivery time
- Numerous re-grinds and re-tippings



	Original process	Our solution
	HSS profile tool, 25	SC-tipped tool, 25
Feed length	480 mm	480 mm
Tool life	15 m	35 m
Cutting speed VC	45 m/min	90 m/min
Feed/tooth fz	0.0016 mm/tooth	0.120 mm/tooth
Machining time	4,300 sec	<200 sec
<b>» 10 times shorter machining time</b>		
Surface finish	Ra 1,1	Ra 0,5

# Carbide fir tree end mill

- Saving machining time:  
Carbide tools for fir tree slot machining



SC fir tree cutter  
(our solution)



## Market-leading delivery time

Kyocera Unimerco customises each tool to meet the customer's individual demand. The delivery time for a solid carbide fir tree cutter is 3 weeks from approval of overall design.

# Intelligent tooling solutions

We adapt the tool to the specific wishes of our customers, whether the main criteria is tool performance or tool life.

Solid carbide tools are continuously updated to meet the increased market demands and to make sure that you get a solution which ensures the most competitive manufacturing process.

## Airfoil – Solid carbide torus end mill

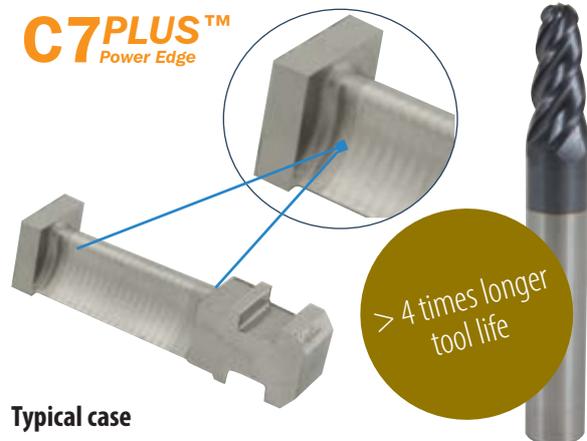


### Example of tool life optimization / annual tool cost savings

	Previous solution	Our solution
	Z3 carbide	Z6 NTS carbide torus cutter
Vc	400 m/min	200 m/min
fz	0.08 mm/cutting edge	0.08 mm/cutting edge
Machining time	120 sec.	120 sec.
Tool life	7 parts	20 parts

This customer achieved a saving of » 60,000 EUR in tool cost for this blade type alone

## Airfoil to platform transition – Taper ballnose carbide end mill



### Typical case

Previous solution	Our solution
Uncoated carbide tapered ballnose end mill	Power Edge™ tapered ballnose end mill

For this finishing operation we did not optimise on machining data, but our customer went from 20 blades tool life to 89 blades with our tool.

### This meant for our customer:

- Approx. 20,000 EUR saved on this tool type alone
- Significant time savings in tool room for setting up
- Fewer regrind shipments
- Lower tool cost per blade

## Platform – NTS end mill



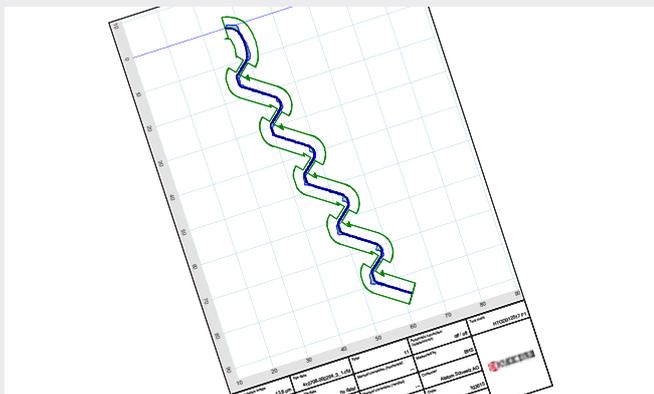
### Performance example

Milling of titanium component (Ti-6Al-4V) Roughing titanium platform	
Ap = 7 mm	fz 0,06 mm/tooth
Ae = 12 mm	Previous carbide solution = 53 min tool life
Vc = 44 m/mm	NTS C7 PLUSTM Power Edge™ = 167 min tool life

> 200 % increase in tool life

# Total quality – YOUR GUARANTEE FOR CONTINUOUS PERFORMANCE

Specification system and service concept



## Measuring report

Turbine blade root forms require extremely accurate machining. In order to add additional value to your manufacturing process, each single profile tool is supplied with a measuring report documenting compliance with the specific profile tolerance.

This documentation is also produced each time we return your cutter after RE•NEW®.



## Packaging solutions

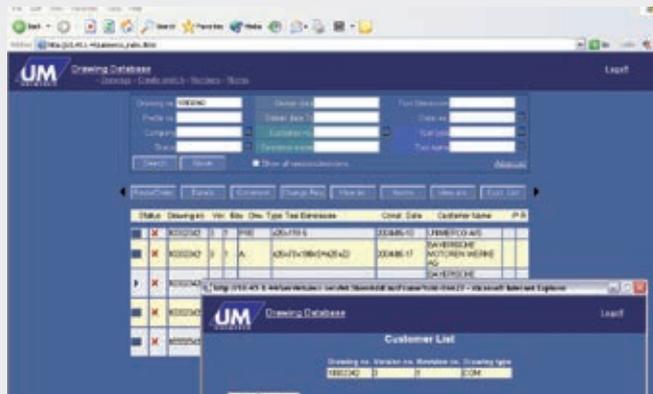
Profile cutters for turbine blade root forms are high-performance tools manufactured to extremely tight tolerances. In order to retain this  $\mu\text{m}$  accuracy throughout the tool life time, each cutter is safely stored in a dedicated box.

This gives maximum protection to the tool during transportation and storage.



## RE•NEW® concept

**All tools are reground and re-coated utilising the same advanced technology as for the manufacture of the tools.** And we regrind your tools with the same care that we use to manufacture new tools. We also RE•NEW® other tool brands with very good results. You will benefit from tool performances on reground tools which can match or even surpass the performance of new tools.



## 100% repeatability

Due to a unique internally developed norm system and a very advanced drawing database, we are able to deliver tools with the exact same geometries throughout all future deliveries, regardless in which KYOCERA UNIMERCO manufacturing facility your tools are being produced.

## Industrial tooling solutions

Kyocera Unimerco is a global manufacturer and distributor, providing standard and customised cutting tool solutions as well as know-how and optimisation guidance for the manufacturing industry.

The company was founded in 1964 and has since expanded into 17 countries, with more than 700 employees.

Today the company is part of the Japan-based Kyocera Corporation.

In 1998 the Sheffield branch was established. It is specialised in supplying the industrial market with inserts, standard tools and related tooling solutions.



[www.kyocera-unimerco.com](http://www.kyocera-unimerco.com)