

# Turbine blade machining

Intelligent tooling solutions – cutting your costs





## Your innovative partner

We aim at improving the competitiveness of our customers by reducing the 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.

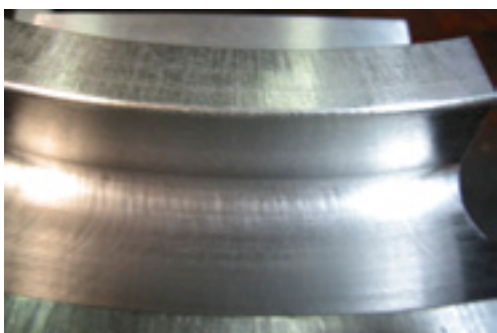
The tools are manufactured on advanced machinery in our four manufacturing locations.

After delivery, we assist you, if necessary, with the implementation of the tooling solution to make sure that everything runs smoothly and you benefit from the 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. Instead of using HSS tools in a traditional process you can use a high performance tooling solution to achieve narrow tolerances much faster.

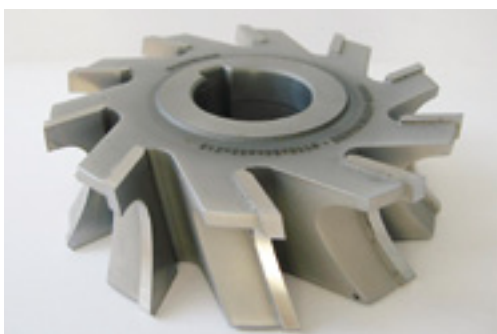


### Fewer tools needed

In most cases, using this approach, the actual number of tools needed for manufacturing a turbine blade can be reduced. In some cases, the number of tools has been reduced by 30%. Of course your advantages are lower tooling costs, shorter cycle time and thereby higher productivity.

### Surface finish

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



### Longer tool life

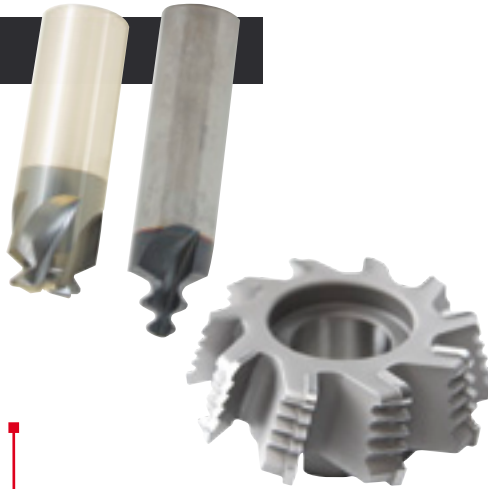
The use of high performance coated carbide tools results in longer tool life. Your benefits are less machine down time, as there are fewer tool changes, and a reduction in the number of internal measurements needed.

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

# Tooling solutions for turbine blade machining

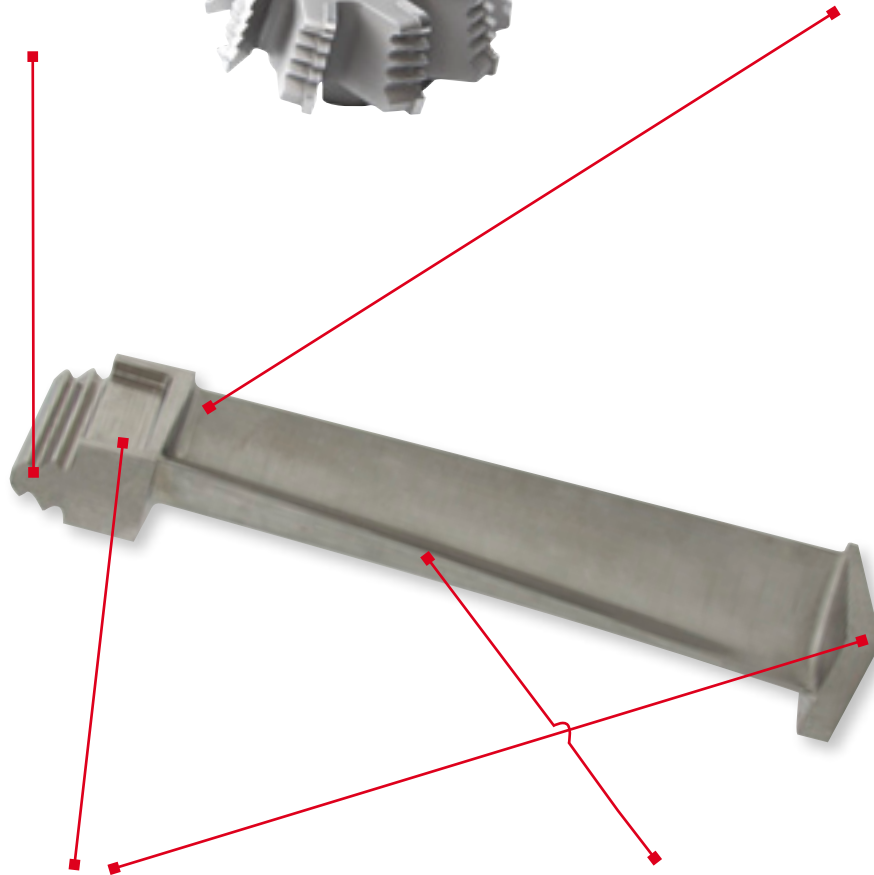
## ROOT FORM

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.



## 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

## Give you...

- › Superior tool life
- › Great component quality
- › Highest possible feed rate
- › Minimised cost per cut



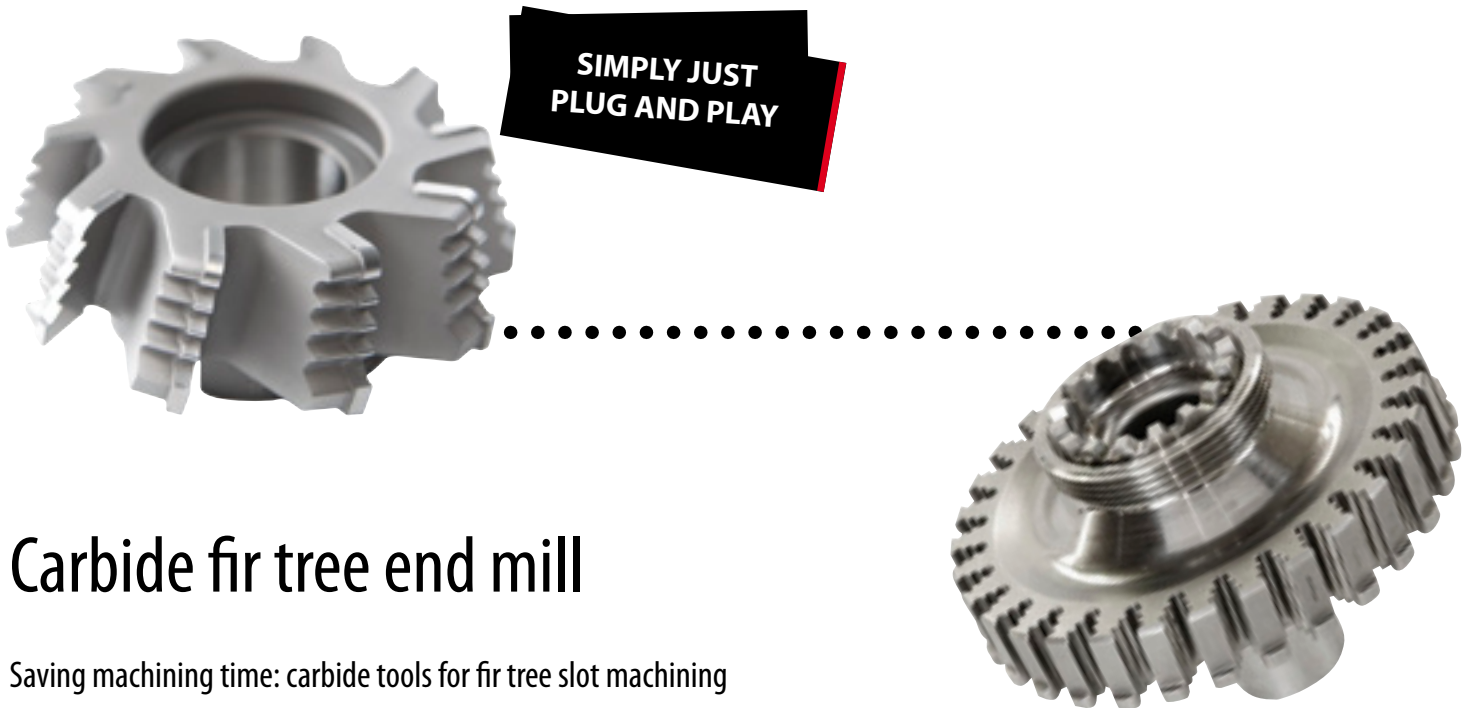
**Market-leading  
delivery time**

# Root form

## Carbide-tipped profile tool on steel body

- › Very accurate profile meets narrow tolerance demands
- › Superior performance due to optimised geometry
- › C5 coating for optimum tool life
- › No presetting time - considerable time savings in tool room
- › Tool diametres up to 180 mm
- › Market-leading delivery time

	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
	» 10 times shorter machining time	
Surface finish	Ra 1,1	Ra 0,5

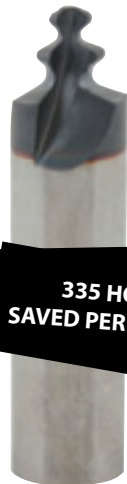


# Carbide fir tree end mill

Saving machining time: carbide tools for fir tree slot machining



HSS fir tree cutter  
(competitor's solution)



**335 HOURS  
SAVED PER MACHINE**

SC fir tree cutter  
(Our solution)

	Previous solution	Our solution
	HSS fir tree cutter	SC fir tree cutter
Surface finish	Ra = 1.2	Ra = 0,4
Tool life	20 slots	192 slots
Machining time/slot	710 sec.	110 sec.
Total numbers of slots per year on this machine	2,000	2,000
Annual time saving or capacity increase	<b>335 hours per machine</b>	

### 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

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

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

### Example of tool life optimisation 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 ball nose carbide end mill

### Typical case

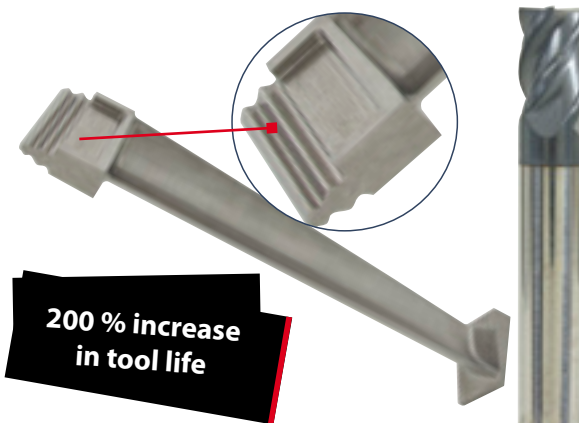
Previous solution	Our solution
Uncoated carbide tapered ballnose end mill	UNIMERCO Power Edge™ tapered ballnose end mill
For this finishing operation we did not optimise on machining data, but our customer went from <b>20 blades</b> tool life to <b>89 blades</b> with our tool.	
This meant for our customer	
<ul style="list-style-type: none"> <li>› App. 20,000 EUR saved on this tool type alone</li> <li>› Significant time savings in tool room for setting up</li> <li>› Fewer regrind shipments</li> <li>› Lower tool cost per blade i.e. cheaper blade</li> </ul>	



## Titanium platform – Standard NTS end mill

### Performance example

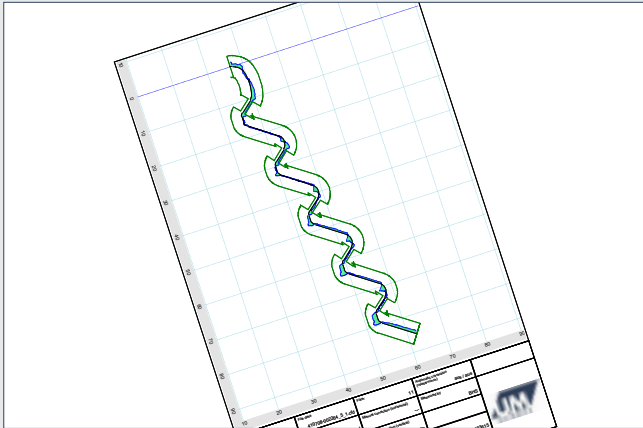
Milling of titanium component (Ti-6Al-4V) Roughing titanium platform	
Ap = 7 mm	Fz 0,06 mm/tooth
Ae = 12 mm	Previous carbide solution = 53 min tool life
Vc = 44 m/mm	NTS C7 PLUS™ Power Edge™ = 167 min tool life
> 200 % increase in tool life	



# Total quality

– your guarantee for continuous performance

## Specification system and service concept



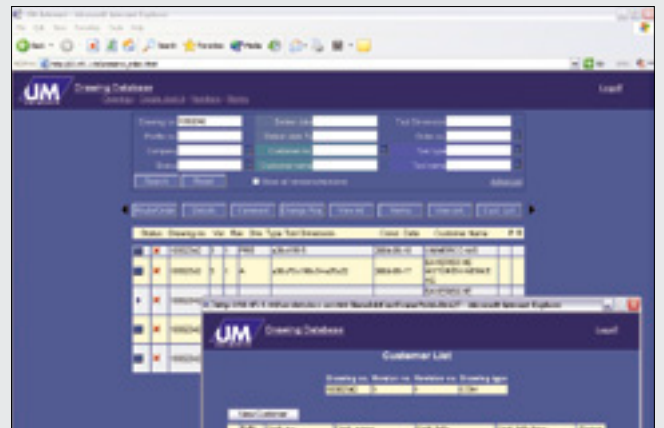
## Measuring report

We know that producing turbine blades requires very narrow tolerances. In order to give you the best possible tool quality, we offer to measure each individual tool and document the findings in a measuring report.

This is our way of documenting that the tools are manufactured according to your requirements, and that they are instantly ready to use - simply plug & play.

## Packaging solutions

To avoid problems during transport, all tools for turbine blade production are delivered in secure plastic or wooden boxes. For tools with larger diameters, a measuring report as well as a scan of the tool profile will be included in the tool box in order to avoid tools being mixed up.



## 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 a new tool.

## 100% repeatability

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

## KYOCERA UNIMERCO Tooling Ltd.

KYOCERA UNIMERCO manufactures, distributes and services tools for machining, primarily for the metal, woodworking, automotive, aerospace, power generation and fluid power industries. The technology centre in Lichfield focuses on effective solutions for production. The tooling concept comprises standard and customised tools, RE-NEW® tool maintenance, coating and optimisation guidance. The Sheffield branch specialises in supplying inserts, standard tools and related tool solutions to the industrial market in the UK, including the general machining, aerospace, offshore and medical industries.

The company was established in 1998, services all of the UK, and is part of the KYOCERA UNIMERCO group, founded in Denmark in 1964 and originally named UNIMERCO. In 2011, all activities were acquired by Japan-based KYOCERA. This has created an even stronger company with a larger range of products, a wide network of companies and distributors all over the world, and an ambitious growth plan.



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