THE NEW VALUE FRONTIER

KYOCERA

Aerospace

Tooling Solutions

Providing Optimal Tooling Solutions for Aerospace Machining

- Airframe
- Engines
- Components
- Composites
- Aluminum
- Titanium

AEROSPACE SOLUTIONS

Airframe

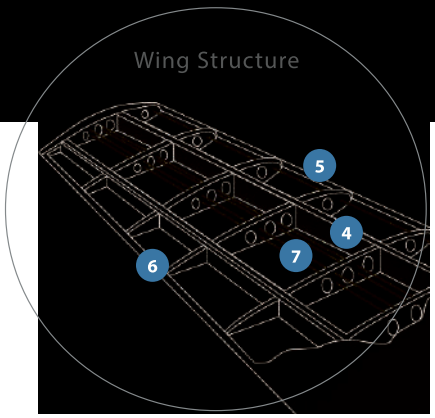
- Fuselage
- Flap Tracks
- Engine Pylons
- Wing Spars
- Leading Edges
- Trailing Edges
- Stringers

Engines

- Blades & Vanes
- Stators
- Blisks
- Fan Casings
- Spools
- Turbine Discs
- Combustion Casings
- Hubs

Components

- Landing Gear
- Floor Panels
- Interiors
- Ducting
- Wheels & Brakes
- Hydraulics & Pneumatics
- Bearing Housings



FUSELAGE

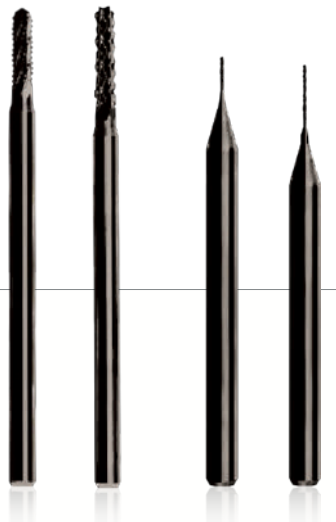
MACHINING CHALLENGE:

Small diameter drilling and milling can be a challenge in composite materials, where tools can become dull quickly. This can lead to burring and other poor quality finishes.

KYOCERA'S TOOLING SOLUTION:

Our up cut and down cut diamond pattern router bits and micro drills provide excellent repeatability when machining CFRP, fiberglass, and composite materials without burrs, splintering, or fraying.

CVD and DLC diamond coatings are available as well as the up cut chipbreaker pattern router bits for finer part edge finishes.



Solid Routers Solid Micro Drills

FLAP / SLAT TRACK

MACHINING CHALLENGE:

Pocket milling in difficult-to-cut materials, such as 15-5 PH or similar stainless steels. Chip evacuation is critical in order to prevent the potential re-cutting or pinching of the high-strength chips that have become trapped in the pockets.

KYOCERA'S TOOLING SOLUTION:

MFH-Raptor
High Feed Milling Cutters

MFH-Raptor Mini
Small Diameter End Mills for High Feed Machining

MEC
Ultra Hurricane End Mills & Face Mills

MFPN
Roughing and General Purpose Face Mill with 10 Usable Corners

MEWH
Helical End Mills

M-SIX (MFWN)
90° Double-Sided 6-Edge Milling Cutters

MEC | MFPN | MFH-Raptor | MFH-Raptor Mini | MEWH | M-SIX (MFWN)

ENGINE PYLON

MACHINING CHALLENGE:

Rough milling of titanium, including heavy axial depths-of-cut in some slotting applications. Inserts with low cutting force designs can be employed in these applications to maximize metal removal.

KYOCERA'S TOOLING SOLUTION:

MFH-Raptor
High Feed Milling Cutters

MFH-Raptor Mini
Small Diameter End Mills for High Feed Machining

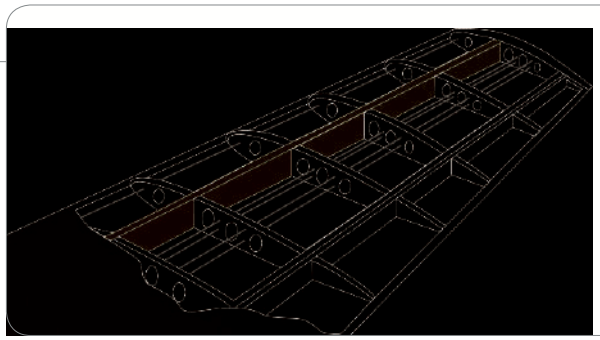
MEC
Ultra Hurricane End Mills & Face Mills

M-SIX (MFWN)
90° Double-Sided 6-Edge Milling Cutters

Grade PR1535
Grade for Titanium Alloy and Precipitation Hardened Stainless Steel

MEC | MFH-Raptor | MFH-Raptor Mini | Grade PR1535 | M-SIX (MFWN)

WING SPAR



MACHINING CHALLENGE:

Large Titanium parts require heavy stock removal. Cutters capable of high metal removal rates are required. Milling inserts with serrated edges can be utilized effectively in wing spar applications.

KYOCERA'S TOOLING SOLUTION:

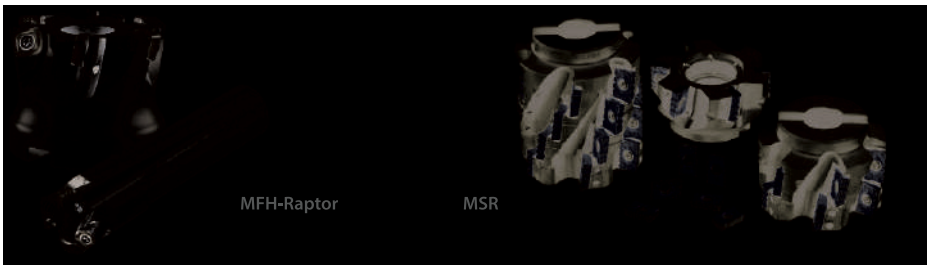
MSR Monster Mill
Heavy Roughing Milling Cutter

MFH-Raptor
High Feed Milling Cutters

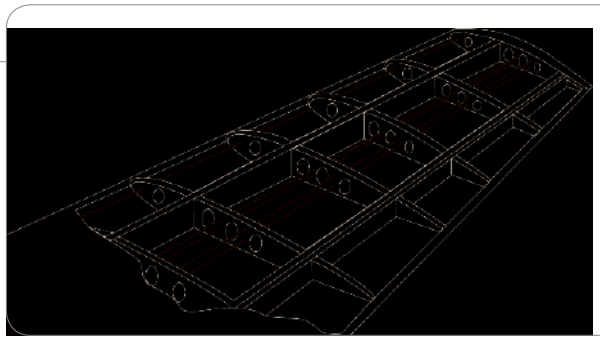
Grade PR1210
MEGACOAT Grade for Milling Titanium

Grade PR1535
MEGACOAT NANO Grade for Milling Titanium and Hardened Stainless Steel

Grade PR1510
MEGACOAT NANO Grade for Milling Titanium



STRINGERS



MACHINING CHALLENGE:

Heavy stock removal on workpieces that are difficult to fixture. Milling tools capable of high metal removal rates while generating low cutting forces are preferred.

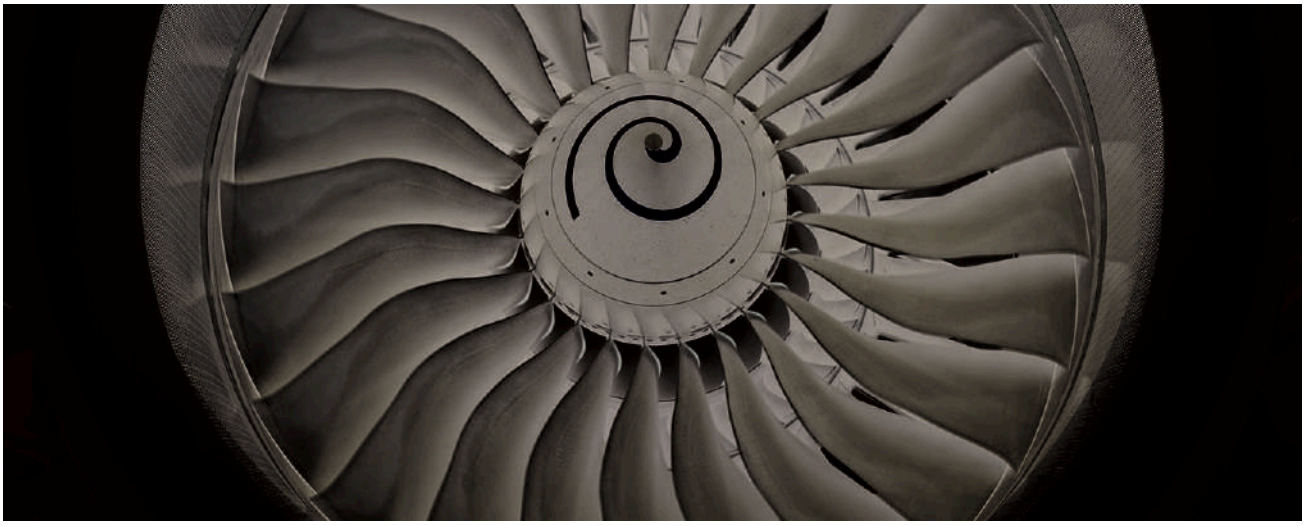
KYOCERA'S TOOLING SOLUTION:

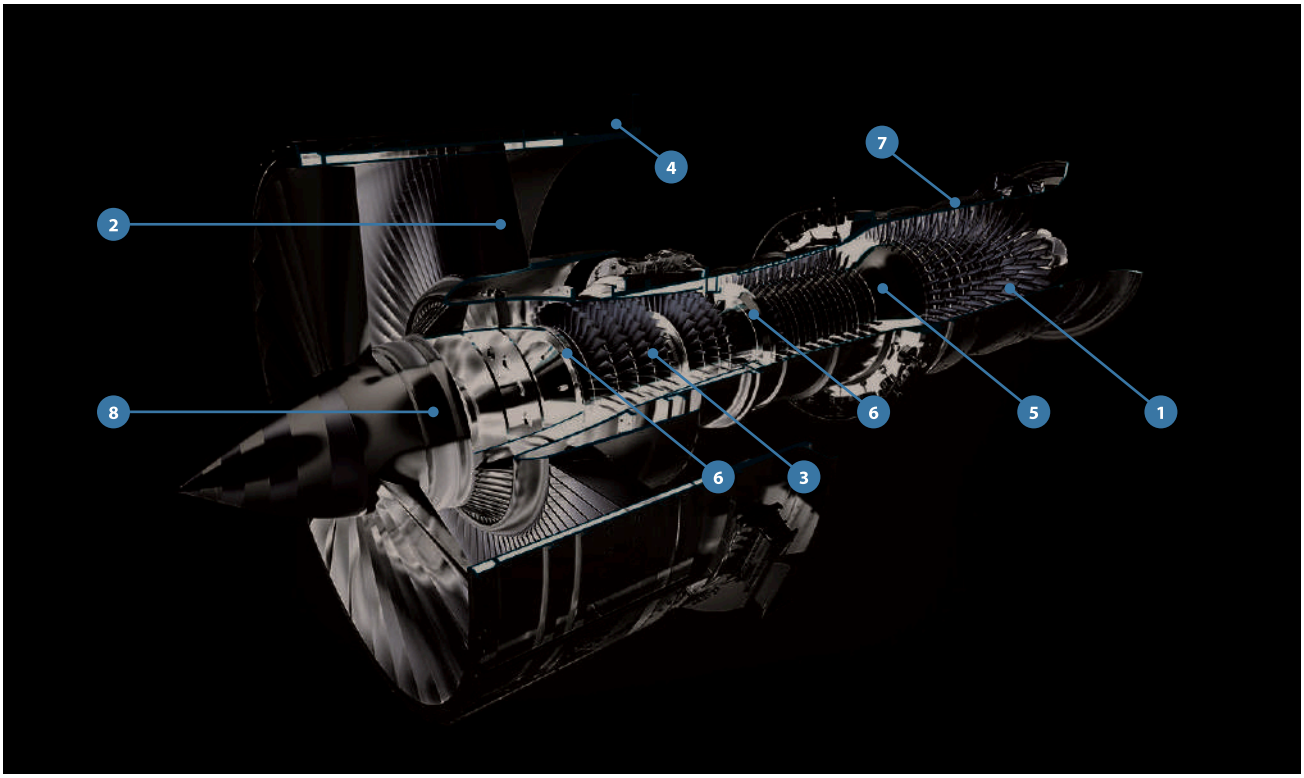
MFH-Raptor
High Feed Milling Cutters

MEC
Ultra Hurricane End Mills & Face Mills

M-SIX (MFWN)
90° Double-Sided 6-Edge Milling Cutters

M-FOUR (MEW)
90° Double-Sided 4-Edge Milling Cutters





1. Blades & Vanes
2. Stators
3. Blisks
4. Fan Casing
5. Spools
6. Turbine Disc
7. Combustion Casing
8. Hub

BLADES & VANES

MACHINING CHALLENGE:

Thin cross sections create the challenge of chatter, especially when combined with limited work holding configurations. Cutters generating low cutting forces are required.

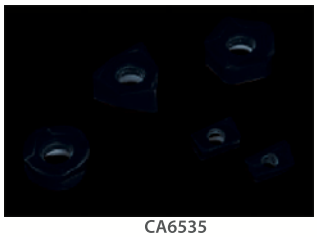
KYOCERA'S TOOLING SOLUTION:

RAD-6 (MRX)
Single-sided 6-Edge Radius (*Button*) Cutter

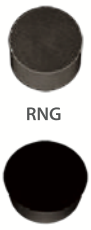
Grade CA6535
for Heat Resistant Alloys

RNG / RPG
Radius Inserts

RAD-6 (MRX)



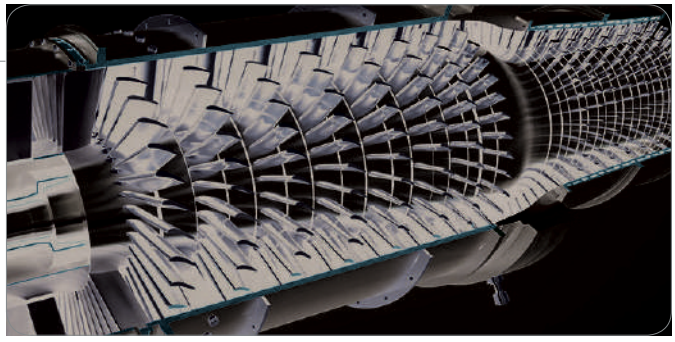
CA6535



RNG

RPG

BLISKS & STATORS



MACHINING CHALLENGE:

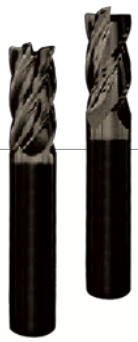
Proper tooling is required to maximize the efficiency offered by advanced programming techniques. Variable helix end mills can be used effectively in these applications. Custom engineered solutions can also be used to improve efficiency.

KYOCERA'S TOOLING SOLUTION:

APOLLO (AP4 & AP5)
Solid Carbide 4 Flute Variable Helix Solid End Mills

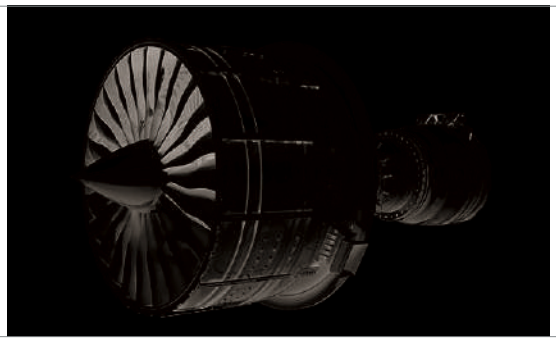
Engineered Solutions
Custom Engineered Tooling Solutions with Your Specifications

Custom Engineered Tooling Solutions



Variable Helix APOLLO End Mills

FAN CASING



MACHINING CHALLENGE:

The combination of component shape and material make the casing a challenging component to machine. Thin walls create work-holding obstacles that can lead to chatter when excessive tool pressure is present. The casing is traditionally manufactured from Titanium alloys, which present an inherent challenge for increased heat at the cutting edge and potential for edge build-up.

KYOCERA'S TOOLING SOLUTION:

RCMT43
Inserts

KGD Grooving
with GDM inserts

Grade PR1535
Grade for Titanium Alloy and Precipitation Hardened Stainless Steel

Grade GW15
Carbide for Heat Resistant Alloys

Grade PR13-Series
PVD Coated Carbide for Heat Resistant Alloys

Grade PR1515
PVD Coated Carbide for Heat Resistant Alloys


Grade PR13-Series

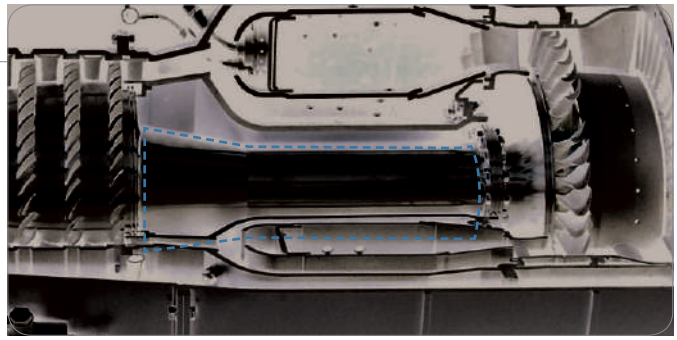

Grade PR1535


RCMT Insert


KGD Grooving


GDM Inserts

SPOOL



MACHINING CHALLENGE:

The jet engine spool is comprised of complex contours that require a high surface finish quality across the entire length of the OD and ID of this titanium part in order to pass ultrasonic inspections.

KYOCERA'S TOOLING SOLUTION:

RCGX
Inserts

RCMT
Inserts

KS6030 / KS6040 / KXW1
SiAlON Ceramic Grades for Heat Resistant Alloys

KGD Grooving System
with Full Radius Inserts

Grade PR1215 / PR1535
PVD PR1215 for Steel and PR1535 for Titanium, and Other HRAs

Grade GW15 / PR1515
Carbide and PVD Coated Carbide for Heat Resistant Alloys


KS6030


KS6040

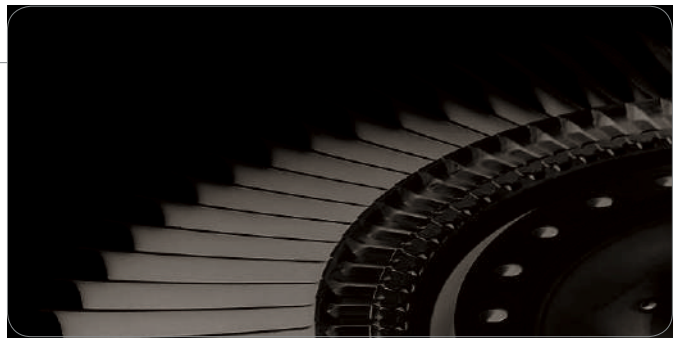

RCGX Insert


RCMT Insert


KGD Grooving


GDM Full Radius Inserts for KGD

TURBINE DISC



MACHINING CHALLENGE:

Plunging/facing applications become more challenging in heat-resistant alloys such as René, INCONEL®, WASPALOY®, and others. Inserts with good chipping and notch resistance are required.

KYOCERA'S TOOLING SOLUTION:

Round Insert Geometries
RCMT, RCGX, and RNG inserts offer optimum chip thinning benefits

Grade KXW1
Whisker Ceramic for Nickel-based High-temp Alloys

Grade KS6040
SiAlON Ceramic for Heat Resistant Alloys

Cera-Notch Grooving
with KCGP inserts

KGD Grooving
with GDM inserts

Grade PR1215 / PR1535 / PR1515 / GW15 / KW10
Carbide and PVD Coated Carbide for Steel, Titanium, and Other HRAs

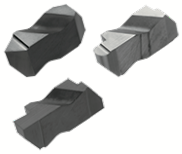

KS6040


RCGX Insert


RCMT Insert


KGD Grooving


GDM Inserts


KCGP Inserts

COMBUSTION CASING

MACHINING CHALLENGE:

Difficult materials, including René alloys, INCONEL® 718, WASPALOY®, Titanium, and the nickel-based Alloys. Similar to challenges presented by fan casings, with addition of nickel-based alloys; workholding rigidity and tool pressure continue to be major machining factors.

KYOCERA'S TOOLING SOLUTION:

APOLLO (AP4 & AP5)
Solid Carbide 4 Flute Variable Helix Solid End Mills

TITAN-AX
Reinforced Shank Solid End Mills with AX High Performance Coating

RNG / Grade KS6040
RNG Inserts with Grade KS6040 for Roughing

RAD-6 (MRX)
Single-sided 6-Edge Radius Cutter

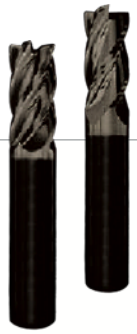
RCMT Inserts
Round Insert Geometries

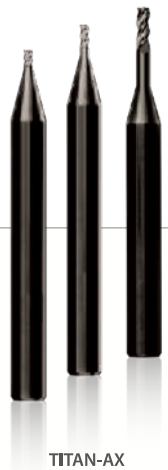

RAD-6 (MRX)


KS6040

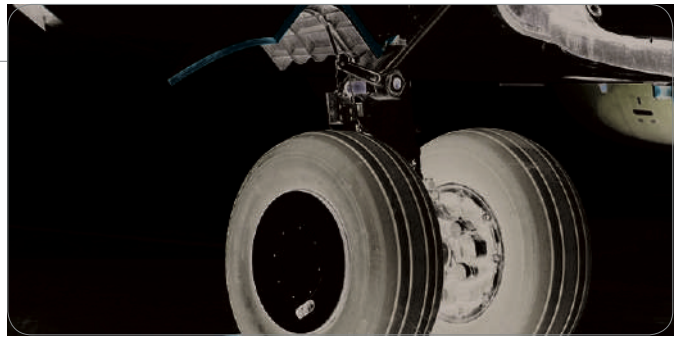

RCMT Insert


RNG Insert


Variable Helix APOLLO End Mills


TITAN-AX End Mills

LANDING GEAR



MACHINING CHALLENGE:

In the hardened state, 300M high-strength alloy steel presents the challenge of size control (holding diameter sizes over length of the part). Cutting tools with high wear resistance are necessary to prevent size variations or taper over the full length of cut.

KYOCERA'S TOOLING SOLUTION:

CA5-Series
CVD Coated Carbide Grades for Steel Machining

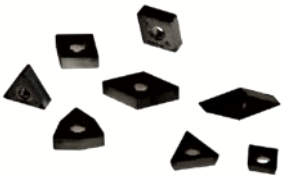
TN620 / PV720
Cermet and MEGACOAT Cermet for Steel Machining

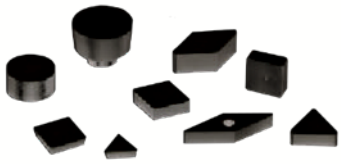
A65 / PT600M
Ceramic Grades for Semi-Roughing to Finishing Hardened Materials

KBN-Series
MEGACOAT CBN Grades for Hardened Materials

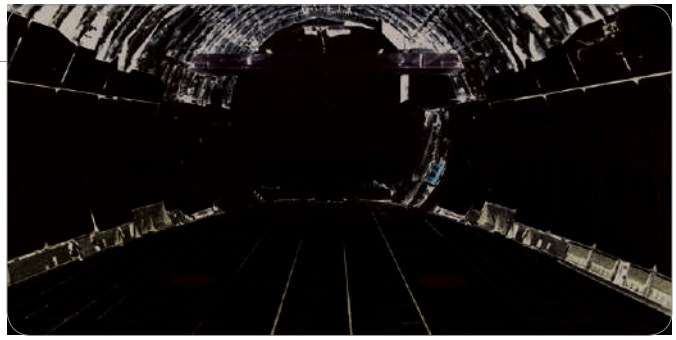

CA5-Series


TN620 / PV720


KBN05M


A65 / PT600M

FLOOR PANELS



MACHINING CHALLENGE:

Honeycomb materials are utilized for their high strength to weight ratios. Thin walled cross sections of aluminum must be carefully machined to prevent tearing or compressing the material.

KYOCERA'S TOOLING SOLUTION:

Solid Carbide Routers
for CFRP, Fiberglass, Honeycomb, and Composites

Solid Carbide End Mills
General Purpose Milling

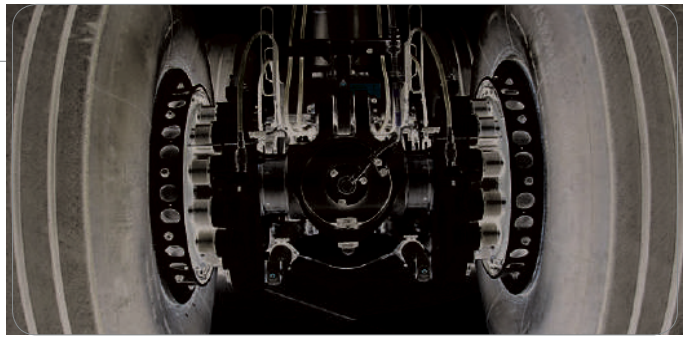
Solid Carbide Drills
Micro and Deep Hole Drilling


Solid Drills


Solid End Mills


Solid Routers

WHEELS & BRAKES



MACHINING CHALLENGE:

The wheels and braking systems are under a massive amount of strain during the braking process. These applications require a high surface finish quality involving complicated profiles inside the bore and thin walled sections. Size control is a challenge and cutting tools with high wear resistance are necessary to prevent size variations or taper over the full length of cut.

KYOCERA'S TOOLING SOLUTION:

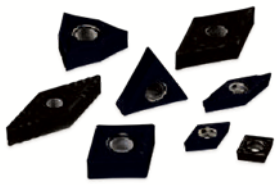
CA5-Series
CVD Coated Carbide Grades for Steel Machining

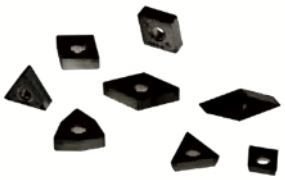
TN620 / PV720
Cermet and MEGACOAT Cermet for Steel Machining

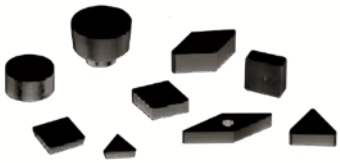
Ceramic A65 / PT600M
Grades for Semi-Roughing to Finishing Hardened Materials

KBN-Series
MEGACOAT CBN Grades for Hardened Materials

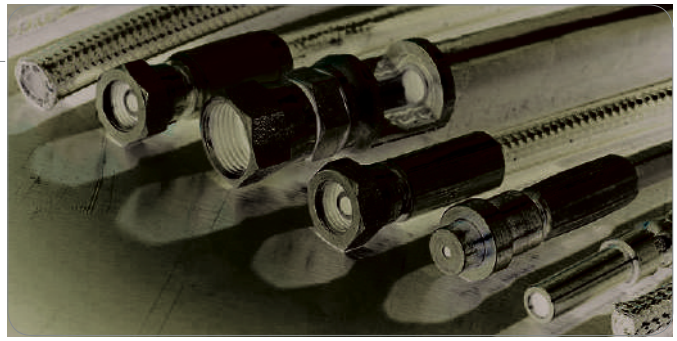

CA5-Series


TN620 / PV720


KBN05M


A65 / PT600M

HYDRAULICS & PNEUMATICS



MACHINING CHALLENGE:

Bar fed lathes require tools with sharp cutting edges and low cutting forces. Heavy depths-of-cut and low feed rates are common. A comprehensive line-up of small tools can offset these challenges and custom engineered micro bars can be utilized effectively in small internal bores.

KYOCERA'S TOOLING SOLUTION:

KW10
Grade for Aluminum

CA65-Series
Grades for Stainless Steel

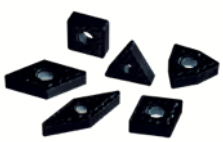
PR13-Series / PR12-Series
Grades for Stainless Steels and Heat-Resistant Alloys

GDM
Grooving and Cut-Off Inserts

TKN
Cut-Off Inserts

EZ Bar
Easy Adjustment Boring Bar

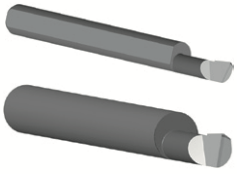
Specials
Solid Boring Bars


Grade CA65-Series

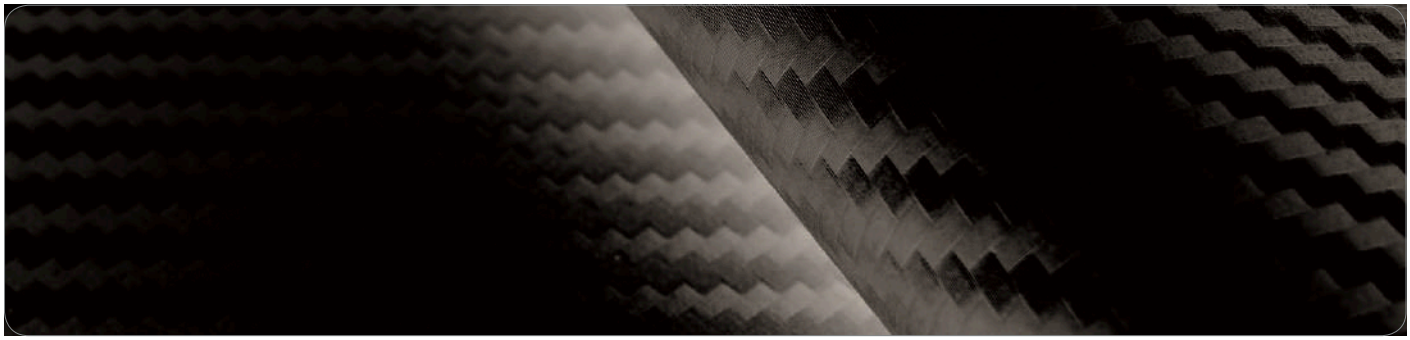

Grade PR13-Series

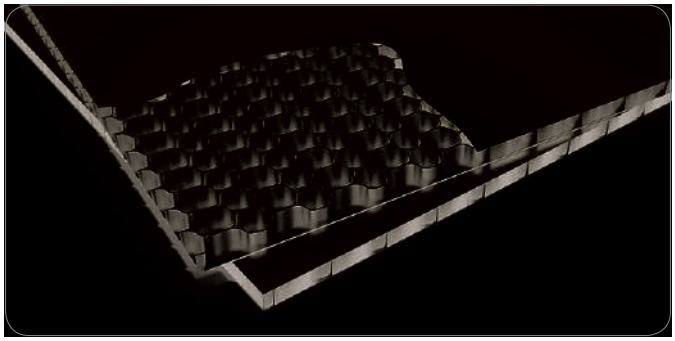
TKN Inserts


GDM Inserts


Special Solid Boring Bars


EZ Bars





COMPOSITE MACHINING

MACHINING CHALLENGE:

Laminate materials can tear easily and machinability can vary based on the composition of the individual layers as well as the full laminate itself. Tooling with sharp cutting edges and abrasive wear resistance are critical for the effective machining of this special class of materials.

KYOCERA'S TOOLING SOLUTION:

MEC
Ultra Hurricane End Mills & Face Mills

Grade KPD001
Super Micro-Grain PCD

Solid Carbide Routers
for CFRP, Fiberglass, and Composites

CVD Coated Routers