

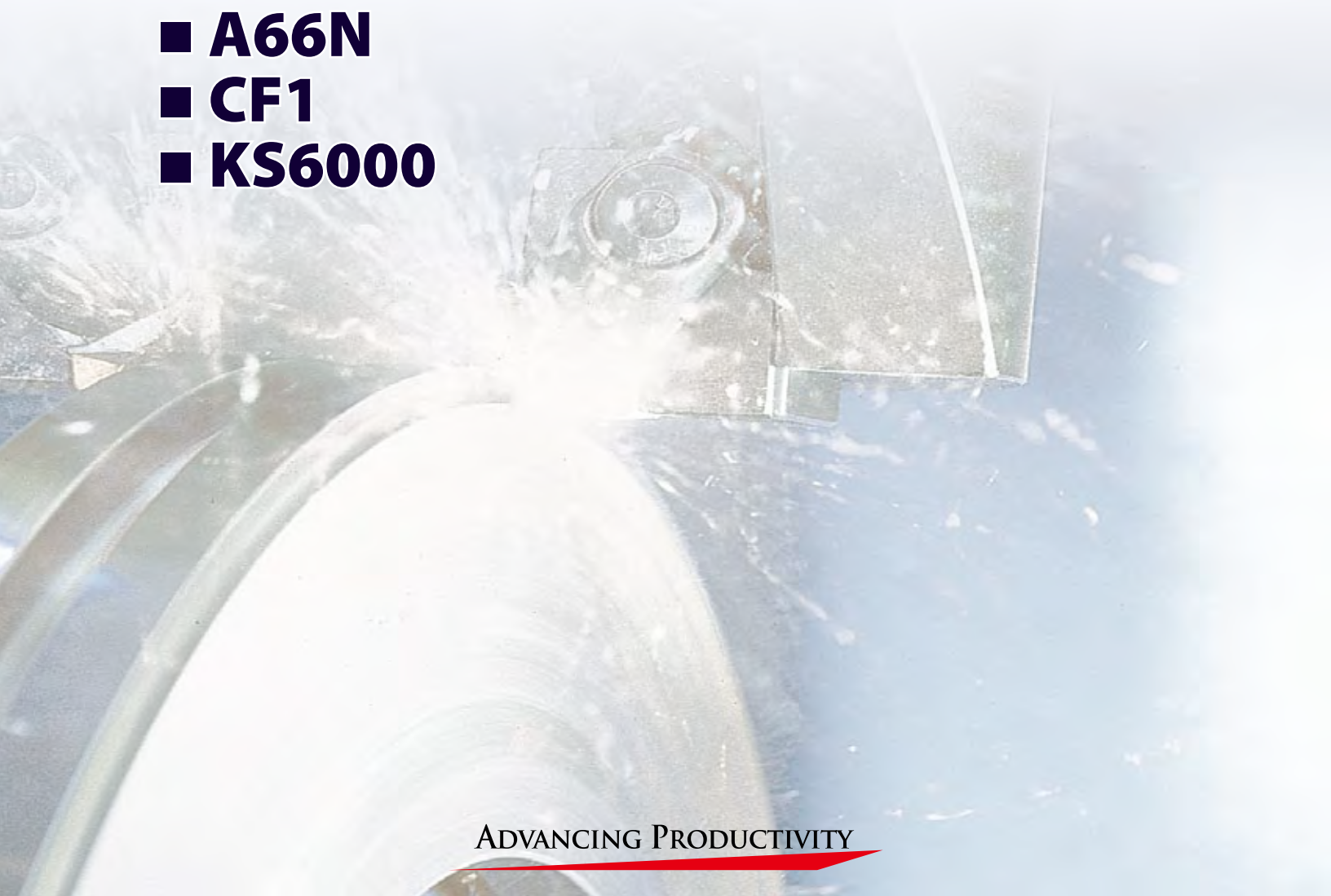
THE NEW VALUE FRONTIER



# Ceramics

Featuring:

- MEGACOAT PT600M
- A65
- A66N
- CF1
- KS6000



ADVANCING PRODUCTIVITY

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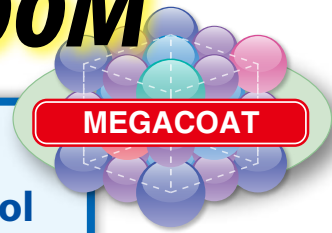
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# MEGACOAT Ceramic PT600M



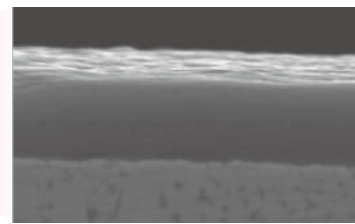
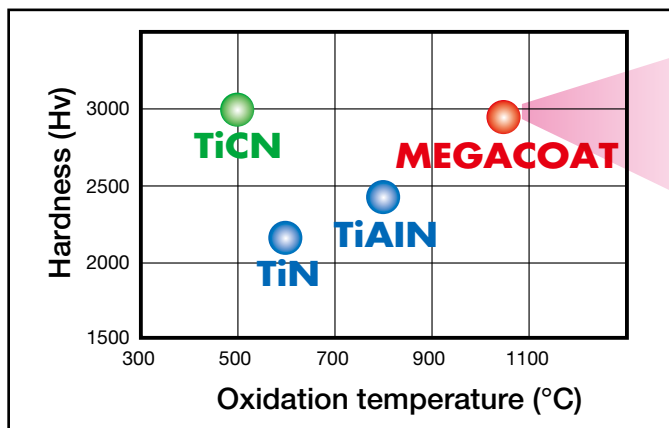
## Advantages

1. The new MEGACOAT ceramic achieves significantly longer tool life, approaching that of CBN
2. Superior economic efficiency in the machining of hardened materials
3. Good wear resistance for high speed machining of gray cast iron

## MEGACOAT

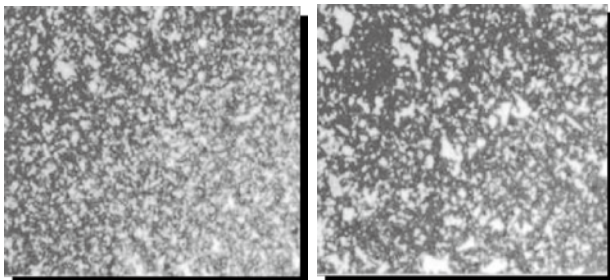
Special PVD coating

Controls crater wear and achieves stable machining with superior oxidation resistance



High oxidation resistance ( $\geq 1000^{\circ}\text{C}$ )  
 ■ Controlling oxidation wear

## Ceramic substrate characteristics



PT600M

Conventional Black Ceramic

Fine Grain Structure of PT600M

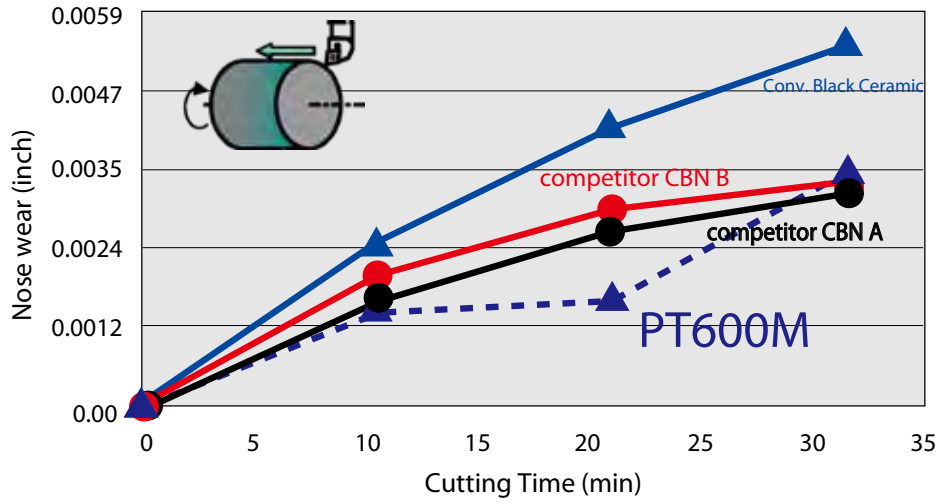
- Compared to conventional black ceramics, the hardness, fracture resistance, strength and oxidation resistance of PT600M have been optimized to achieve longer tool life
- A smaller grain size reduces the potential for sudden fracture

### Static property comparison of PT600M and Conventional Black Ceramic

grade	Hardness Hv (GPa)	Fracture Toughness $K_{1C}$ (MPam <sup>1/2</sup> )	Strength (MPa)	Oxidation resistance <sup>*1</sup> (mg/cm <sup>2</sup> )
PT600M	20.0	6.5	1000	2.1
Black Ceramic	19.0	4.3	850	2.8

\*Oxidation resistance: The increase in weight per unit area when atmospherically oxidized for one hour at 1200°C

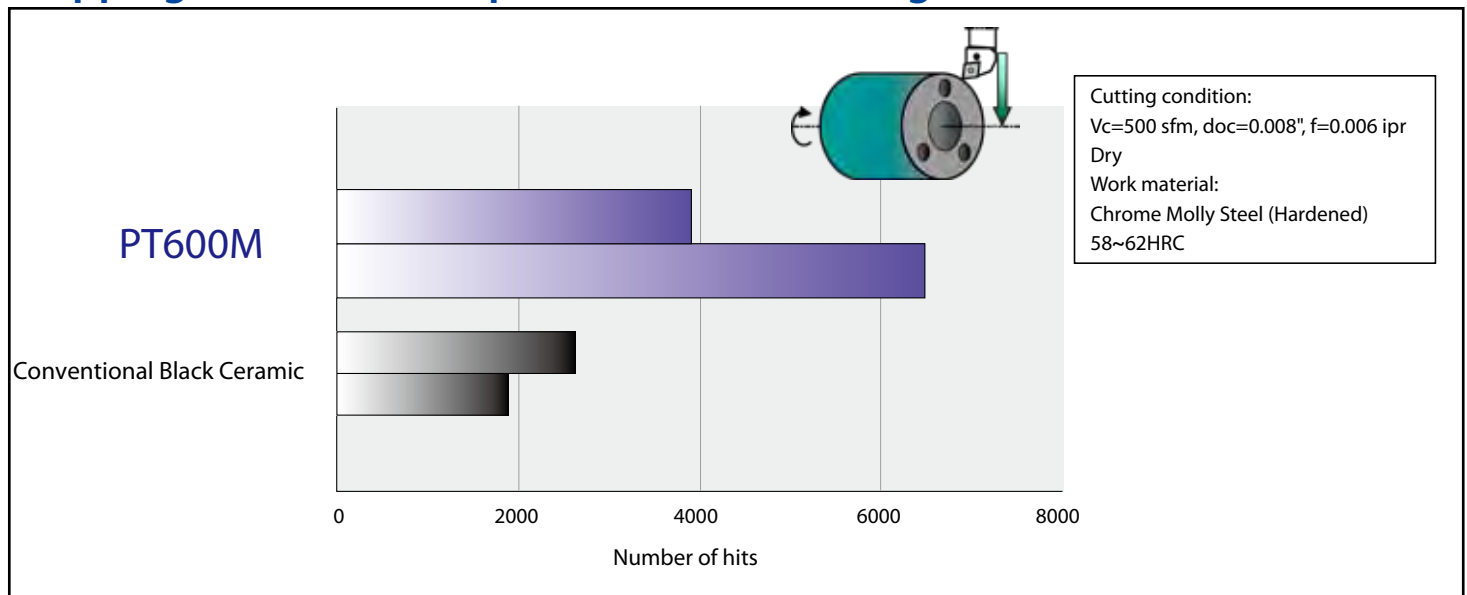
## Wear comparison (for machining of hardened materials)



Cutting condition:  
 $V_c=325$  sfm,  $doc=0.008"$ ,  $f=0.004$  ipr  
 Wet  
 Work material:  
 Chrome Molly Steel (Hardened)  
 58~62HRC

Wear resistance is comparable to that of competitor's CBN A and B for low speed machining of hardened materials

## Chipping resistance comparison (for machining of hardened materials)



Cutting condition:  
 $V_c=500$  sfm,  $doc=0.008"$ ,  $f=0.006$  ipr  
 Dry  
 Work material:  
 Chrome Molly Steel (Hardened)  
 58~62HRC

Chipping resistance significantly improved compared to Conventional Black Ceramic

**MEGACOAT plus fine-grain ceramic structure miniaturization allow PT600M to achieve significantly longer tool life for machining of hardened materials and gray cast iron**



## PT600M Case study

<b>Bearing Steel</b>	
<ul style="list-style-type: none"> <li>·Bearing</li> <li>·Vc=650 sfm</li> <li>·doc=0.012"</li> <li>·f=0.006 ipr</li> <li>·Wet</li> <li>·DNGA433S00825 (special order)</li> </ul>	
<b>PT600M</b>	84min/insert
Competitor C (CBN)	40min/insert
<p>Under cutting conditions equivalent to those of Competitor C (CBN), the tool life of PT600M was approximately twice as long and cost was reduced by about 70%</p> <p style="text-align: right;">(Evaluation by the user)</p>	



## Edge preparation

Symbol/Cutting edge Condition	Classification		Example		Shape
	gray cast iron	high hard materials			
T Chamfered Cutting Edge	★	☆	<b>T00220</b>	0.002"×20° Chamfered Cutting Edge	<p>e.g.) T00825</p>
			<b>T00320</b>	0.003"×20° Chamfered Cutting Edge	
			<b>T00420</b>	0.004"×20° Chamfered Cutting Edge	
			<b>T00825</b>	0.008"×25° Chamfered Cutting Edge	
S Chamfered and hone	☆	★	<b>S00320</b>	0.003"×20° Chamfer and hone	<p>e.g.) S00825</p>
			<b>S00825</b>	0.008"×25° Chamfer and hone	
K Double Chamfered Cutting Edges		★	<b>K06015</b>	0.060"×15° Primary Chamfer 0.008"×30° Secondary Chamfer	<p>e.g.) K06015</p>
			<b>K20003</b>	2.00mm×3° Primary Chamfer Secondary Chamfer varies	
P Double Chamfered and hone			<b>P08015</b>	0.080" x 15° Primary Chamfer 0.006" x 25° Secondary Chamfer and Hone	<p>e.g.) P08015</p>

★:1st. Choice ☆:2nd. Choice

## Recommended Cutting Conditions

•Hardened ( $r\epsilon=0.031''$ )

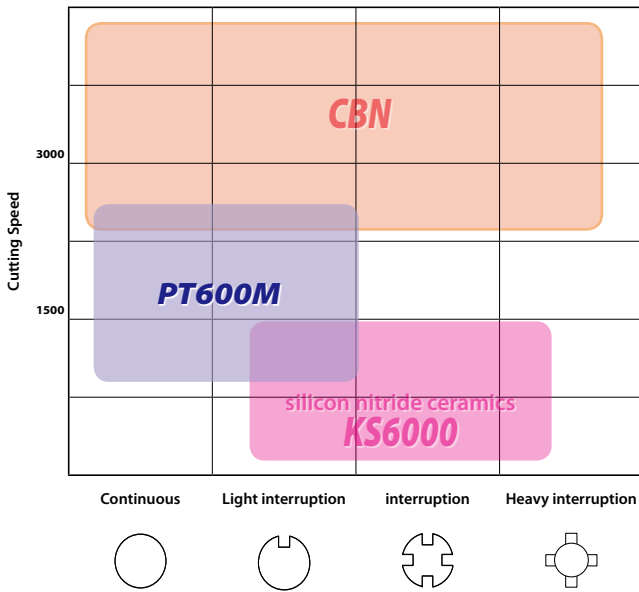
Hardness of work material	Vc (sfm)	doc (inch)	f (ipr)
40~50HRC	200-250-325	0.008-0.020-0.028	0.002-0.004-0.006
50~65HRC	100-130-200	0.008-0.020-0.028	0.002-0.004-0.006

•Gray cast iron ( $r\epsilon=0.031''$ )

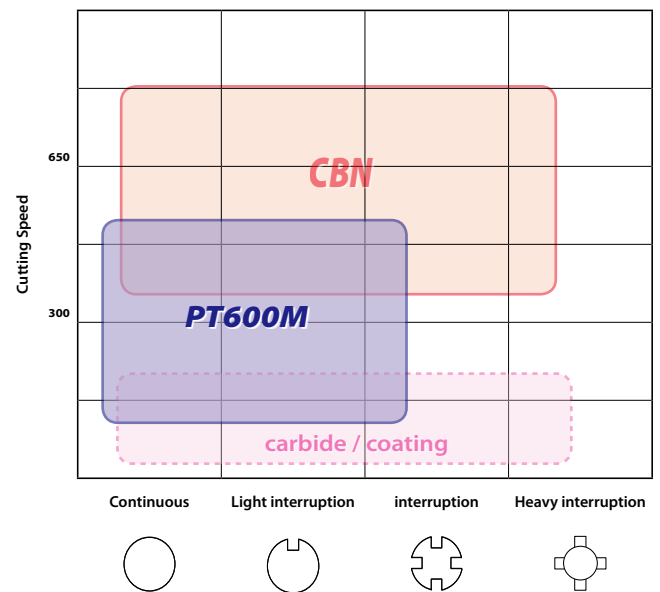
work material	Vc (sfm)	doc (inch)	f (ipr)
FC250~FC300	975-1475-1975	0.012-0.020-0.040	0.004-0.008-0.012

## Application range of PT600M

Gray Cast Iron



Hardened/Heat Treated Materials








**Why Ceramic?** Kyocera's ceramic inserts are capable of running at high speeds, thus reducing expensive machining times. Hard turning of 38Rc to 64Rc carbon and alloy steels, or rough to finish turning of cast irons is recommended for ceramic inserts. Kyocera's ceramic grades are designed to resist oxidation and maintain hardness at elevated temperatures.

## Advantages of Ceramic

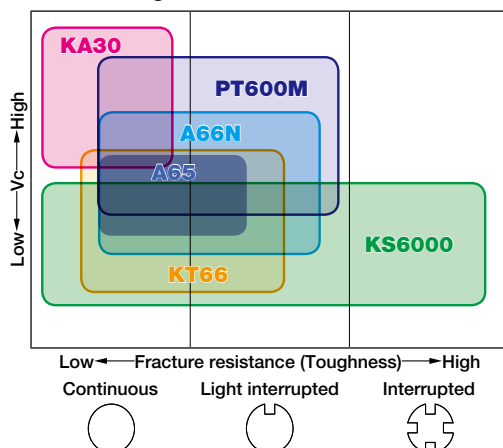
1. Excellent wear resistance enables high cutting speeds
2. Ceramic maintains good surface finishes due to the low affinity to workpiece materials
3. KS6000 has improved thermal shock resistance allowing cast iron machining with coolant

## Features of Ceramic

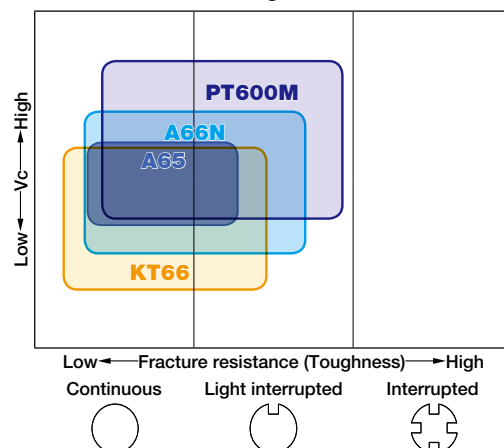
Material	Symbol	Color	Main Component	Coating layer hardness (GPa)	Base Material Hardness (GPa)	Fracture Toughness (MPa·m <sup>1/2</sup> )	Transverse Strength (MPa)	Advantages
	KA30	White	Al <sub>2</sub> O <sub>3</sub>	-	17.5	4.0	750	<ul style="list-style-type: none"> <li>Aluminum Oxide Ceramic (Al<sub>2</sub>O<sub>3</sub>)</li> <li>For finishing of cast iron at high cutting speeds without coolant</li> </ul>
	KS6000	Gray	Si <sub>3</sub> N <sub>4</sub>	-	15.7	6.5	1230	<ul style="list-style-type: none"> <li>Silicon Nitride Ceramic (Si<sub>3</sub>N<sub>4</sub>)</li> <li>Designed for interrupted, high feed machining of cast iron (with or without coolant).</li> </ul>
	KT66	Black	Al <sub>2</sub> O <sub>3</sub> +TiC	-	20.1	4.1	980	<ul style="list-style-type: none"> <li>Aluminum Oxide and Titanium Carbide (Al<sub>2</sub>O<sub>3</sub>+TiC)</li> <li>Application: Hardened material / Rolled steel machining</li> </ul>
	A65	Black	Al <sub>2</sub> O <sub>3</sub> +TiC <sub>3</sub>	-	20.1	4.1	980	<ul style="list-style-type: none"> <li>Aluminum Oxide and Titanium Carbide (Al<sub>2</sub>O<sub>3</sub>+TiC)</li> <li>Application: Semi-roughing to finishing of steel, cast iron and hardened materials</li> </ul>
	A66N (TiN COAT)	Gold	Al <sub>2</sub> O <sub>3</sub> +TiC	20	20.1	4.1	980	<ul style="list-style-type: none"> <li>Aluminum Oxide and Titanium Carbide (Al<sub>2</sub>O<sub>3</sub>+TiC) + TiN Coated Ceramic</li> <li>Application: PVD coated ceramics for hardened materials machining</li> </ul>
	PT600M (MEGACOAT)	Blackish red	Al <sub>2</sub> O <sub>3</sub> +TiC	30	20.1	4.1	980	<ul style="list-style-type: none"> <li>Aluminum Oxide and Titanium Carbide (Al<sub>2</sub>O<sub>3</sub>+TiC) + MEGACOAT Coated Ceramic</li> <li>Application: Hardened materials, rolled steel and cast iron machining</li> </ul>

## Ceramic Area Map

❖ Cast iron Machining

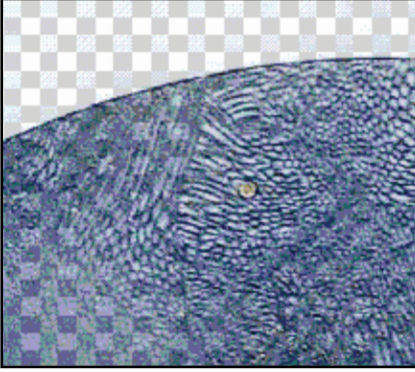


❖ Hardened materials machining



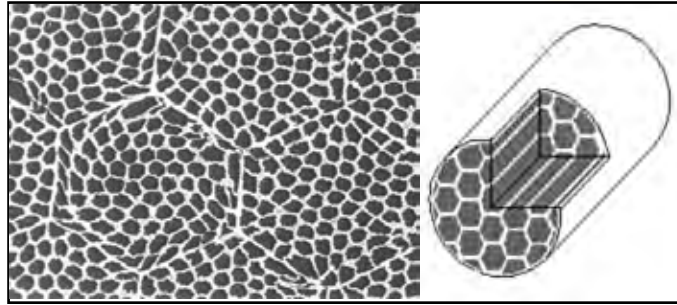
# CF1 - Cell Fiber Ceramic

Continuing with Kyocera's long tradition of cutting edge ceramic technology, cell fiber ceramic combines toughness and wear resistance into one insert, similar to whisker reinforced ceramics. Cell fibers feature a hard, wear resistant ceramic core and a tough ceramic shell. The tough shell stops cracks that form in the core.



## Advantages of Cell Fiber Ceramic

1. Excellent performance in high temp alloys under 50Rc
2. Combats thermal shock created by coolant and interruptions
3. Improved resistance to notching

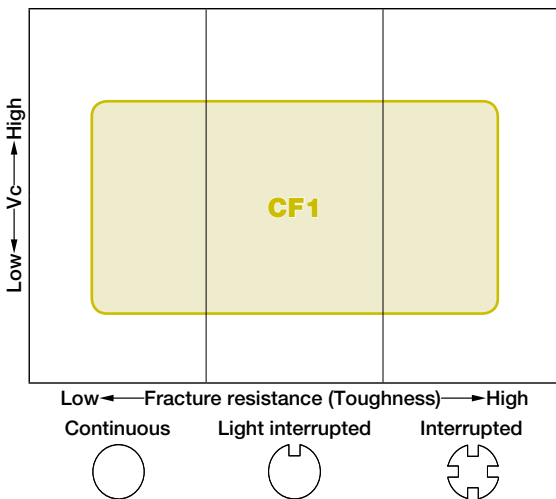


Cell fibers are grouped together to prevent large scale fracture

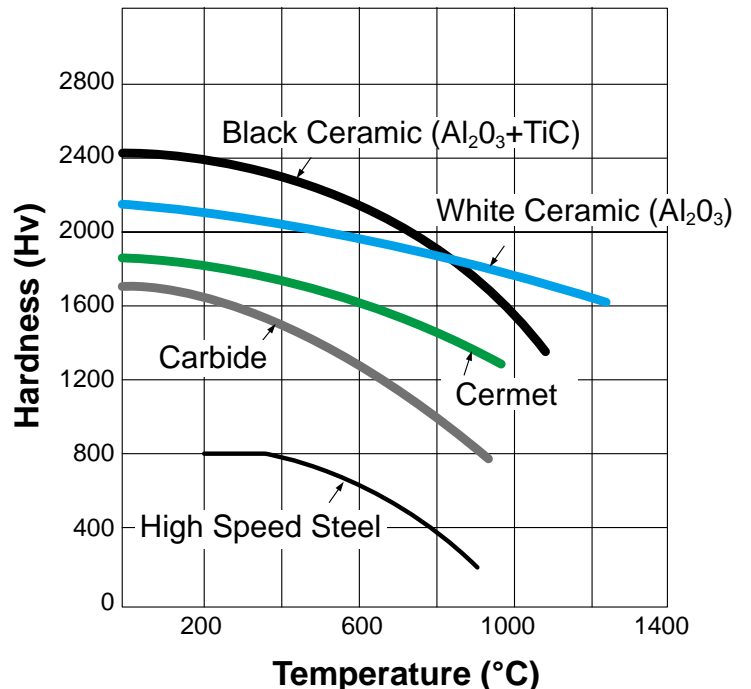
## Ceramic Applications

Workpiece Material	Cast Iron (Gray Cast Iron/Ductile Cast Iron)				High Hard Material (Heat Treated Steel/Chilled Cast Iron)				Hard-to-machine Material (Titanium Alloy/Ni Alloy)			
	Finishing		Roughing		Finishing		Roughing		Finishing		Roughing	
Cutting Range Classification	K01	K10	K20	K30	H01	H10	H20	H30	S01	S10	S20	S30
Ceramic	A65 A66N KS6000				A65 A66N PT600M				CF1			

## Heat Resistant Alloys Machining





## Hot Hardness

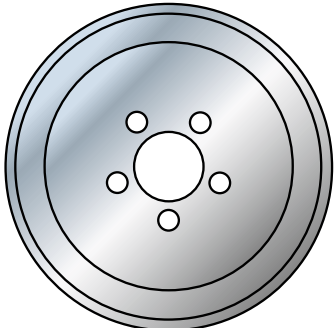


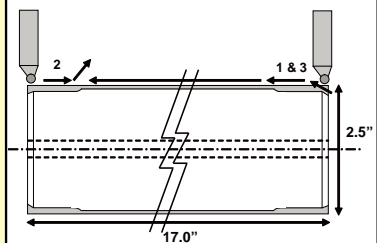


## Case Studies

A65	
Flight Control Parts	
<ul style="list-style-type: none"> <li>Vc = 500 SFM</li> <li>d = 0.070"</li> <li>f = .001 ipr</li> <li>Dry</li> <li>KCG 3062 T00320 4140</li> </ul>	
A65	46 parts p/edge
Competitor CBN	30 pcs/edge
<p>A65 improved productivity by 46%. In addition, the cost of the A65 is 70% less than the competitor's CBN grade, providing significant cost efficiency.</p>	

A66N	
Nozzle Plunger	
Rough Profile <ul style="list-style-type: none"> <li>Vc = 450 SFM</li> <li>d = 0.010"</li> <li>f = .004 ipr</li> <li>Dry</li> <li>RNG43 T00625AA</li> <li>Stellite No.12</li> </ul>	
A66N	5 parts p/edge
Competitor S	3 pcs/edge
<p>A66N improved productivity by 67%. In addition, the cost of the A66N is 50% less than Competitor S, thus providing significant cost efficiency.</p>	

KS6000	
Brake Drum - Bore	
<ul style="list-style-type: none"> <li>Vc = 2615 SFM</li> <li>d = .125"</li> <li>f = .011 ipr</li> <li>Dry</li> <li>CNGA 543 T00825</li> <li>Gray Cast Iron (35B)</li> </ul>	
KS6000	62 pcs/edge 107% Improvement!!!
Competitor Si <sub>3</sub> N <sub>4</sub>	30 pcs/edge
<p>KS6000 more than doubled the tool life of a comparably priced insert.</p>	

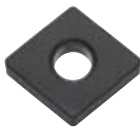
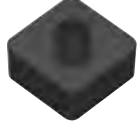
CF1		
Turbine Rotor Stud		
<b>Roughing</b> <ul style="list-style-type: none"> <li>Vc = 800 SFM</li> <li>d = .050"</li> <li>f = .015 ipr</li> <li>Wet</li> <li>RNG45 T00420</li> </ul> <b>Finishing</b> <ul style="list-style-type: none"> <li>Vc = 1000 SFM</li> <li>d = .005"</li> <li>fz = .0045 ipr</li> <li>Wet</li> <li>RNG45 T00420</li> </ul>	Inconel 718, 38Rc	
CF1	Equivalent parts/edge as competitor	Equivalent parts/edge as competitor
Operation	Roughing	Finishing
Competitor Whisker Reinforced Ceramic	Excessive notching	Excessive wear



## 80°Diamond • Negative

				(in)			
Description	I.C.(A)	T	$\phi d$	Description	I.C.(A)	T	$\phi d$
CNGA43__	1/2	3/16	0.203	CNGA54__	5/8	1/4	0.250
CNMA43__				CNGA64__	3/4		0.312
				CNGX45__	1/2	5/16	-

Classification of usage ✚ : Interruption / 1st Choice ✚✚ : Interruption / 2nd choice ● : Light Interruption / 1st choice ○ : Light Interruption / 2nd choice ● : Continuous / 1st choice ○ : Continuous / 2nd choice	K	Gray Cast Iron (With Scale)								
		Gray Cast Iron (Without Scale)	●	○	●					
	S	Heat-Resistant Alloy								
	H	Hardened Material (Finishing)								

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)	Ceramic						
					Alumina	PVD	MEGACOAT	Silicon Nitride	Cellfiber		
				rε	KA30	A65	KT66	A66N	PT600M	KS6000	CF1
	CNGA 432T00425AA	S00425	CNGA 120408S01025	1/32	●						
	433T00425AA		CNGA 120412S01025	3/64	●						
	CNGA 431T00625AA	S00625	CNGA 120404S01525	1/64			●				
	432T00625AA		120408S01525	1/32			●				
	433T00625AA		120412S01525	3/64			○				
	CNGA 431S00825	S00825	CNGA 120404S02025	1/64				●			
	432S00825		120408S02025	1/32				○			
	433S00825		120412S02025	3/64				●			
	CNGA 431T01230AA	S01230	CNGA 120404S03030	1/64				●			
	432T01230AA		120408S03030	1/32				○			
	433T01230AA		120412S03030	3/64				○			
	CNGA 433T00220	T00220	CNGA 120412T00520	3/64	○						
	CNGA 432T00325	T00325	CNGA 120408T00825	1/32		●					
	433T00325		120412T00825	3/64		●					
	CNGA 431T00625	T00625	CNGA 120404T01525	1/64				●			
	432T00625		120408T01525	1/32				●			
	433T00625		120412T01525	3/64				●			
	CNGA 431T00825	T00825	CNGA 120404T02025	1/64		○	○		●		
	432T00825		120408T02025	1/32		●	○		○	●	
	433T00825		120412T02025	3/64		●	○		●	●	
434T00825	120416T02025		1/16						●		
CNGA 543T00825	T00825	CNGA 160612T02025	3/64						●		
544T00825		160616T02025	1/16						○		
CNGA 643T00825	T00825	CNGA 190612T02025	3/64		●				●		
644T00825		190616T02025	1/16		●						
CNMA 432T00625AA	S00625	CNMA 120408S01525	1/32				○				
433T00625AA		120412S01525	3/64								
CNMA 432T01230AA	S01230	CNMA 120408S03030	1/32				○				
433T01230AA		120412S03030	3/64				○				
CNMA 432T00625	T00625	CNMA 120408T01525	1/32				●				
433T00625		120412T01525	3/64				●				
	CNGX 452T00825	T00825	CNGX 120708T02025	1/32							
	453T00825		120712T02025	3/64					○		
	454T00825		120716T02025	1/16					●		
	CNGX 454T01225	T01225	CNGX 120716T03025	1/16					●		

■ 55°Diamond • Negative  
75°Diamond • Negative

Description	I.C.(A)	T	$\phi d$
DNGA43__	1/2	3/16	0.203
DNGA44__		1/4	
DNGX35__	0.394	5/16	-
DNGX45__	1/2		

Description	I.C.(A)	T	$\phi d$
ENG45__	1/2	5/16	-

Classification of usage	K	Gray Cast Iron (With Scale)					
		✦ : Interruption / 1st Choice ✧ : Interruption / 2nd choice ● : Light Interruption / 1st choice ○ : Light Interruption / 2nd choice ● : Continuous / 1st choice ○ : Continuous / 2nd choice	●	○	●	○	○
	S	Heat-Resistant Alloy					
	H	Hardened Material (Finishing)					
				○	●		

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)	Alumina Ceramic						PVD Ceramic	MEGACOAT Ceramic	Silicon Nitride Ceramic	Cellfiber Ceramic	
					rε	KA30	A65	KT66	A66N	PT600M					K36000
	DNG 431T00425AA	S00425	DNGN 150404S01025	1/64	○										
	432T00425AA		DNGN 150408S01025	1/32	○										
	433T00425AA		DNGN 150412S01025	3/64	○										
	434T00425AA		DNGN 150416S01025	1/16	○										
	DNG 432T00825	T00825	DNGN 150408T02025	1/32			○		○						
	DNG 451T00625AA	S00625	DNGN 150704S01525	1/64					○						
	452T00625AA		DNGN 150708S01525	1/32					○						
	453T00625AA		DNGN 150712S01525	3/64						○					
	DNG 451S00825	S00825	DNGN 150704S02025	1/64						○					
	452S00825		DNGN 150708S02025	1/32						○					
	453S00825		DNGN 150712S02025	3/64							○				
	DNG 451T00825	T00825	DNGN 150704T02025	1/64		○									
452T00825	DNGN 150708T02025		1/32		○										
453T00825	DNGN 150712T02025		3/64			○									
454T00825	DNGN 150716T02025		1/16				○								
	DNGA 432T00425AA	S00425	DNGA 150408S01025	1/32	●										
	433T00425AA		DNGA 150412S01025	3/64	●										
	DNGA 431T00625AA	S00625	DNGA 150408S01525	1/32					○						
	432T00625AA		DNGA 150412S01525	3/64						○					
	DNGA 431S00825	S00825	DNGA 150404S02025	1/64						●					
	432S00825		DNGA 150408S02025	1/32							○				
	DNGA 432T01230AA	S01230	DNGA 150408S03030	1/32						○					
	DNGA 432T00325	T00325	DNGA 150408T00825	1/32		●									
	433T00325		DNGA 150412T00825	3/64		●									
	DNGA 431T00625	T00625	DNGA 150404T01525	1/64						●					
	432T00625		DNGA 150408T01525	1/32						●					
	433T00625		DNGA 150412T01525	3/64							●				
DNGA 431T00825	T00825	DNGA 150404T02025	1/64		●	○			●						
432T00825		DNGA 150408T02025	1/32		●	○			●		●				
433T00825		DNGA 150412T02025	3/64		●	○			●						
434T00825		DNGA 150416T02025	1/16		●										
DNGA 441T00825		T00825	DNGA 150604T02025	1/64		○	○			●					
442T00825	DNGA 150608T02025		1/32		○	○			●						
443T00825	DNGA 150612T02025		3/64		○	○			●		●				
	DNGX 352T00825	T00825	DNGX 120708T02025	1/32								○			
	353T00825		DNGX 120712T02025	3/64									○		
	354T00825		DNGX 120716T02025	1/16									○		
	DNGX 452T00825	T00825	DNGX 150708T02025	1/32									○		
	453T00825		DNGX 150712T02025	3/64									○		
	ENG 452T00625AA	S00625	ENG 130708S01525	1/32					○						
	453T00625AA		ENG 130712S01525	3/64						○					
	ENG 452S00825	S00825	ENG 130708S02025	1/32						○					
	453S00825		ENG 130712S02025	3/64							○				
	ENG 451T00825	T00825	ENG 130704T02025	1/64		○				○					
	452T00825		ENG 130708T02025	1/32		○					○				
	453T00825		ENG 130712T02025	3/64			○					○			
	454T00825		ENG 130716T02025	1/16				○							
455T00825	ENG 130720T02025		5/64					○							
			ENG 130730T02025	0.118						○					


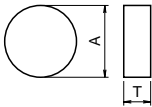


● : Std. Stock ○ : World Express

■ Round • Negative  
■ 90°Square • Negative

Description	I.C.(A)	T	$\phi d$
RNG33_	3/8	3/16	-
RNG35_		5/16	
RNG43_	1/2	3/16	
RNG45_		5/16	
RNG55_	5/8		

Description	I.C.(A)	T	$\phi d$
SNG43_	1/2	3/16	-

Classification of usage	Gray Cast Iron (With Scale)		Gray Cast Iron (Without Scale)		Heat-Resistant Alloy		Hardened Material (Finishing)	
	+	⊕	●	☉	+	⊕	○	☉
⊕ : Interruption / 1st Choice								
⊕ : Interruption / 2nd choice								
● : Light Interruption / 1st choice								
☉ : Light Interruption / 2nd choice								
● : Continuous / 1st choice								
○ : Continuous / 2nd choice								

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)	Alumina Ceramic		PVD Ceramic	MEGACOAT Ceramic	Silicon Nitride Ceramic	Cellulose Ceramic	
					KA30	A65	KT66	A66N	PT600M	KS6000	CF1
 	RNG 33T00625AA	S00625	RNGN 090400S01525	-			○				
	33S00825	S00825	090400S02025	-				●			
	33T00420	T00420	090400T01020	-						●	
	33T00825	T00825	090400T02025	-	○			●			
	RNG 35T00420	T00420	RNGN 090700T01020	-						●	
	RNG 43T00625AA	S00625	RNGN 120400S01525	-			○				
	43S00825	S00825	120400S02025	-				●			
	43T00420	T00420	120400T01020	-						●	
	43T00625	T00625	120400T01525	-			●				
	43T00820	T00820	120400T00820	-						●	
	43T00825	T00825	120400T02025	-	●	○		●	●		
	RNG 45K06015	K06015	RNGN 120700K15015	-			○				
	45T00625AA	S00625	120700S01525	-				○			
	45S00825	S00825	120700S02025	-				○			
	45T00420	T00420	120700T01020	-						●	
	45T00625	T00625	120700T01525	-			●				
	45T00820	T00820	120700T00820	-						●	
	45T00825	T00825	120700T02025	-	●	○		●	●		
	RNG 55T00625AA	S00625	RNGN 150700S01525	-			○				
	55S00825	S00825	150700S02025	-				●			
55T00825	T00825	150700T02025	-	○			●				
 	SNG 431T00425AA	S00425	SNGN 120404S01025	1/64	○						
	432T00425AA		SNGN 120408S01025	1/32	●						
	433T00425AA		SNGN 120412S01025	3/64	●						
	434T00425AA		SNGN 120416S01025	1/16	●						
	435T00425AA		SNGN 120420S01025	5/64	○						
	SNG 432T00625AA	S00625	SNGN 120408S01525	1/32			○				
	433T00625AA		SNGN 120412S01525	3/64			○				
	434T00625AA		SNGN 120416S01525	1/16			○				
	SNG 432S00825	S00825	SNGN 120408S02025	1/32				●			
	433S00825		SNGN 120412S02025	3/64				●			
	434S00825		SNGN 120416S02025	1/16				●			
	SNG 434T01230AA	S01230	SNGN 120416S03030	1/16			○				
	SNG 432T00220	T00220	SNGN 120408T00520	1/32	○	○	○				
	433T00220		SNGN 120412T00520	3/64	○						
	SNG 432T00420	T00420	SNGN 120408T01020	1/32						●	
	433T00420		SNGN 120412T01020	3/64						●	
	434T00420		SNGN 120416T01020	1/16						●	
	435T00420		SNGN 120420T01020	5/64						●	
	SNG 432T00625	T00625	SNGN 120408T01525	1/32			●				
	433T00625		SNGN 120412T01525	3/64			●				
SNG 431T00825	T00825	SNGN 120404T02025	1/64	○			●				
432T00825		SNGN 120408T02025	1/32	●	○		●				
433T00825		SNGN 120412T02025	3/64	●	○		●	●			
434T00825		SNGN 120416T02025	1/16	●	○		●	●			
435T00825		SNGN 120420T02025	5/64	○	○		●	○			


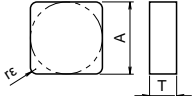



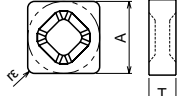
● : Std. Stock ○ : World Express



## 90°Square • Negative

Description	I.C.(A)	T	φd	Description	I.C.(A)	T	φd
SNG45	1/2	5/16	-	SNGA43	1/2	3/16	0.203
SNM45				SNMA43			
SNG55	5/8			SNGX45	1/2	5/16	-
				SNGX55	5/8		


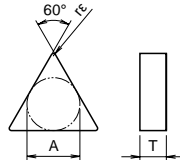
Classification of usage		Gray Cast Iron (With Scale)		Gray Cast Iron (Without Scale)		Heat-Resistant Alloy		Hardened Material (Finishing)	
✚	Interruption / 1st Choice	K		●	☺	✚			
☺	Interruption / 2nd choice								
●	Light Interruption / 1st choice	S						✚	
☺	Light Interruption / 2nd choice	H							☺
●	Continuous / 1st choice								
○	Continuous / 2nd choice								

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)		Alumina Ceramic		PVD Ceramic	MEGACOAT Ceramic	Silicon Nitride Ceramic	Cellfiber Ceramic	
				rε	KA30	A65	KT66	A66N	PT600M	KS6000	CF1	
 	SNG 451T00425AA	S00425	SNGN 120704S01025	1/64	○							
	452T00425AA		SNGN 120708S01025	1/32	●							
	453T00425AA		SNGN 120712S01025	3/64	●							
	454T00425AA		SNGN 120716S01025	1/16	●							
	SNG 451T00625AA	S00625	SNGN 120704S01525	1/64				○				
	452T00625AA		SNGN 120708S01525	1/32				○				
	453T00625AA		SNGN 120712S01525	3/64					○			
	454T00625AA		SNGN 120716S01525	1/16					○			
	455T00625AA		SNGN 120720S01525	5/64					○			
	SNG 451S00825	S00825	SNGN 120704S02025	1/64					●			
	452S00825		SNGN 120708S02025	1/32					●			
	453S00825		SNGN 120712S02025	3/64					●			
	454S00825		SNGN 120716S02025	1/16					●			
	455S00825		SNGN 120720S02025	5/64					●			
	SNG 452T00420	T00420	SNGN 120708T01020	1/32								●
	453T00420		SNGN 120712T01020	3/64								●
	454T00420		SNGN 120716T01020	1/16								●
	455T00420		SNGN 120720T01020	5/64								●
	SNG 451T00825	T00825	SNGN 120704T02025	1/64		○			●			
	452T00825		SNGN 120708T02025	1/32		○			●			
453T00825	SNGN 120712T02025		3/64		●			●				
454T00825	SNGN 120716T02025		1/16		●			●	●			
455T00825	SNGN 120720T02025		5/64		●			●				
SNG 553T00825	T00825	SNGN 150712T02025	3/64		●		○					
554T00825		SNGN 150716T02025	1/16		●		○					
SNM 454T00825	T00825	SNMN 120716T02025	1/16		○							
 	SNGA 432T00625AA	S00625	SNGA 120408S01525	1/32				●				
	433T00625AA		SNGA 120412S01525	3/64				○				
	SNGA 432S00825	S00825	SNGA 120408S02025	1/32				●				
	433S00825		SNGA 120412S02025	3/64				●				
	SNGA 432T00625	T00625	SNGA 120408T01525	1/32				●				
	SNGA 432T00825	T00825	SNGA 120408T02025	1/32		○	○	●		○		
	433T00825		SNGA 120412T02025	3/64		○	○	●		○		
	434T00825		SNGA 120416T02025	1/16			○	●		●		
	SNMA 432T01230AA	S01230	SNMA 120408S03030	1/32				○				
	SNMA 433T00625	T00625	SNMA 120412T01520	3/64				●				
 	SNGX 452T00825	T00825	SNGX 120708T02025	1/32						○		
	453T00825		SNGX 120712T02025	3/64							○	
	454T00825		SNGX 120716T02025	1/16							○	
	455T00825		SNGX 120720T02025	5/64							○	
	SNGX 553T00825	T00825	SNGX 150712T02025	3/64							○	
	554T00825		SNGX 150716T02025	1/16							○	
	555T00825		SNGX 150720T02025	5/64							○	
	SNGX 553T01230	T01230	SNGX 150712T03030	3/64							○	
	554T01230		SNGX 150716T03030	1/16							○	
	555T01230		SNGX 150720T03030	5/64							○	

## 60°Triangle • Negative

(in)				(in)			
Description	I.C.(A)	T	$\phi d$	Description	I.C.(A)	T	$\phi d$
TNG22_	1/4	1/8	-	TNG43_	1/2	3/16	-
TNG32_	3/8	3/16		TNGA33_	3/8	3/16	0.150
TNG33_		5/16		TNGA43_	1/2		0.203
TNG35_							

Classification of usage		Gray Cast Iron (With Scale)		Gray Cast Iron (Without Scale)		Heat-Resistant Alloy		Hardened Material (Finishing)	
✚	Interruption / 1st Choice	K	●	☺	✚				
☺	Interruption / 2nd choice		☺	☺					
●	Light Interruption / 1st choice	S							
☺	Light Interruption / 2nd choice								
●	Continuous / 1st choice	H							
○	Continuous / 2nd choice								

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)	Material										
					rε	KA30	A65	KT66	A66N	PT600M	KS6000	CF1			
 	TNG 221T00220	T00220	TNGN 110304T00520	1/64	○				●						
	TNG 222T00220		TNGN 110308T00520	1/32	○		○	●							
	TNG 223T00220		TNGN 110312T00520	3/64	○			●							
	TNG 322T00825	T00825	TNGN 160308T02025	1/32	●										
	TNG 331T00425AA	S00425	TNGN 160404S01025	1/64	○										
	TNG 332T00425AA		TNGN 160408S01025	1/32	●										
	TNG 333T00425AA		TNGN 160412S01025	3/64	●										
	TNG 334T00425AA		TNGN 160416S01025	1/16	●										
	TNG 335T00425AA		TNGN 160420S01025	5/64	○										
	TNG 331T00625AA	S00625	TNGN 160404S01525	1/64				○							
	TNG 332T00625AA		TNGN 160408S01525	1/32				○							
	TNG 333T00625AA		TNGN 160412S01525	3/64				○							
	TNG 331S00825	S00825	TNGN 160404S02025	1/64					●						
	TNG 332S00825		TNGN 160408S02025	1/32					●						
	TNG 333S00825		TNGN 160412S02025	3/64					●						
	TNG 331T00220	T00220	TNGN 160404T00520	1/64	○	○	○								
	TNG 332T00220		TNGN 160408T00520	1/32	○	○	○								
	TNG 333T00220		TNGN 160412T00520	3/64	○	○	○								
	TNG 334T00220		TNGN 160416T00520	1/16	○										
	TNG 335T00220		TNGN 160420T00520	5/64	○										
TNG 332T00625	T00625	TNGN 160408T01525	1/32				●								
TNG 331T00825	T00825	TNGN 160404T02025	1/64	○	○		●								
TNG 332T00825		TNGN 160408T02025	1/32	●	○		●		○						
TNG 333T00825		TNGN 160412T02025	3/64	●	○		●		○						
TNG 352T00625AA	S00625	TNGN 160708S01525	1/32				○								
TNG 352S00825	S00825	TNGN 160708S02025	1/32					●							
TNG 351T00825	T00825	TNGN 160704T02025	1/64	○				●							
TNG 352T00825		TNGN 160708T02025	1/32	○				●							
TNG 353T00825		TNGN 160712T02025	3/64	○				●							
TNG 354T00825		TNGN 160716T02025	1/16	○											
TNG 355T00825		TNGN 160720T02025	5/64	○											
TNG 432T00825	T00825	TNGN 220408T02025	1/32	●											
TNG 433T00825		TNGN 220412T02025	3/64	●											
TNG 434T00825		TNGN 220416T02025	1/16	●											
TNGA 332T00425AA	S00425	TNGA 160408S01025	1/32	●											
TNGA 331T00625AA	S00625	TNGA 160404S01525	1/64				○								
TNGA 332T00625AA		TNGA 160408S01525	1/32				○								
TNGA 333T00625AA		TNGA 160412S01525	3/64				○								
TNGA 331S00825	S00825	TNGA 160404S02025	1/64					●							
TNGA 332S00825		TNGA 160408S02025	1/32					●							
TNGA 333S00825		TNGA 160412S02025	3/64					○							
TNGA 332T01230AA	S01230	TNGA 160408S03030	1/32				○								
TNGA 333T01230AA		TNGA 160412S03030	3/64				○								
TNGA 332T00220	T00220	TNGA 160408T00520	1/32	○											
TNGA 332T00625	T00625	TNGA 160408T01525	1/32					●							
TNGA 331T00825	T00825	TNGA 160404T02025	1/64	○	○			●							
TNGA 332T00825		TNGA 160408T02025	1/32	●	○			●		○					
TNGA 333T00825		TNGA 160412T02025	3/64	○				●		○					
TNGA 432T00825	T00825	TNGA 220408T02025	1/32	●											
TNGA 433T00825		TNGA 220412T02025	3/64	●											

- 35°Diamond • Negative
- 80°Trigon • Negative
- 90°Square • Positive
- 60°Triangle • Positive

(in)					(in)				
Description	I.C.(A)	T	$\phi d$	$\alpha$	Description	I.C.(A)	T	$\phi d$	$\alpha$
VNGA33__	3/8	3/16	0.150	-	TBG121__	5/32	1/16	-	5°
WNGA43__	1/2	3/16	0.203	-	TCG33__	3/8	3/16	-	7°
SPG32__	3/8	1/8	-	11°	TPG1815__	7/32	3/32	-	11°
SPG42__	1/2				TPG22__	1/4	1/8		
SPG43__	1/2	3/16	-	-	TPG32__	3/8	-	-	-
					TPG43__	1/2	3/16	-	-

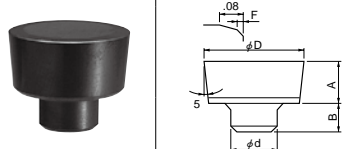
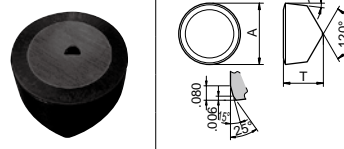
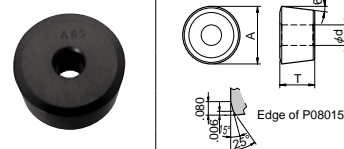
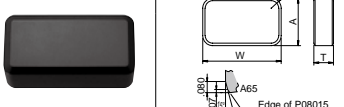
Classification of usage	K	Gray Cast Iron (With Scale)		G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			
		Gray Cast Iron (Without Scale)																							
✱ : Interruption / 1st Choice																									
✪ : Interruption / 2nd choice																									
● : Light Interruption / 1st choice																									
○ : Light Interruption / 2nd choice																									
● : Continuous / 1st choice																									
○ : Continuous / 2nd choice																									

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)	Ceramic																						
					rε	KA30	A65	KT66	A66N	PT600M	KS6000	CF1	Alumina Ceramic	PVD Ceramic	MEGACONT Ceramic	Silicon Nitride Ceramic	Cellfiber Ceramic										
	VNGA 331T00625AA	S00625	VNGA 160404S01525	1/64																							
	332T00625AA		VNGA 160408S01525	1/32																							
	VNGA 331S00825	S00825	VNGA 160404S02025	1/64																							
	332S00825		VNGA 160408S02025	1/32																							
	VNGA 331T00625	T00625	VNGA 160404T01525	1/64																							
	332T00625		VNGA 160408T01525	1/32																							
	VNGA 331T00825	T00825	VNGA 160404T02025	1/64																							
	332T00825		VNGA 160408T02025	1/32																							
	VNGA 331T00825	T00825	VNGA 160412T02025	3/64																							
	333T00825		VNGA 190408T02025	1/32																							
VNGA 432T00825	T00825	VNGA 160408S01525	1/32																								
VNMA 332T00625AA	S00625	VNMA 160408S01525	1/32																								
	WNGA 432T00625AA	S00625	WNGA 080408S01525	1/32																							
	WNGA 431T00625	T00625	WNGA 080404T01525	1/64																							
	WNGA 432T00825		WNGA 080408T02025	1/32																							
	433T00825	T00825	080412T02025	3/64																							
	434T00825		080416T02025	1/16																							
	SPG 322T00320	T00320	SPGN 090308T00820	1/32																							
	SPG 422T00320AA	S00320	SPGN 120308S00820	1/32																							
	422S00320		-	1/32																							
	SPG 422T00320	T00320	SPGN 120308T00820	1/32																							
	423T00320		120312T00820	3/64																							
	424T00320		120316T00820	1/16																							
	SPG 432T00825		T00825	SPGN 120408T02025	1/32																						
		TBG 1211T00320AA	S00320	TBGN 060104S00820	1/64																						
		1211S00320		-	1/64																						
		1212T00320AA		TBGN 060108S00820	1/32																						
1212S00320		-		1/32																							
TBG 1211T00320		T00320	TBGN 060104T00820	1/64																							
1212T00320			TBGN 060108T00820	1/32																							
TCG 331T00320		T00320	TCGN 160404T00820	1/64																							
332T00320			160408T00820	1/32																							
TPG 18151T00320		T00320	TPGN 090204T00820	1/64																							
18152T00320			090208T00820	1/32																							
TPG 221T00320AA		S00320	TPGN 110304S00820	1/64																							
221S00320			-	1/64																							
222T00320AA			TPGN 110308S00820	1/32																							
222S00320			-	1/32																							
TPG 221T00320		T00320	TPGN 110304T00820	1/64																							
222T00320			110308T00820	1/32																							
TPG 321T00320AA		S00320	TPGN 160304S00820	1/64																							
321S00320			-	1/64																							
322T00320AA			TPGN 160308S00820	1/32																							
322S00320			-	1/32																							
TPG 323T00320AA	S00320	TPGN 160312S00820	3/64																								
323S00320		-	3/64																								
TPG 321T00320	T00320	TPGN 160304T00820	1/64																								
322T00320		160308T00820	1/32																								
323T00320		160312T00820	3/64																								
TPG 322T00825	T00825	TPGN 160308T02025	1/32																								
TPG 432T00320	T00320	TPGN 220408T00820	1/32																								

● : Std. Stock ○ : World Express

## Inserts for Hardened Rolls

Classification of usage ✚ : Interruption / 1st Choice ⚙ : Interruption / 2nd choice ● : Light Interruption / 1st choice ○ : Light Interruption / 2nd choice ● : Continuous / 1st choice ○ : Continuous / 2nd choice	K	Gray Cast Iron (With Scale)											
	K	Gray Cast Iron (Without Scale)											
	S	Heat-Resistant Alloy											
	H	Hardened Material (Finishing)											

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension					Alumina Ceramic		PVD Ceramic	MEGACOAT Ceramic	Silicon Nitride Ceramic	Cellfiber Ceramic
				$\phi D$	$\phi d$	A	B	F	KA30	A65	KT66	A66N	PT600M	KS6000
	<b>RBG 16W</b>	K08003	<b>RBG 16W</b>	0.630	0.315	0.315		0.008		○				
	<b>20W</b>	K08003	<b>20W</b>	0.787	0.394	0.394		0.012		○				
	<b>12K2003</b>	K20003	<b>12K2003</b>	12mm	6mm	6mm	3mm	0.2mm			○			
	<b>16K2003</b>	K20003	<b>16K2003</b>	16mm	8mm	8mm	5mm	0.2mm			○			
	<b>20K2003</b>	K20003	<b>20K2003</b>	20mm	10mm	10mm	5mm	0.3mm			○			
	<b>RCGX 102T04015</b>	T04015	<b>RCGX 060400</b>	A	$\phi d$	T					●			
	<b>102H315T04015</b>		<b>060700</b>	1/4		0.180					●			
	<b>103T08015/625AA</b>	P08015	<b>090700</b>	3/8	-	0.315	-	-			●	●		
	<b>104T08015/625AA</b>		<b>120700</b>	1/2							●	●		
	<b>106T08015/625AA</b>		<b>191000</b>	3/4		0.394						●		
	<b>RCMA 66T08015/625AA</b>	P08015	<b>RCMA 190900</b>	3/4	0.250	3/8					●	●		
	<b>88T08015/625AA</b>		<b>251200</b>	1	0.266	1/2						●	●	
	<b>812T08015/625AA</b>		<b>251800</b>			3/4	-	-				●		
	<b>106T08015/625AA</b>		<b>310900</b>			3/8						●		
	<b>1012T08015/625AA</b>		<b>311800</b>	1-1/4	0.390	3/4						●		
	<b>LNU 6688T08015/625A</b>	P08015	<b>LNUN 381232</b>	A	T	W	rε	-						
				3/4	1/2	1 1/2	1/8	-			●			

## Grooving Inserts

Edge Preparation			
Symbol	Cutting Edge Condition	Example (inch)	Example (mm)
T	Chamfered Cutting Edges	T00420 .004"x20° chamfer	T01020 0.1mmx20° chamfer
S	Chamfered and Rounded Cutting Edge	S00420 .004"x20° chamfer+hone	S01020 0.1mmx20° chamfer+hone

Classification of usage

- ✦ : Interruption / 1st Choice
- ✧ : Interruption / 2nd choice
- : Light Interruption / 1st choice
- : Light Interruption / 2nd choice
- : Continuous / 1st choice
- : Continuous / 2nd choice

K	Gray Cast Iron (With Scale)																				
	Gray Cast Iron (Without Scale)		○	●																	
S	Heat-Resistant Alloy																				
H	Hardened Material (Finishing)										○	●									

Shape	Description (ANSI)	Std. Edge Prep. (inch)	Description (ISO)	Dimension (inch)						Ceramic													
				W	B	re	A	L	H	Alumina Ceramic	PVD Ceramic	MEGACOAT Ceramic	Silicon Nitride Ceramic	Cellfiber Ceramic									
				KA30	A65	KT66	A66N	PT600M	KS6000	CF1													
	GS 91-5	T00420	GS 91-5	0.197	-	0.020	-	0.59	0.295	○													
	91-8		91-8	0.315	-	0.031	-	-	-	-	○												
	GH 4020-05	S00420	GH 4020-05	0.157	-	-	-	-	-			○											
	4020-05	T00420	4020-05	0.157	-	-	-	-	-			○											
	5020-05	S00420	5020-05	0.197	-	0.020	-	0.79	0.3			○											
	5020-05	T00420	5020-05	0.197	-	0.020	-	0.79	0.3			○											
	6020-05	T00420	6020-05	0.236	-	-	-	-	-			○											
	7020-05	T00420	7020-05	0.276	-	-	-	-	-			○											
	DB 125R15	T00420	-	0.125	-	0.015	-	-	0.250	●													
	187R15	T00420		0.187	-	0.015	-	1.125	0.250	●													
	187R30	T00420		0.187	-	0.030	-	1.125	0.250	●													
	250R15	T00420		0.250	-	0.015	-	-	0.336	●													
	250R30	T00420		0.250	-	0.030	-	-	0.336	●													
	DB 125FNR	T00420	-	0.125	-	0.063	-	-	0.250	●													
	187FNR	T00420		0.187	-	0.094	-	1.125	0.250	●													
	250FNR	T00420		0.250	-	0.125	-	-	0.336	●													
	GG 157-20	T00320	-	0.157	-	0.020	-	0.591	0.197	●													
	197-20	T00320		0.197	-	0.032	-	-	-	-	●												
	KCG 2062 <sup>R/L</sup>	T00320	-	0.062	-	0.005	-	-	-	●													
	2094 <sup>R/L</sup>			0.094	0.110	I	0.150	0.540	0.22														
	2125 <sup>R/L</sup>			0.125	-	0.010	-	-	-	-			L										
	KCG 3062 <sup>R/L</sup>	T00320	-	0.062	0.094	-	-	-	-	R													
	3094 <sup>R/L</sup>			0.094	-	0.005	-	-	-	0.195	0.810	0.34	●										
	3125 <sup>R/L</sup>			0.125	0.150	I	0.195	0.810	0.34				R										
	3156 <sup>R/L</sup>			0.156	-	0.010	-	-	-	-			●										

KCG2...G=#.1875  
KCG3...G=#.3750



# Other Cutting Tool Products from



## Drilling

THE NEW VALUE FRONTIER  
**KYOCERA**

### Drilling

- Magic Drills
- Holeshot Drills
- Coremaster Drills
- Stinger Drills
- Counterbores
- Countersinks

- Drilling Diameters from 0.394" to 4"
- Drilling Depths up to 5xD
- Wide variety of grade offerings for:
  - Steel
  - Stainless Steel
  - Cast Iron
  - Non-Ferrous Materials

ADVANCING PRODUCTIVITY

## Milling

THE NEW VALUE FRONTIER  
**KYOCERA**

### M-Series Milling

- MEC Ultra-High-Speed Endmills & Facemills
- MECX Ultra-High-Speed Fine-Pitch Endmills & Facemills
- MECH Medical Endmills
- MEY Ultra-Drill Mills
- MSR Heavy Roughing Cutters
- MSRS Heavy Roughing Facemills

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### Milling

OTM Milling Product Lineup

- End Mills
- Face Mills
- Chamfer Mills
- Custom Milling Cutters

ADVANCING PRODUCTIVITY

## Grooving

THE NEW VALUE FRONTIER  
**KYOCERA**

### CERA-NOTCH

GROOVING AND THREADING SYSTEM

Grooving  
Threading  
Face Grooving  
Deep Grooving

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### SIGE Internal Grooving

- Made in a single process from start to finish
- High rigidity and high accuracy
- High rigidity and high accuracy
- High rigidity and high accuracy
- High rigidity and high accuracy

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### OTM API Ring Groovers

Single workpiece processing of up to 100 API Ring Groovers

Advantages:

- Lower cost per cut
- Great surface finish
- Reliable repeatability
- Easy to set and adjust
- Free cutting geometry

ADVANCING PRODUCTIVITY

## Turning

THE NEW VALUE FRONTIER  
**KYOCERA**

### Double-Sided Swiss Tools

- Double-sided negative insert increases productivity and stability
- Sharp cutting edge equivalent to positive insert edge
- Two new PVD Coated grades:
  - PR1005 for Titanium and low carbon steel
  - PR1023 for Stainless Steel and general use

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### CA55 Series

CVD Coated Carbide Grades for Steel

- CA5505
- CA5515
- CA5525
- CA5535

Featuring the RH & PX Chipbreakers for Heavy Machining

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### CA65<sup>15/25</sup> and PR11<sup>25</sup>

for Stainless Steel Machining

New MQ Chipbreaker

Innovative solutions for Stainless Steel Machining

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER  
**KYOCERA**

### KBN10M / KBN25M KBN10C / KBN25C

PVD COATED CBN

Featuring Kyocera's New Metacoat PVD Coating Technology

ADVANCING PRODUCTIVITY

THE NEW VALUE FRONTIER



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