

2007-2008



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# NTK

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# CUTTING TOOLS

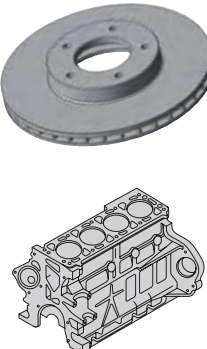






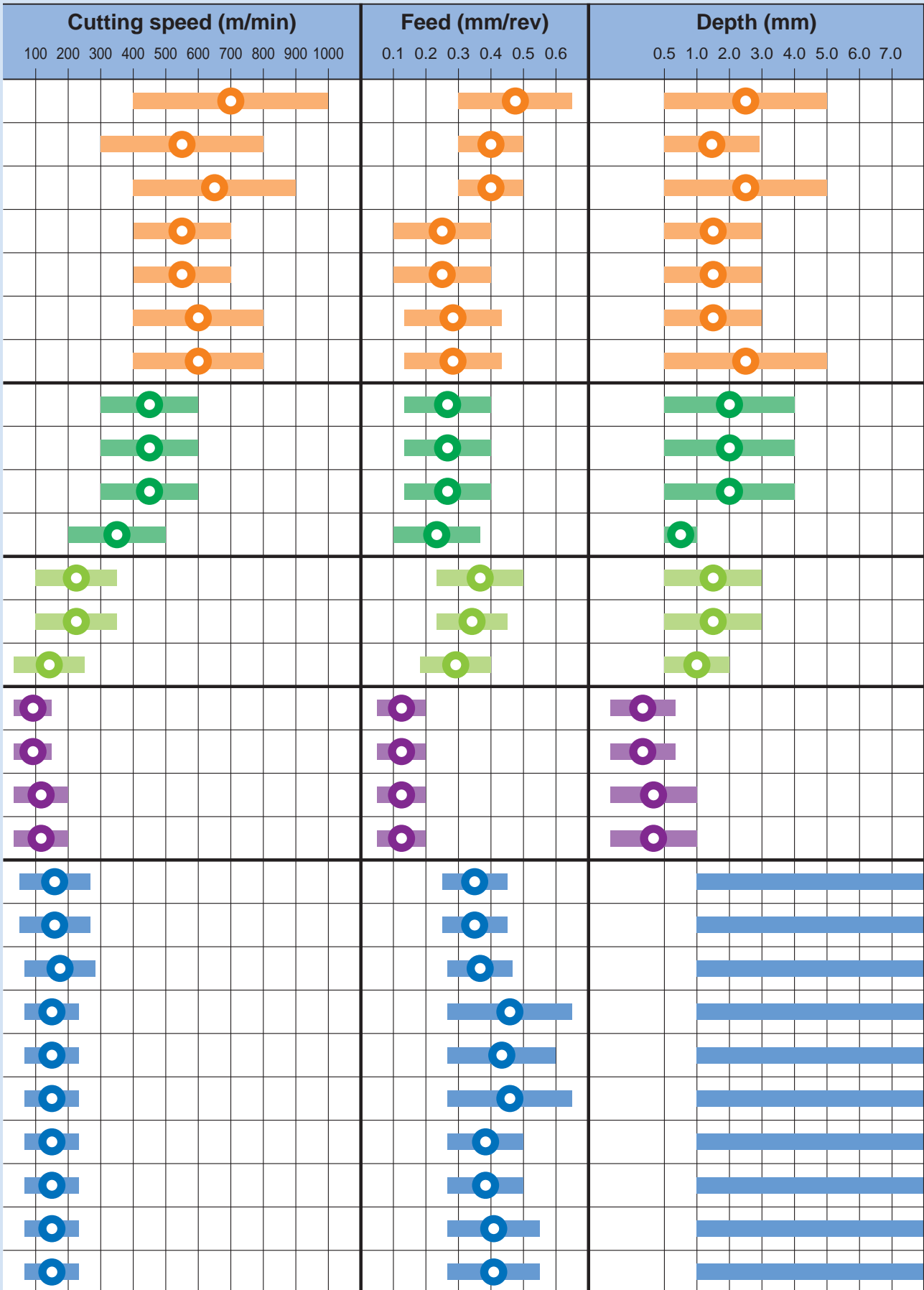
**NGK** | **NTK**  
SPARK PLUGS | TECHNICAL CERAMICS

NGK SPARK PLUG EUROPE GMBH  
NGK SPARK PLUGS(U.K.), LTD

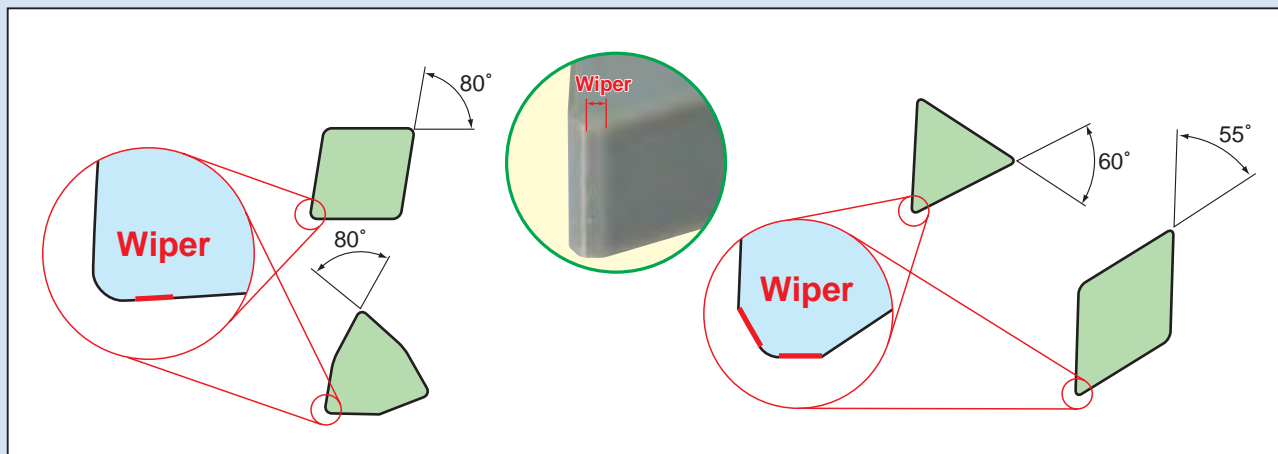
2007  
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CUTTING TOOLS

# How to select Ceramic and CBN Recommended cutting condition

Work	Grade	Rough	Semi-Finish	Finish	Insert Shape			Dry	Wet			
					Circle	Triangle	Star					
<b>Cast iron</b> 	Ceramic	SX1	●			●	○	●	○			
		SP2		●			●		●	○		
		SX9	●					●	●			
		HW2 / HC1			●	●			●			
	HC2			○	●	●		●	○			
	CBN	B20	●					●		●		
B16		●					●		●			
<b>Ductile Cast iron</b> 	Ceramic	SP2	●			●			●			
		SX9	●				●			●		
		SX8	●					●		●		
		HC6			●	●				●		
<b>Heat resistant Alloy</b> 	Ceramic	SX9	●	○			●	○	●			
		WA1	●	○			●	○	●			
		HC7			●	●			○	●		
<b>Hardened steel</b> 	Ceramic	ZC7			●	●			●			
		ZC4			●	●				●		
	CBN	B24	●		●		●			●		
		B36	●		●			●	●	○		
<b>Mill Rolls</b> 	HSS	Ceramic	WA1	●	●	●		●		●	○	
			HC2 / HC7	○	○	○	●			●		○
	Cast iron	Ceramic	WA1	○	○	○		●		●	○	
			HC2 / HC7	●	●	●	●			●		○
	Ductile	Ceramic	B22	○	○	○		●		●	○	
			WA1	○	○	○		●		●	○	
	Ductile	Ceramic	HC2 / HC7	●	●	●	●			●		○
			SP2	○	○	○		●		●		○
	Ductile	CBN	B22	○	○	○		●			○	
			B22	○	○	○		●			○	

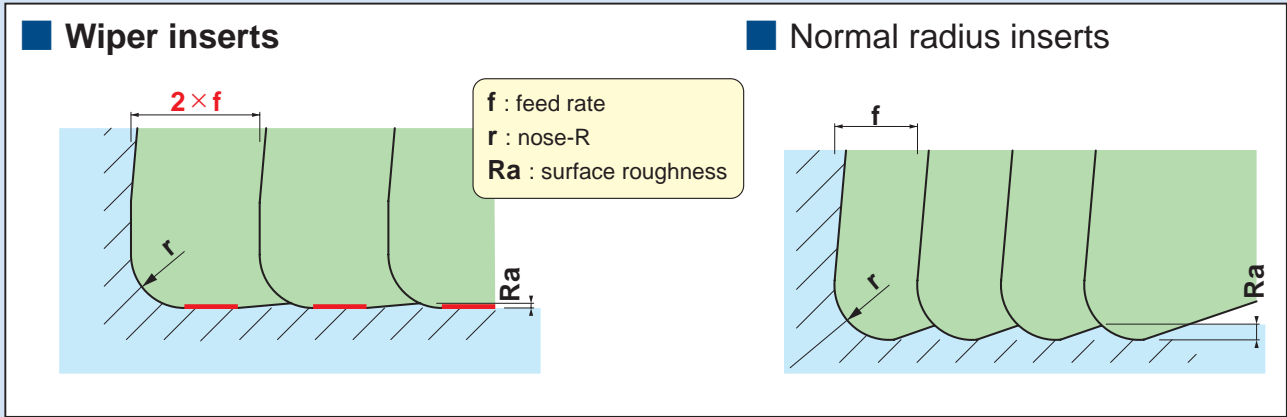


# Wiper Technology Good surface finish and high productivity with high feed rate



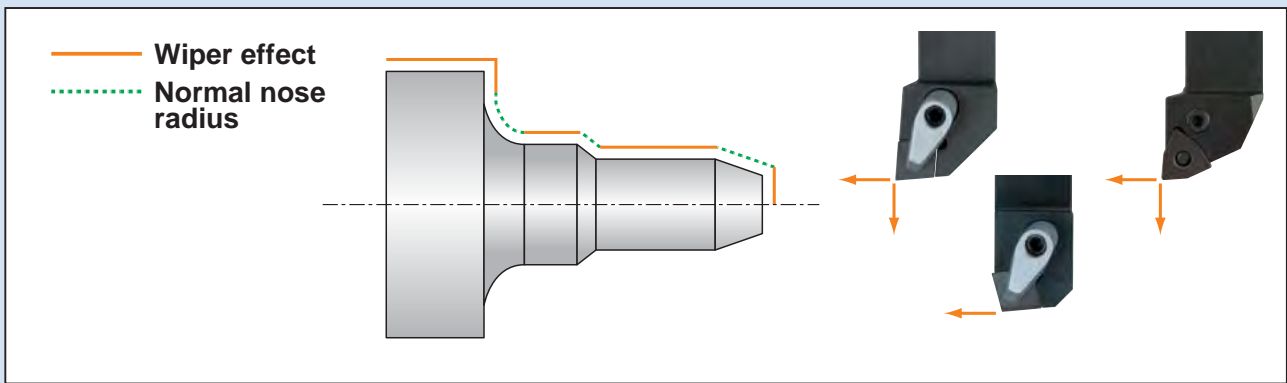
Shape	Item-No. IC, T, R	Wiper (mm)	IC	SX1	ZC7	Holder	
	CNGA	120404 WL	12.7	▲	▲	CCLN <sup>R/L</sup> CCBN <sup>R/L</sup> MCLN <sup>R/L</sup>	
		120408 WL		▲	▲		
		120412 WL		▲	▲		
		120416 WL		▲	▲		
	CNGX	120708 WL TN DP5		▲	—	CDJN <sup>R/L</sup> MDJN <sup>R/L</sup>	
		120712 WL TN DP5		▲	—		
		120716 WL TN DP5		▲	—		
		120720 WL TN DP5		▲	—		
	DNGA	150408 WJ		▲	△	CSHN <sup>R/L</sup>	
		150412 WJ		▲	△		
		150616 WJ		▲	△		
	DNGX	120708 WJ TN DP5		▲	—		
		120712 WJ TN DP5		▲	—		
		120716 WJ TN DP5		▲	—		
		150708 WJ TN DP5		▲	—		
		150712 WJ TN DP5		▲	—		
		150716 WJ TN DP5		▲	—		
	SNGN	120408 WH		▲	▲		
		120412 WH		▲	▲		
		120416 WH		▲	▲		
	SNGX	120708 WH TN DP5	▲	—			
		120712 WH TN DP5	▲	—			
		120716 WH TN DP5	▲	—			
	TNGA	160408 WG	9.525	▲	▲	CTGN <sup>R/L</sup> MTGN <sup>R/L</sup>	
		160412 WG		▲	▲		
		160416 WG		▲	▲		
	TNGN	160408 WG		▲	▲		
		160412 WG		▲	▲		
		160416 WG		▲	▲		
	WNGA	080408 WL		12.7	▲	▲	MWLN <sup>R/L</sup>
		080412 WL			▲	▲	
		080416 WL			▲	▲	
	WNGX	080408 WL TNF DP5			▲	—	MWLN <sup>R/L</sup>
		080412 WL TNF DP5			▲	—	
		080416 WL TNF DP5			▲	—	

# What is Wiper ?

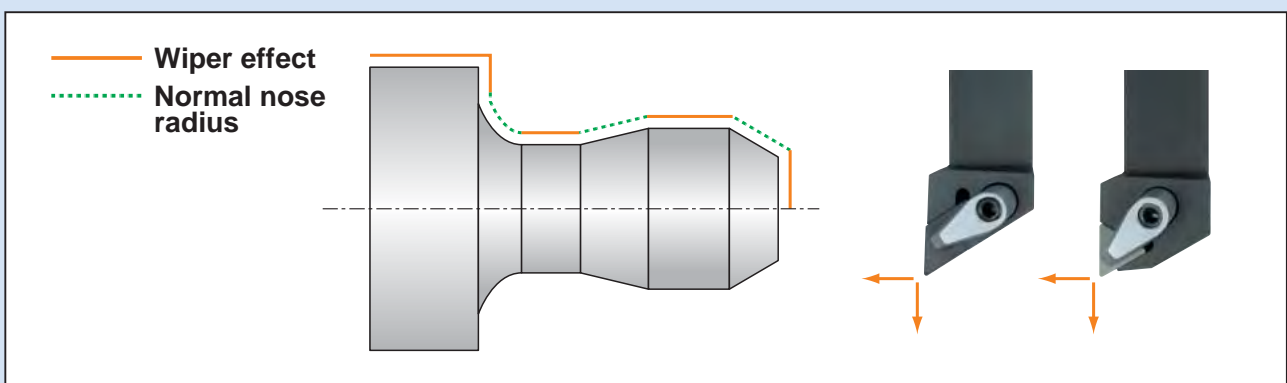


Wiper inserts will bring high quality of surface with high feed rate.

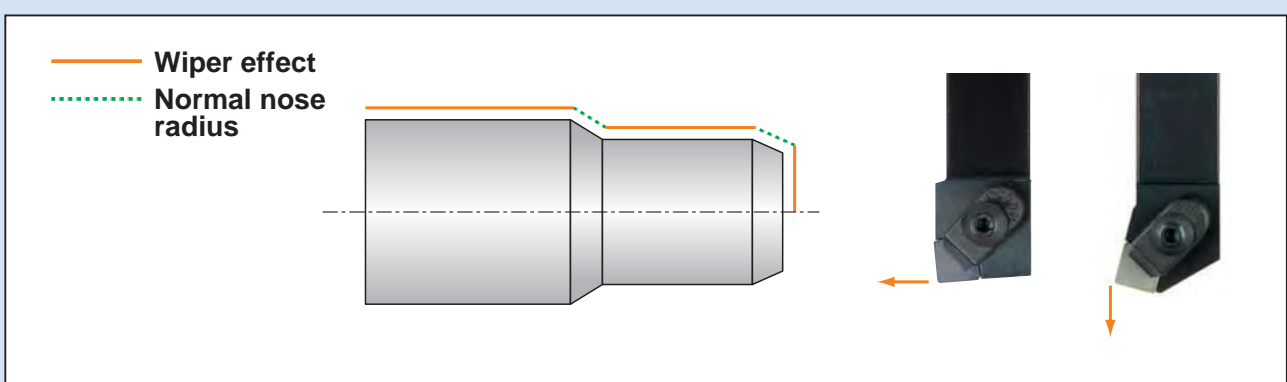
## • CNG / WNG inserts



## • DNG / TNG inserts

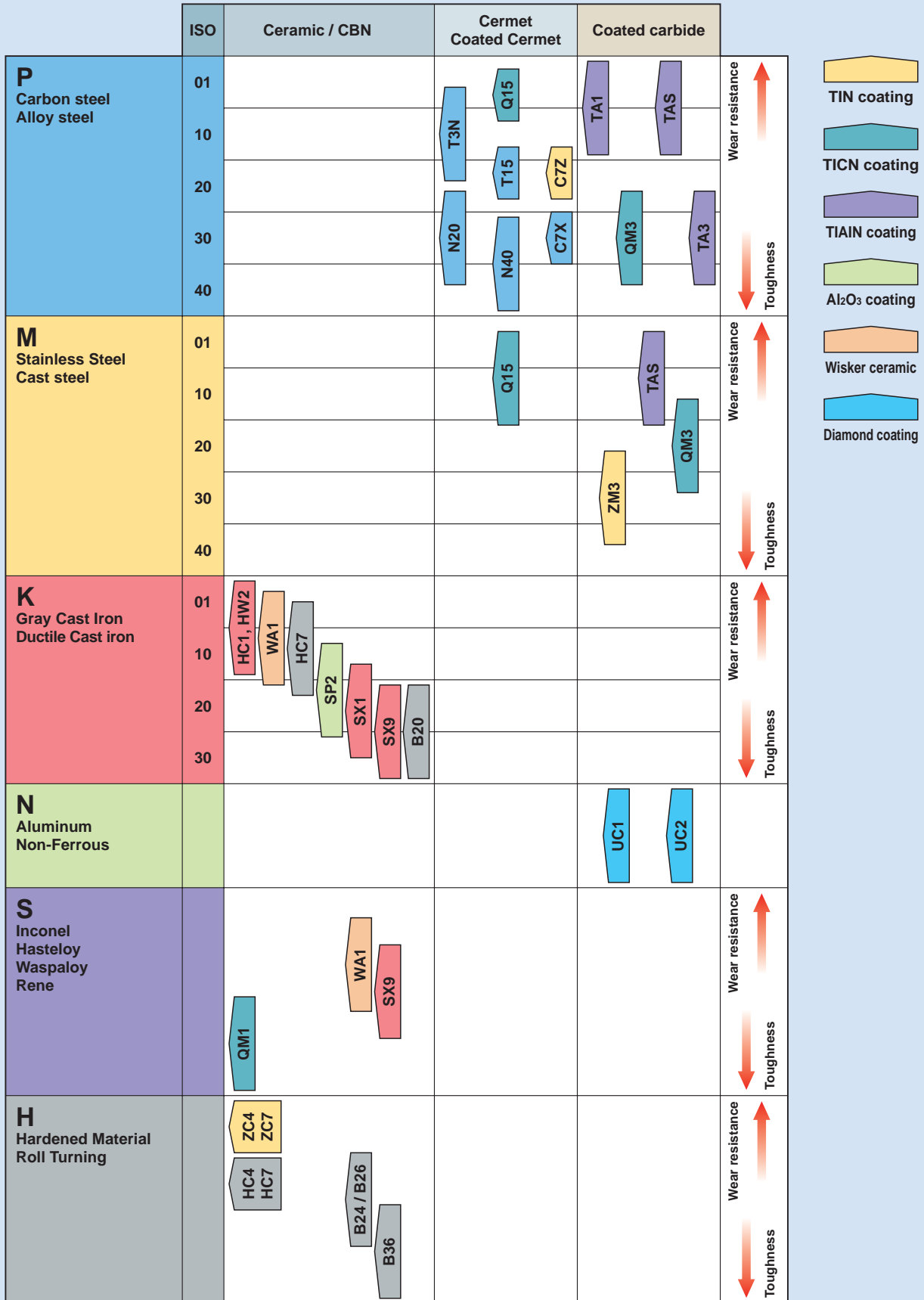


## • SNG inserts



# Turning-Use Insert Grade Selection Guide

## Recommended Types of Grade and Application Areas



## High Speed Cutting for Cast Iron

# SX1

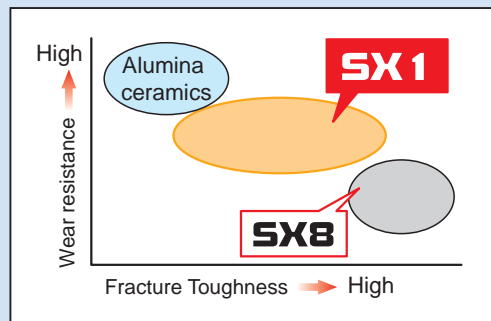
### Feature

- Outstanding wear resistance by reducing binder.
- Improved fracture toughness
- Available high-speed cutting (*up to 1000 m/min*)



### Recommended Cutting Conditions

Material	Work piece	Applications	Cutting speed (m/min)	Feed (mm/rev)	Coolant
<b>SX1</b>	Cast Iron	Turning	~1,000	~0.7	DRY (WET)
		Milling	~800	~0.3	

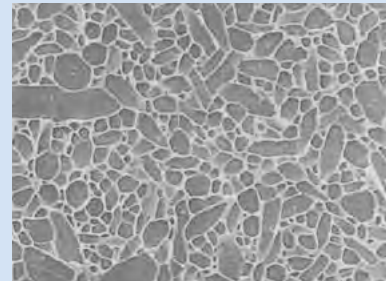


### Data

#### Physical Characteristics

Material	Density (g/m <sup>3</sup> )	Hardness (HRA)	Bending strength (M Pa)	Young's modulus (GPa)	Thermal expansion coefficient (X10 <sup>-6</sup> /K)
<b>SX1</b>	3.2	93.5	1,200	320	3.0
SX8	3.2	93	1,200	320	3.0

Micro structure of **SX1**

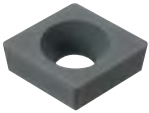
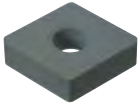
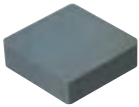
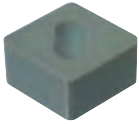
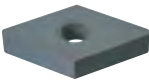
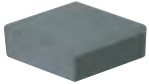
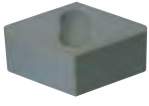

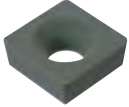


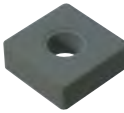
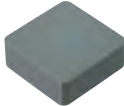
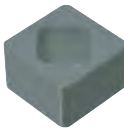
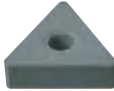
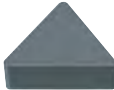
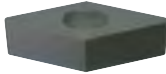
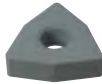
#### Case Study

Disc brake	250 (Gray Cast Iron)
Insert: SNGN 120420 TNF (T02025)	
Cutting speed (m/min)	800
Feed (mm/rev)	0.65
Depth of cut (mm)	2
Coolant	WET
<b>SX1</b>	150 pcs
Competitor's Ceramic	100 pcs

Disc rotor	250 (Gray Cast Iron)
Insert: CNGA 120412 TNF (T02025)	
Cutting speed (m/min)	188~374
Feed (mm/rev)	0.3
Depth of cut (mm)	2.5
Coolant	Dry
<b>SX1</b>	200 pcs
Competitor's CBN	120 pcs

## SX1

Shape	Item-No. IC T R	SX 1
	CCGW 120404 TNCE 120408 TNCE 120412 TNCE 120416 TNCE	● ● ● ●
	CNGA 120408 TNF 120412 TNF 120416 TNF 120716 TN 160608 SNF 160612 TN 160616 TN 190616 TN	● ● ● ● ● ● ● ●
	CNGN 120408 TNF 120412 TNF 120416 TNF 120708 TNF 120712 TNF 120716 TNF	● ● ● ● ● ●
	CNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 160708 TN DP5 160712 TN DP5 160716 TN DP5 160720 TN DP5 160732 TN DP5	● ● ● ● ● ● ● ● ●
	DNGA 150408 TNF 150412 TNF 150416 TNF 150608 SNF 150612 SNF	● ● ● ● ●
	DNGN 150408 TNF 150412 TNF	● ●
	DNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 150708 TN DP5 150712 TN DP5 150716 TN DP5 150720 TN DP5	● ● ● ● ● ● ● ●
	RNGN 120400 TN 120700 TN	● ●
	SCGW 120404 TNCE 120408 TNCE 120412 TNCE 120416 TNCE	● ● ● ●

Shape	Item-No. IC T R	SX 1
	SNGA 120408 TNF 120412 TNF 120416 TNF 120420 TN	● ● ● ●
	SNGN 120408 TNF 120412 TNF 120416 TNF 120420 TNF 120424 TNF 120708 TNF 120712 TNF 120716 TNF 120720 TNF	● ● ● ● ● ● ● ● ●
	SNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 150708 TN DP5 150712 TN DP5 150716 TN DP5 150720 TN DP5	● ● ● ● ● ● ● ●
	TNGA 160408 TNF 160412 TNF 160416 TNF 160420 TNF	● ● ● ●
	TNGN 160408 TNF 160412 TNF 160416 TNF 160420 TNF	● ● ● ●
	VNGX 160704 TN DP5 160708 TN DP5 160712 TN DP5 160716 TN DP5	● ● ● ●
	WNGA 080408 TNF 080412 TNF 080416 TNF	● ● ●

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	06, 07
TNCE	T01020	—
TNF	T02025	—
SNF	S02025	—

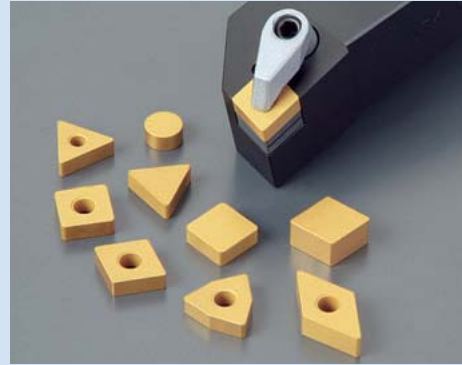


## Improved Flank Wear Resistance

# SP2

### Feature

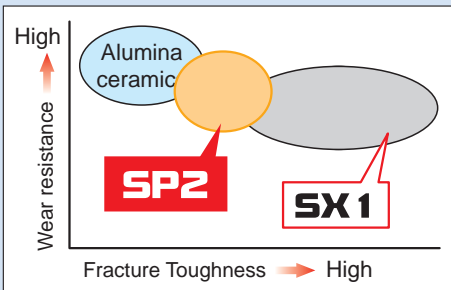
- Greatly improved flank wear resistance
- Excellent heat resistance
- High-speed rough turning of gray cast iron



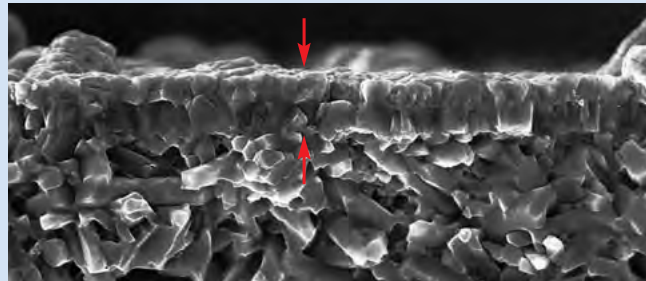
### Recommended Cutting Conditions

Material	Work piece	Applications	Cutting speed (m/min)	Feed (mm/rev)	Coolant
<b>SP2</b>	Gray Cast Iron	Turning	~1000	~0.5	<b>DRY</b> (WET)

### Data



Coating layer of **SP2**



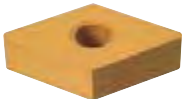








### Case Study

Brake drum		250 (Gray Cast Iron)
Insert: SNGN 120420 TNF (T02025)		
Cutting speed (m/min)	200	
Feed (mm/rev)	0.4	
Depth of cut (mm)	2	
Coolant	WET	
<b>SP2</b>	200 pcs	
Cermet	100 pcs	

Disc brake		250 (Gray Cast Iron)
Insert: SNGN 120412 TNFE (T02020)		
Cutting speed (m/min)	600	
Feed (mm/rev)	0.32	
Depth of cut (mm)	3.0	
Coolant	Dry	
<b>SP2</b>	75 pcs	
Competitor's CBN	30 pcs	

## SP2

Shape	Item-No. IC, T, R	SP2
	CNGA 120408 TNF	●
	120412 TNF	●
	120712 TN	
	120716 TN	●
	CNGN 120408 TNF	
	120412 TNF	
	120416 TNF	●
	120704 TN	●
	120708 TN	●
	120712 TN	●
	160708 TN	●
160712 TN	●	
	DNGA 150608 TN	●
	150612 TN	●
	150416 TNF	
	RNGN 090400 TNF	●
	120400 TN	●
	120400 TNF	●
	250700 PN	●

Shape	Item-No. IC, T, R	SP2
	SNGA 120412 TNF	●
	120412 TNFE	●
	SNGN 120412 TNF	●
	120416 TNF	●
	120708 TN	●
	120712 TN	●
	120716 TN	●
150716 TN	●	
	TNGA 160404 TN	●
	160404 TNF	
	160408 TNF	●
160412 TNF	●	
	TNGN 160408 TNF	●
	160412 TNF	
	160416 TNF	●
	WNGA 080408 TNF	●
	080412 TNF	●

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	06, 07
TNCE	T01020	—
TNF	T02025	—
TNFE	T02020	—
PN	Double T-land with R-horn	—

## Specialist for Milling and Interrupted Cutting of Cast Iron

# SX8

### Feature




- Good performance in rough milling with coolant
- Good heat-resistance in interrupted cutting with coolant



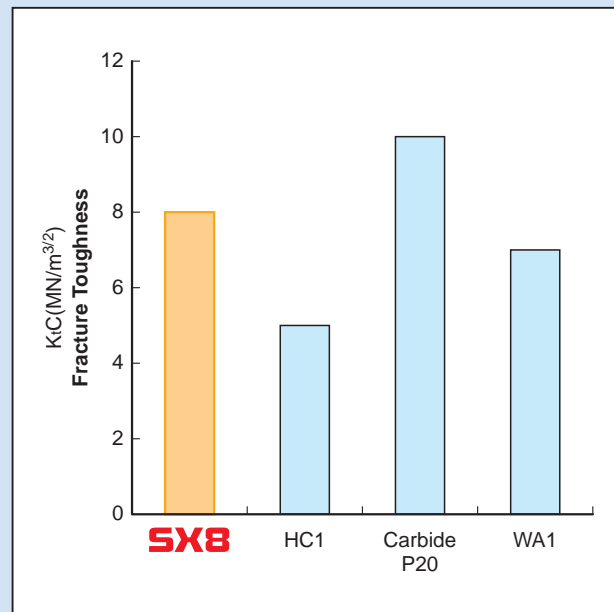
### Recommended Cutting Conditions

Material	Work	Machining method	Cutting speed (m/min)	Feed (mm/rev)
<b>SX8</b>	Cast Iron	Milling and Interrupted cutting	~600	~0.5

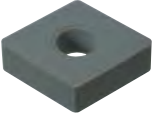
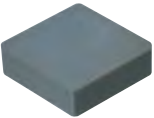
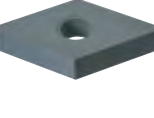
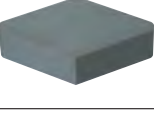
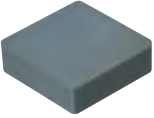
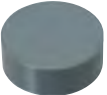
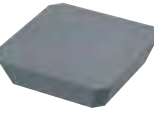

### • Case Study

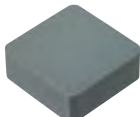
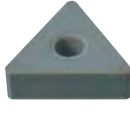

<b>Cylinder block</b>	250 (Gray Cast Iron)
Insert: SPGN 120432 TN (T01025)	
	
Cutting speed (m/min)	150
Feed (mm/rev)	0.15
Depth of cut (mm)	5.0
Coolant	Wet
<b>SX8</b>	 630 pcs
Cermet	 180 pcs

### Fracture Toughness



## SX8

Shape	Item-No. IC T R	SX8
	CNGA 120404 TN	●
	120408 TN	●
	120408 TNF	●
	120412 TN	●
	120412 TNF	●
	120416 TN	●
	120708 TN	●
	120712 TN	●
	120716 TN	●
	CNGN 120408 TN	●
	120408 TNF	●
	120412 TN	●
	120412 TNF	●
	120416 TN	●
	120708 TN	●
	120712 TN	●
	120716 TN	●
	160612 TN	●
160616 TN	●	
	DNGA 150412 TN	●
	150608 TN	●
	150612 TN	●
	150708 TN	●
	150716 TN	●
	DNGN 150612 TN	●
	150708 TN	●
	150712 TN	●
	150716 TN	●
	ENGN 130408 TN	●
	130412 TN	●
	130708 TN	●
	130712 TN	●
	130716 TN	●
	130720 TN	●
	130724 TN	●
	RNGN 120400 TN	●
	120400 TNF	●
	120700 TN	●
	SCGN 1204ZZ FNX08	
	120412 TNFE	
	120416 TNFE	
	SDCA 1204 AETN	●
	120408 TN	●
SECN 1203 AFTN	●	
	SNGA 120408 TNF	●
	120412 TN	●
	120416 TN	●

Shape	Item-No. IC T R	SX8
	SNGN 120408 TN	●
	120412 TN	●
	120412 TNF	●
	120416 TNF	●
	120420 TN	●
	120424 TN	●
	120432 TN	●
	120708 TN	●
	120712 TN	●
	120716 TN	●
	120720 TN	●
		SPCN 1203 EDTR
1204 EDTR		●
1504 EDTR		●
SPGN 120308 TN		●
120312 TN		●
120408 TN		●
	120412 TNCE	●
	TNGA 160408 TN	●
	160412 TN	●
	160416 TN	●
	160420 TN	●
	160708 TN	●
	160712 TN	●
	160716 TN	●
	160720 TN	●
	190712 TN	●
	TPGN 110302 TN	●
	110304 TN	●
	160308 TN	●
	220412 TN	●
	220416 TN	●

## Edge-Preparation

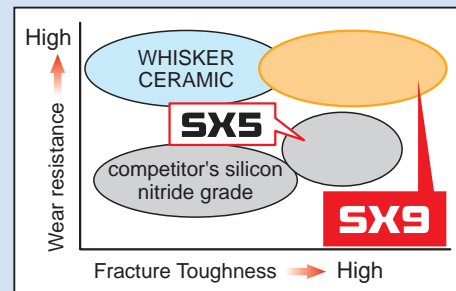
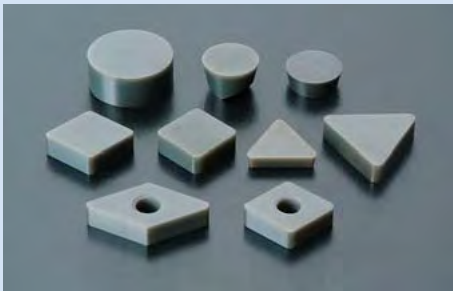
Description	ISO	T
TN	T01025	04
	T02025	06. 07
TNCE	T01020	—
TNF	T02025	—
TNFE	T02020	—
TR	T01025	—
FNX08	Without E.P	—

## For Machining Nickel Based Alloys

# SX9

### Feature

- Our special manufacturing process dramatically increases heat resistance and fracture toughness
- Excellent wear resistance is achieved by optimizing binding compound
- Designed for high speed machining of Inconel, Waspaloy, Hasteloy and Stellite
- Drastic cost reduction compared to whisker reinforced ceramics



### Recommended Cutting Conditions

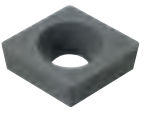
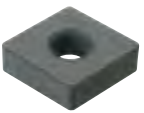
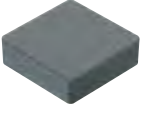
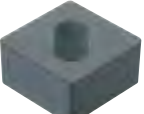
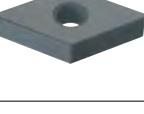

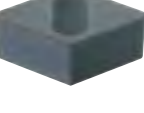


Material	Work piece	Applications	Cutting speed (m/min)	Feed (mm/rev)
<b>SX9</b>	Nickel Based Alloys (Inconel, etc.)	Turning	Continuous	~300
			Scale Cut (roughing)	~230
	Cobalt Based Alloys (Stellite, etc.)	Milling	Lightly Interrupted	~200
				~1000

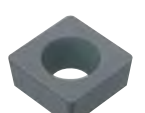
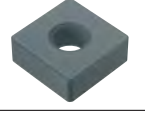
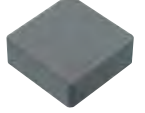
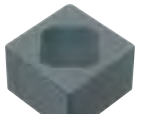
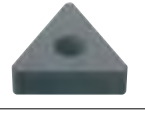

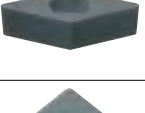

### Case Study

Aircraft part	Inconel 718	
Insert: RNGN 120700 TNB (T00525)		
Cutting speed (m/min)	180	
Feed (mm/rev)	0.2	
Depth of cut (mm)	0.6	
Coolant	WET	
<b>SX9</b>	2 pcs	
Whisker ceramics	1 pc	
		Competitor's tool chipped frequently due to notch wear SX9 excelled in notch wear resistance and obtained double tool life

Aircraft part	Inconel 600	
Insert: RNGN 120700 TNB (T00525)		
Cutting speed (m/min)	250	
Feed (mm/rev)	0.2	
Depth of cut (mm)	2.0	
Coolant	WET	
<b>SX9</b>	2 pass	
Competitor's ceramics	2 pass	
		Competitor's ceramic tool showed inconsistent tool life SX9 showed better wear resistance compared to the competition

## SX9

Shape	Item-No. IC T R	SX9
	CCGW 120404 TNCE 120408 TNCE 120412 TNCE 120416 TNCE	● ● ● ●
	CNGA 120408 TNF 120412 TNF 120416 TNF 120716 TN 160608 SNF 160612 TN 160616 TN 190616 TN	● ● ● ● ● ● ● ●
	CNGN 120408 TNF 120412 TNF 120416 TNF 120708 TNF 120712 TNF 120716 TNF 160712 TN 160716 TN	● ● ● ● ● ● ● ●
	CNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 160708 TN DP5 160712 TN DP5 160716 TN DP5 160720 TN DP5 160732 TN DP5	● ● ● ● ● ● ● ● ●
	DNGA 150408 TNF 150412 TNF 150416 TNF 150608 SNF 150612 TNFE	● ● ● ● ●
	DNGN 150408 TNF 150412 TNF 150408 TN 150412 TN 150416 TN	● ● ● ● ●
	DNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 150708 TN DP5 150712 TN DP5 150716 TN DP5 150720 TN DP5	● ● ● ● ● ● ● ●
	RCGX 0908 TNB 1208 TNB	● ●
	RNGN 120400 TN 120700 TNB 120700 TN 190700 TNB	● ● ● ●

Shape	Item-No. IC T R	SX9
	SCGW 09T308 TNCE 120404 TNCE 120408 TNCE 120412 TNCE 120416 TNCE	● ● ● ● ●
	SNGA 120408 TNF 120412 TNF 120416 TNF 120420 TN	● ● ● ●
	SNGN 120408 TNF 120412 TNF 120416 TNF 120420 TNF 120424 TNF 120708 TNF 120712 TNF 120716 TNF 120720 TNF 150712 TN 150716 TN	● ● ● ● ● ● ● ● ● ● ●
	SNGX 120708 TN DP5 120712 TN DP5 120716 TN DP5 120720 TN DP5 150708 TN DP5 150712 TN DP5 150716 TN DP5 150720 TN DP5	● ● ● ● ● ● ● ●
	TNGA 160408 TNF 160412 TNF 160416 TNF	● ● ●
	TNGN 160408 TNF 160412 TNF 160416 TNF 160420 TNF	● ● ● ●
	VNGX 160704 TN DP5 160708 TN DP5 160712 TN DP5 160716 TN DP5	● ● ● ●
	WNGA 080408 TNF 080412 TNF 080416 TNF	● ● ●

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	06, 07
TNB	T00525	—
TNCE	T01020	—
TNF	T02025	—
TNFE	T02020	—
SNF	S02025	—

## Cast Iron for High-Speed Finishing

# HC1, HW2

### Feature

Alumina/zirconia-based ceramic material

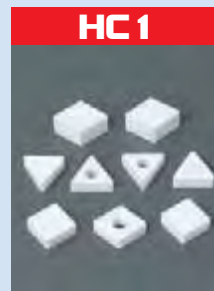
This new type of Alumina ceramics improves the reliability of the cutting edge.

- Outstanding fracture toughness
- Excellent wear resistance
- Stable machining performance at high-speed machining ranges



### Recommended Cutting Conditions

Material	Work material	Purpose	Cutting speed (m/min)	Feed (mm/rev)
<b>HC1 HW2</b>	Cast Iron	Finish turning	~1,000	~0.4





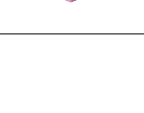



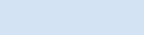







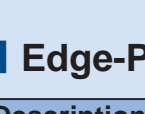
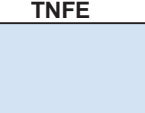
### • Case Study

Disc brake	250 (Gray Cast Iron)
Insert: TNGN 160412 TNF (T02025)	
Cutting speed (m/min)	360
Feed (mm/rev)	0.3
Depth of cut (mm)	0.5
Coolant	DRY
<b>HW2</b>	130 pcs
Ceramic	65 pcs

Cylinder liner	250 (Gray Cast Iron)
Insert: SNGN 120716 SNC (S01025)	
Cutting speed (m/min)	260 - 600
Feed (mm/rev)	0.32
Depth of cut (mm)	2
Coolant	DRY
<b>HW2</b>	70 pcs
Ceramic	30 pcs

## Standard insert

Shape	Item-No. IC T R	HC1	HW2
	CNGA 120404 TN		●
	120408 TN	●	●
	120412 TN		
	120416 TN	●	●
	CNGN 120404 TN	●	●
	120408 TN	●	●
	120412 TN		
	120416 TN	●	●
	120704 TN		●
	120708 TN		●
	120712 TN	●	●
	CNGX 120708 TN DP5		●
	120712 TN DP5		●
	120716 TN DP5		●
	120720 TN DP5		●
	120724 TN DP5		●
	CNMX 120708 TN DP5		●
	DNGA 150404 TN	●	●
	150408 TN	●	●
	150412 TN	●	●
	150416 TN	●	●
	DNGN 150708 TNFE		●
	150712 TNFE		●
	150716 TN	●	●
	150716 TNFE		●
	DNGX 120704 TNB DP5		●
	120708 TN DP5		
	120712 TN DP5		
	120716 TN DP5		
	120720 TN DP5		
	150704 TN DP5		●
	150708 TN DP5		
	150712 TN DP5		
	150716 TN DP5		
	150720 TN DP5		
	DNMX 120708 TN DP5		●
120712 TN DP5		●	
	RNGN 120400 TN	●	●
	120700 TN	●	●
	190700 TN		
	SNGA 120404 TN		●
	120408 TN	●	●
	120412 TN		●
	120416 TN	●	●

Shape	Item-No. IC T R	HC1	HW2
	SNGN 120404 TN		●
	120408 TN	●	●
	120412 TN	●	●
	120416 TN	●	●
	120704 TN	●	●
	120708 TN	●	●
	120712 TN	●	●
	120716 TN	●	●
	120730 TN	●	●
	150716 TN	●	●
	SNGX 120704 TN DP5		
	120708 TN DP5		●
	120712 TN DP5		●
	120716 TN DP5		●
	120720 TN DP5		●
	120724 TN DP5		●
	SNMX 120712 TN DP5		●
120716 TN DP5		●	
	TNGA 160404 TN		●
	160408 TN	●	●
	160412 TN		●
	160416 TN		●
	TNGN 160408 TN	●	
	160412 TN	●	
	160416 TN		
	160708 TN	●	●
	160712 TNFE		●
160716 TNFE		●	
	VNGA 160404 TN	●	●
	160408 TN		●
	WNGA 080404 TN		●
	080408 TN		●
	080412 TN		●

※Pictures are HW2

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	07
TNB	T00525	—
TNFE	T02020	—



## For Heat Resistant Aerospace Alloys

# WA1

### Feature

- Excellent wear resistance with high toughness  
Excellent crack resistance
- Whisker-reinforcing technology for  
Heat-resistant alloys  
High-hardened mill rolls

WA1 is a whisker-reinforced composite ceramic material with silicon-carbide whisker added to alumina, the main component.



### Recommended Cutting Conditions

Cutting	Work material	Heat resistant alloys
Cutting speed V	(m / min)	200~500
Feed f	(mm / rev)	0.1~0.3
Depth of cut d	(mm)	~3.0
Coolant		WET



### • Characteristics of WA1

	WA1	Al <sub>2</sub> O <sub>3</sub> -based
Density (g/cm <sup>3</sup> )	3.7	4.0
Hardness (HRA)	94.5	94.0
Fracture toughness (MPa · m <sup>1/2</sup> )	7.0	4.0

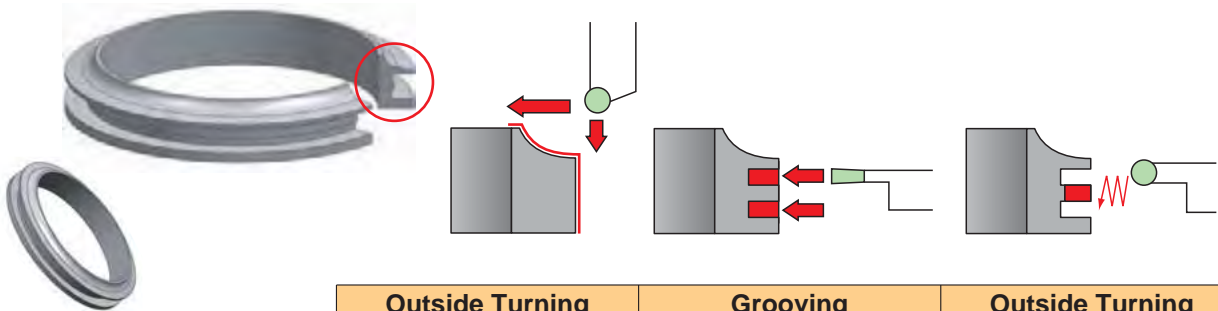
### • Structure



### • Case Study

#### Ring for bearing housing


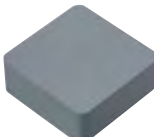
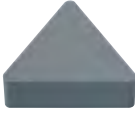
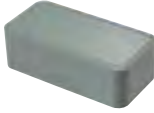
Inconel 718 (Aircraft parts)



	Outside Turning	Grooving	Outside Turning
Insert	RNGN 120700 TNB (T00525)	VGW-375-2ENA (R-horn)	RPGX 0908 TNB (T00525)
Cutting speed (m/min)	300	300	300
Feed (mm/rev)	0.15	0.1	0.06
Depth of cut (mm)	3 - 4	-	2 - 3
Coolant	WET	WET	WET

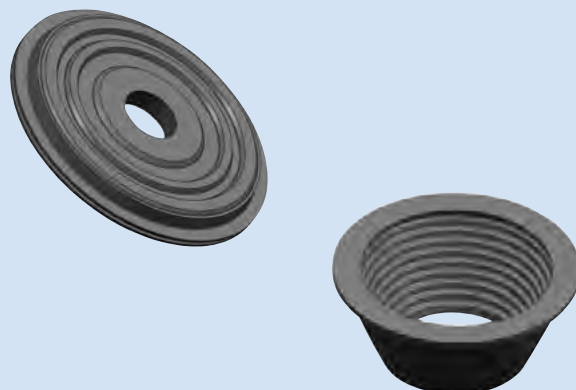
## WA1

Shape	Item-No.	WA 1
	CNGN 120404 TN	
	120408 TN	●
	120408 TNB	●
	120412 TN	●
	120412 TNB	●
	120416 TNB	●
	120708 TNB	●
	120712 TNB	●
	160712 TNB	●
	160716 TNB	●
	DNGN 150412 TNB	●
	150708 TN	●
	150708 TNB	
	150712 TN	●
	150712 TNB	●
	150716 PN9	●
	190612 TNB	●
	RBGX 16S SN2	
	26S SN3	
	RCGX 0608 TNB	●
	0908 TNB	●
	0908 PN	●
	1208 TNB	●
	1510 PN	
	1910 PN	●
	RCGY 090603 TNB	
	120603 TNB	
	RNGN 090300 TNB	
	120400 TN	●
	120400 TNB	●
	120700 PN9	●
	120700 TN	●
	120700 TNB	●
	150700 TN	
	190700 TN	

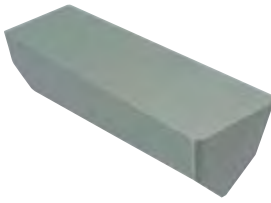
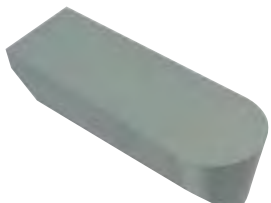
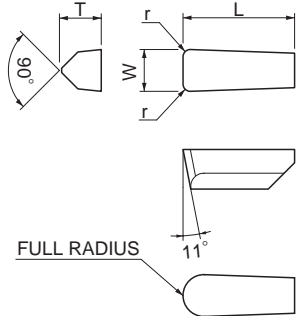
Shape	Item-No.	WA 1
	RPGX 0604 TNB	
	0908 TNB	●
	1208 TNB	●
	SNGN 120408 TNB	
	120412 TNB	●
	120416 TNB	●
	120708 TNB	●
	120712 TNB	●
	120716 TNB	●
	150712 TN	●
	150716 TN	●
	190712 TN	●
	190716 TN	
	TNGN 160404 TN	●
	160408 TN	
	160412 TN	
	LNMN 6688 PN	

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	07
TNB	T00525	—
PN	Double T-land with R-horn	—
PN9	Double T-land with R-horn	—



## WA1

Shape	Item-No.	Dimensions (mm)				WA1
		W	r	L	T	
	VGW4-1 25-R ENA	3.175	FULL-R	12.7	4.75	▲
	125-1 TNCE		0.4			▲
	125-2 T014		0.8			▲
	156-R ENA	3.962	FULL-R			▲
	156-1 ENA		0.4			○
	156-2 ENA		0.8			○
	187-R ENA	4.75	FULL-R			▲
	187-1 ENA		0.4			▲
	187-2 TNCE		0.8			●
	VGW6- 250-R ENA	6.35	FULL-R	19.05	6.35	●
	250-1 ENA		0.4			▲
	250-2 ENA		0.8			●
	250-3 ENA	1	▲			
	281-R ENA	7.14	1.2			●
	281-1 ENA		0.4			○
	281-2 ENA		0.8			○
	281-3 ENA		1.2			○
		VGW8- 312-R ENA	7.93			FULL-R
312-1 ENA		0.4		○		
312-2 ENA		0.8		○		
312-3 ENA		1.2		○		
312-4 ENA		1.6	○			
344-R ENA		8.74	FULL-R	●		
344-1 ENA			0.4	○		
344-2 ENA			0.8	○		
344-3 ENA			1.2	○		
344-4 ENA		1.6	○			
375-R ENA		9.53	FULL-R	●		
375-1 ENA			0.4	○		
375-2 ENA			0.8	○		
375-3 ENA			1.2	○		
375-4 ENA			1.6	○		

## Edge-Preparation

Description	ISO
ENA	R-horn
TNCE	T01020
T014	T02220

## Continuous Cutting for High-Hardness Materials **HC7, ZC7**

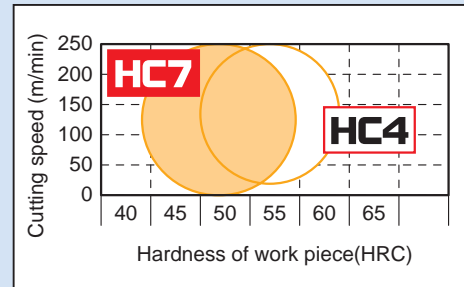
### Feature

- Excellent wear resistance in wide hardness range of operations such as removing carburized layer.
- High quality surface with wiper facet inserts.
- Excellent chip control with AG chip form.



### Recommended Cutting Conditions

Material	Work material	Purpose	Cutting speed (m/min)	Feed (mm/rev)
<b>HC7</b> <b>HC4</b>	Carburized steel Hardened steel Die steel	Turning (Continuous)	~150	0.2

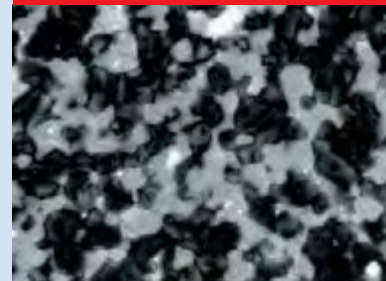


### Data

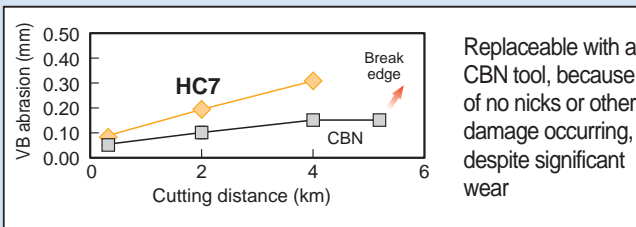
#### Physical Characteristics

Material	Density (g/m <sup>3</sup> )	Hardness (HRA)	Bending strength (M Pa)	Thermal expansion coefficient
<b>HC7</b>	4.6	95.0	1,100	7.9
<b>HC4</b>	4.6	95.5	1,000	7.8

#### Structure of HC7



#### Cutting Performance



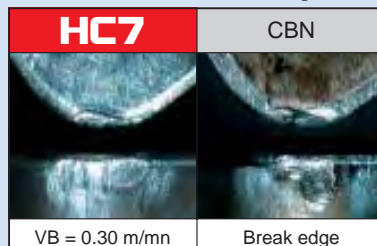
#### Cutting Conditions

(18CrMo4, HRC60-50)

- V = 100 m/min
- f = 0.1 mm/rev
- d = 0.2 mm
- Coolant: Not used
- Cutting insert

SNGN 120408

#### Photos of tool damage



#### Case Study

#### Gear

- Work material: Carburized and hardened steel
- Insert: TNGN 160412
- V=100m/min
- f=0.12mm/rev
- d=0.15mm (max.)
- Coolant: Used

**HC7**

80 pcs

**CBN**

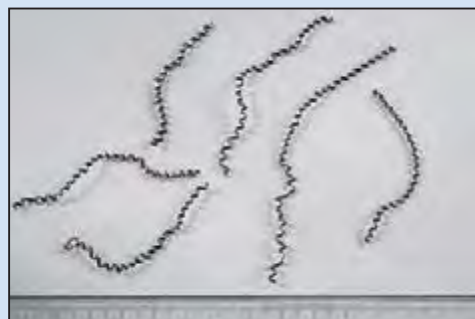
80 pcs

Highly cost-effective because of tool life equivalent to CBN's

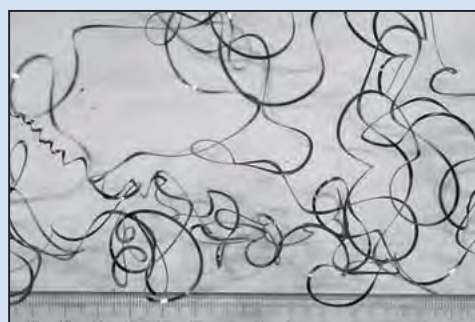
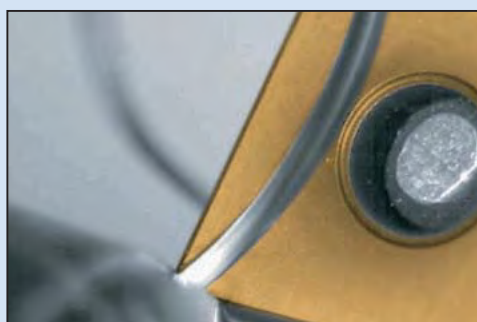
## Hardened-Steel Chip Control

### Ceramic "ZC7" AG Chipbreaker

With AG  
chipbreaker



Without AG  
chipbreaker







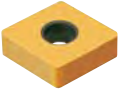
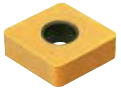
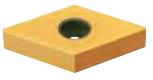
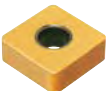



"AG chipbreaker", when added to any "ZC7" ceramic tool develops excellent wear resistance in a wide hardness range, during machining operations such as carburized-layer removal, improves surface-machining defects and machine stoppage due to poor formation of chips, thus allowing extended operation.

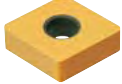
### Recommended Cutting Conditions

Work material	Hardness	Cutting speed (m/min)	Feed (mm/rev)	Cutting depth (mm)
Carburized hardened steel Induction hardened steel	30~62	~150	0.1~0.2	0.25~0.6

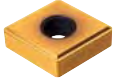
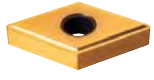

## Standard Insert

Shape	Item-No. IC, T, R	ZC7
	CNGN 120408 SNF 120412 SNF	●
	DNGN 150408 SNF	●
	RNGN 120400 SNF 120700 SNF	●
	SNGN 120408 SNF 120412 SNF 120416 SNF	
	TNGN 160408 SNF 160412 SNF	
	TPGN 110304 TNC 110304 TNC 160304 TN 160308 TN	●  ● ●
	CNGA 120404 TN 120404 SNF 120408 TN 120408 SNF 120412 SNF	● ● ● ● ●
	DNGA 150404 TN 150404 SNF 150408 TN 150408 SNF 150412 SNF	●  ●
	SNGA 120408 SNF 120412 SNF	
	TNGA 160404 TN 160404 SNF 160408 SNF 160412 SNF	● ● ● ●
	VNGA 160404 TN 160404 SNF 160408 SNF 160412 SNF	● ● ● ●

## Wiper Insert

Shape	Item-No. IC, T, R	ZC7
	CNGA 120408 WL TN 120412 WL TN	●

## Chipbreaker

Shape	Item-No. IC, T, R	ZC7
	CNGG 120408 ZNC GAG 120412 ZNC GAG	● ●
	DNNG 150408 ZNC GAG 150412 ZNC GAG	● ●
	TNGG 160408 ZNC GAG 160412 ZNC GAG	● ●

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	07
TNC	T01025	—
SNF	S02025	—
ZNC	S01025	—

## Continuous Cutting for High-Hardness Materials

# HC2, HC4, ZC4

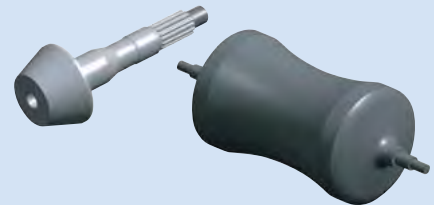
### HC2

This grade is used for finishing operations of cast iron and hardened steel.

Excellent wear resistance in a wide hardness range  
This grade is our general black ceramic.

### HC4 and ZC4




The finest grain size particle, with high melting point, is composited HC4 improves in both hardness and strength, and it shows superior performance as a special material for machining high-hardness materials. ZC4 coated with TiN to further improve wear resistance is also included in the NTK ceramic product line up.



## Recommended Cutting Conditions (For turning)

Work material	Status and others	Machining processes	Cutting speed (m/min)	Recommendation
Gray cast iron	After cast-metal	High-speed semi-finishing and finishing	100~500	<b>HC2 / HC7</b>
	Surface removal			
High-hardened materials	Less than HRC60	Finishing	~150	<b>HC7</b>
	HRC65 or less			<b>HC4</b>
Mill Rolls	HS85 or less	Semi-finishing and finishing	~100	<b>HC2 / HC7</b>

### Case Study

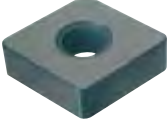
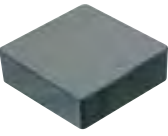
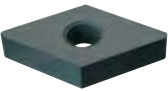
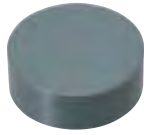
<b>Roll</b>	210Cr12 (Alloy Steel)
Insert: RCGX 1208 PN HC2 (Double T with R)	
 	
Cutting speed (m/min)	80
Feed (mm/rev)	0.2
Depth of cut (mm)	0.5~3.0
Coolant	WET
<b>HC2</b>	 <b>20 pcs</b>
Competitor's Ceramic	 <b>10 pcs</b>

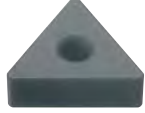
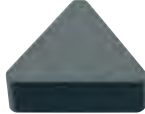
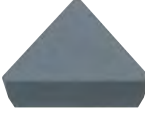
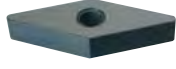
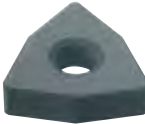
<b>Differential drive</b>	C45 (Carbon Steel)
Insert: TNGA 160412 ZNF HC4 (S02025)	
	
<b>HRC 50-55</b>	
Cutting speed (m/min)	100
Feed (mm/rev)	0.06
Depth of cut (mm)	0.2
Coolant	WET
<b>HC4</b>	 <b>150 pcs</b>
Competitor's CBN	 <b>150 pcs</b>





## HC4, ZC4

Shape	Item-No. IC T R	HC4	ZC4
	CNGA 120404 ZNF	●	●
	120408 ZNF	●	●
	120412 ZNF	●	●
	120416 ZNF	●	
	CNGN 120408 ZNF	●	●
	120412 ZNF	●	●
	120708 ZNF	●	●
	120712 ZNF	●	
	DNGA 150404 ZNF	●	
	150408 ZNF	●	
	150604 ZNF	●	●
	150608 ZNF	●	●
	150612 ZNF	●	
	RNGN 120400 ZNF	●	
	120700 ZNF	●	●

Shape	Item-No. IC T R	HC4	ZC4
	TNGA 160404 ZNF	●	
	160408 ZNF	●	
	160412 ZNF	●	●
	TNGN 160404 ZNF		
	160408 ZNF	●	●
	160412 ZNF	●	
	TPGN 090204 ZNC	●	
	110304 ZNC	●	●
	110308 ZNC	●	●
	160304 ZNC	●	
	160308 ZNC	●	
	VNGA 160404 ZNF	●	
	160408 ZNF	●	
	160412 ZNF		
	WNGA 080408 ZNF	●	

※ Pictures are **HC4**

## Edge-Preparation

Description	ISO	T
ZNC	S01025	—
ZNF	S02025	—

# Continuous Cutting for Ductile Cast Iron

# HC6

## Feature

- Excellent wear-resistance for Ductile cast iron
- TiC-based ceramic



## Recommended Cutting Conditions

Work material	Purpose	Cutting speed (m/min)	Feed (mm/rev)
Ductile cast iron	Finishing	100~500	~0.4

## Case Study

Case	Ductile cast iron
Insert: DNGN 120412 TN (T01025)	
Cutting speed (m/min)	300
Feed (mm/rev)	0.2
Depth of cut (mm)	0.5
Coolant	WET
<b>HC6</b>	300 pcs
Coated carbide	150 pcs

## HC6

Shape	Item-No. IC, T, R	HC6
	CNGN 120404 TN 120408 TN	●
	DNGN 120412 TN 120416 TN 120704 TN 120708 TN 120712 TN 120716 TN 120708 TN 120712 TN 150704 TN 150708 TN 150712 TN	● ● ● ● ● ● ● ● ● ● ●
	RNGN 120400 TN 120700 TN	● ●

Shape	Item-No. IC, T, R	HC6
	SNGN 120408 TN 120412 TN 120416 TN 120420 TN 120712 TN 120716 TN	● ● ● ● ● ●
	TNGN 160408 TN 160412 TN 160416 TN	● ● ●
	TPGN 110308 TN 110312 TN 160308 TN 160312 TN 220404 TN 220408 TN 220412 TN	● ● ● ● ● ● ●

## Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	07