2007-2008

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2007
2008

NTK CUTTING TOOLS

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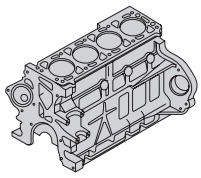
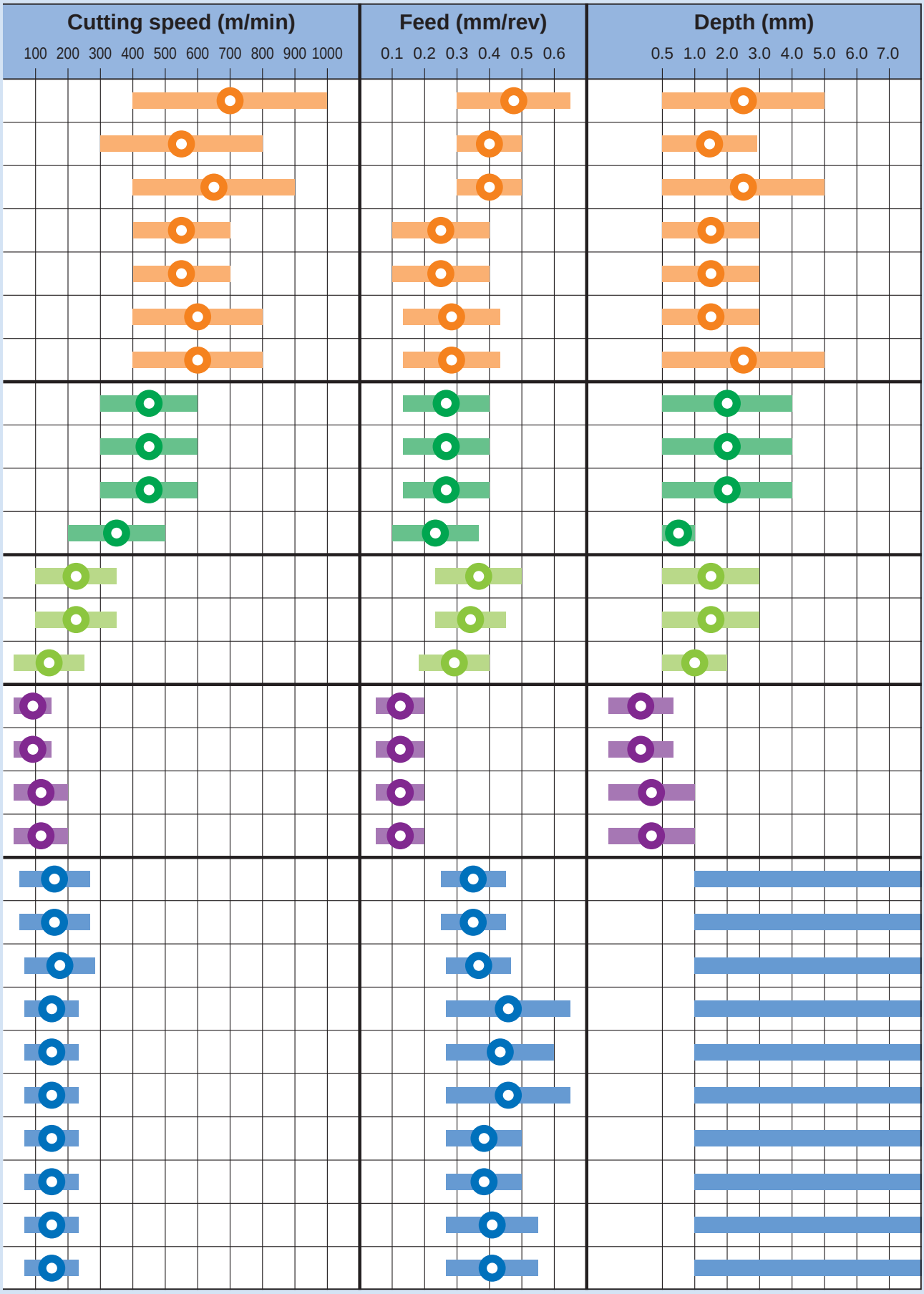
NGK SPARK PLUGS | NTK TECHNICAL CERAMICS

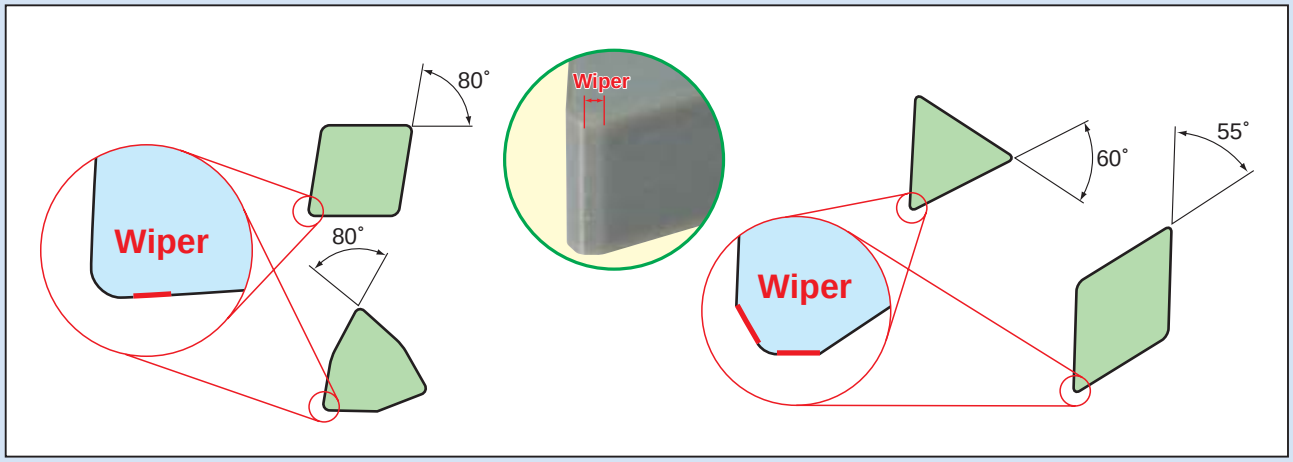
NGK SPARK PLUG EUROPE GMBH
NGK SPARK PLUGS(U.K.), LTD

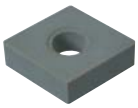
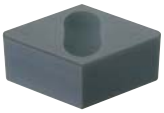
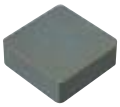
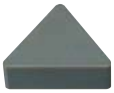
How to select Ceramic and CBN Recommended cutting condition

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


Cutting speed (m/min)
100 200 300 400 500 600 700 800 900 1000
Feed (mm/rev)
0.1 0.2 0.3 0.4 0.5 0.6
Depth (mm)
0.5 1.0 2.0 3.0 4.0 5.0 6.0 7.0

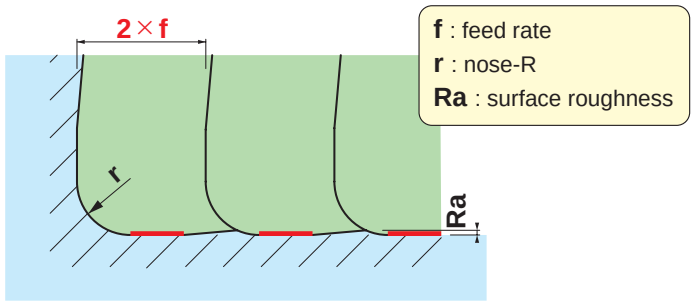
Wiper Technology Good surface finish and high productivity with high feed rate



Shape	Item-No. IC T R		Wiper (mm)	IC	SX1	ZC7	Holder
	CNGA	120404 WL	0.35		▲	▲	CCLN R/L CCBN R/L MCLN R/L
		120408 WL	0.65		▲	▲	
		120412 WL	0.85		▲	▲	
		120416 WL	1.05		▲	▲	
	CNGX	120708 WL TN DP5	0.35		▲	–	
		120712 WL TN DP5	0.65		▲	–	
		120716 WL TN DP5	0.85		▲	–	
		120720 WL TN DP5	1.05		▲	–	
	DNGA	150408 WJ	0.4		▲	△	CDJN R/L MDJN R/L
		150412 WJ	0.55		▲	△	
		150616 WJ	0.75		▲	△	
	DNGX	120708 WJ TN DP5	0.4	12.7	▲	–	
		120712 WJ TN DP5	0.55		▲	–	
		120716 WJ TN DP5	0.75		▲	–	
		150708 WJ TN DP5	0.4		▲	–	
		150712 WJ TN DP5	0.55		▲	–	
		150716 WJ TN DP5	0.75		▲	–	
	SNGN	120408 WH	0.65		▲	▲	CSHN R/L
		120412 WH	0.85		▲	▲	
		120416 WH	1.05		▲	▲	
	SNGX	120708 WH TN DP5	0.65		▲	–	
		120712 WH TN DP5	0.85		▲	–	
		120716 WH TN DP5	1.05		▲	–	
	TNGA	160408 WG	0.4		▲	▲	CTGN R/L MTGN R/L
		160412 WG	0.55		▲	▲	
		160416 WG	0.75	9.525	▲	▲	
	TNGN	160408 WG	0.4		▲	▲	
		160412 WG	0.55		▲	▲	
		160416 WG	0.75		▲	▲	
	WNGA	080408 WL	0.65		▲	▲	MWLN R/L
		080412 WL	0.85		▲	▲	
		080416 WL	1.05	12.7	▲	▲	
	WNGX	080408 WL TNF DP5	0.65		▲	–	MWLN R/L
		080412 WL TNF DP5	0.85		▲	–	
		080416 WL TNF DP5	1.05		▲	–	

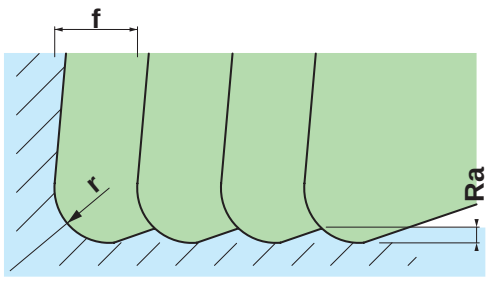
What is Wiper ?

Wiper inserts



f : feed rate
r : nose-R
Ra : surface roughness

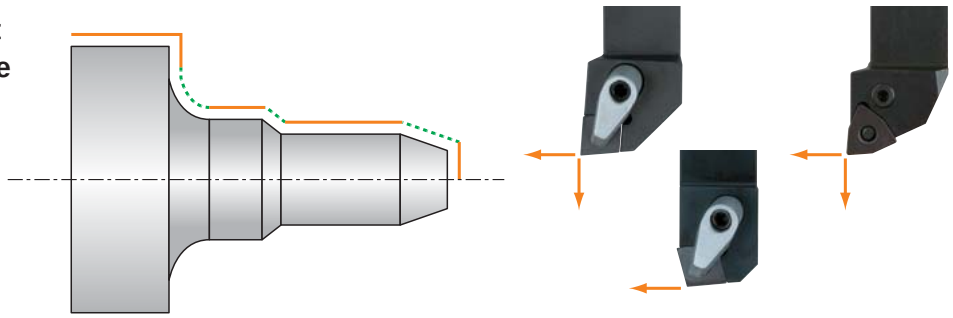
Normal radius inserts



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

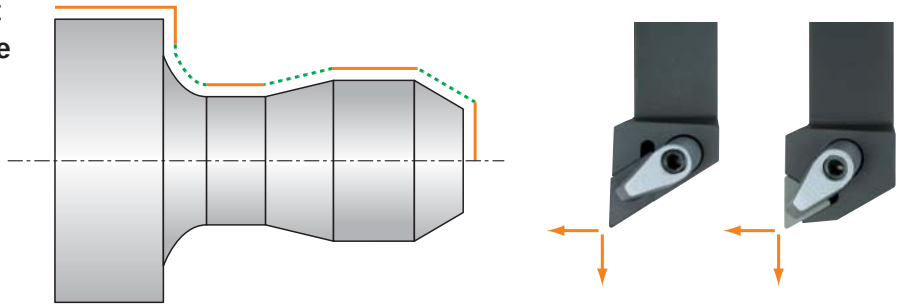
● CNG / WNG inserts

Wiper effect
Normal nose radius



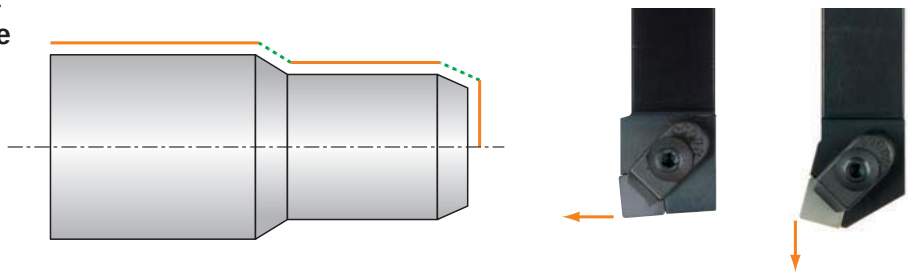
● DNG / TNG inserts

Wiper effect
Normal nose radius



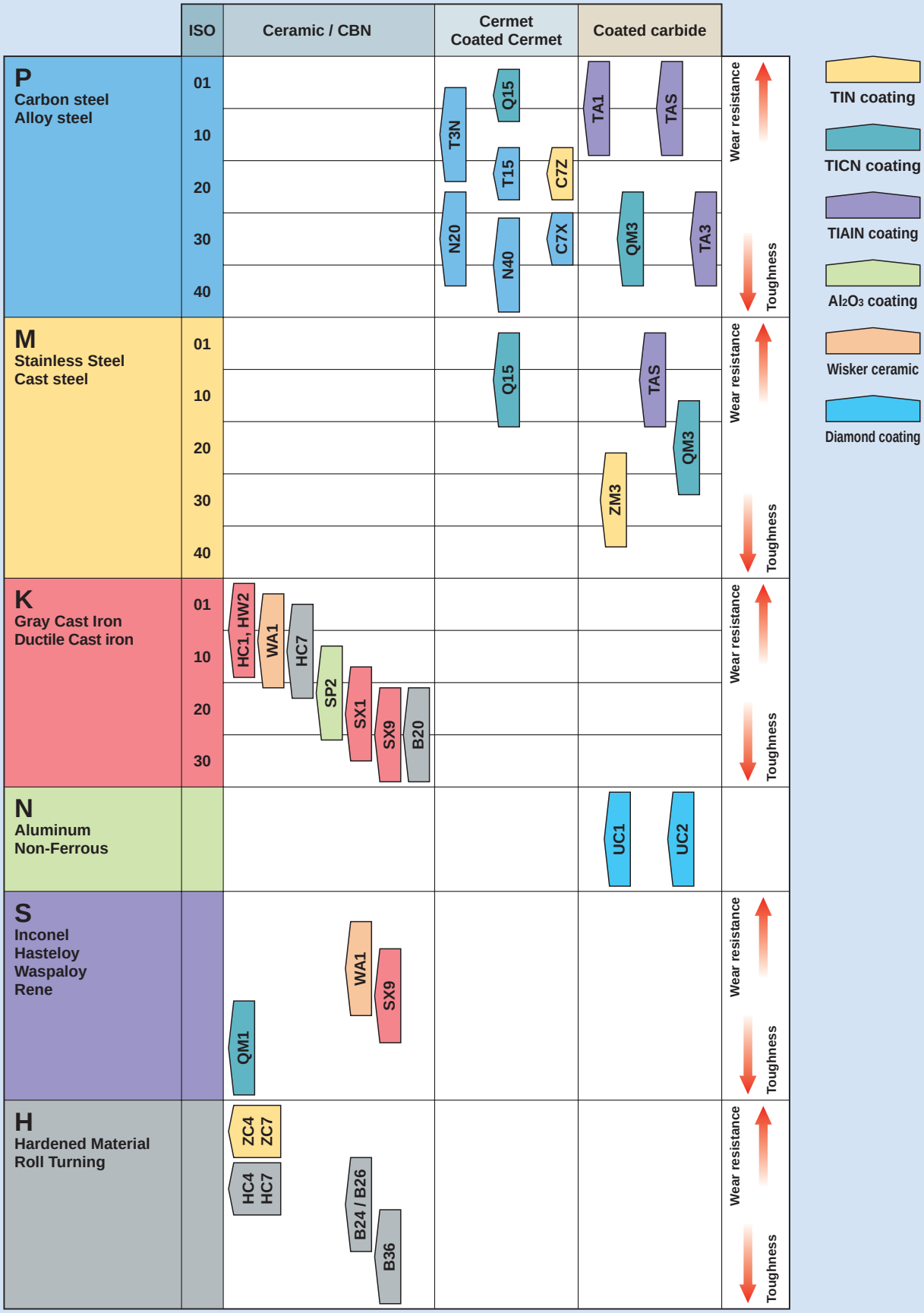
● SNG inserts

Wiper effect
Normal nose radius



Turning-Use Insert Grade Selection Guide

Recommended Types of Grade and Application Areas



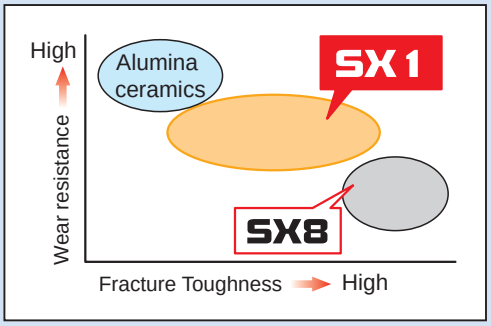
High Speed Cutting for Cast Iron SX1

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
SX1	Cast Iron	Turning	~1,000	~0.7	DRY (WET)
		Milling	~800	~0.3	

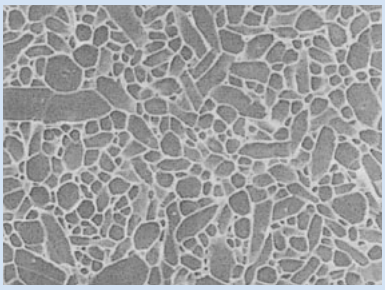


Data

Physical Characteristics

Material	Density (g/m³)	Hardness (HRA)	Bending strength (M Pa)	Young's modulus (GPA)	Thermal expansion coefficient (X10⁻⁶/K)
SX1	3.2	93.5	1,200	320	3.0
SX8	3.2	93	1,200	320	3.0

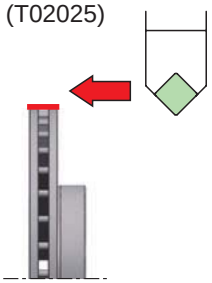
Micro structure of SX1



Case Study

Disc brake — 250 (Gray Cast Iron)

Insert: SNGN 120420 TNF (T02025)

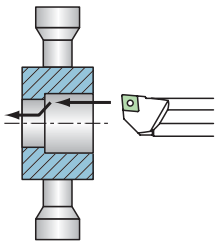


Cutting speed (m/min)	800
Feed (mm/rev)	0.65
Depth of cut (mm)	2
Coolant	WET

SX1	150 pcs
Competitor's Ceramic	100 pcs

Disc rotor — 250 (Gray Cast Iron)

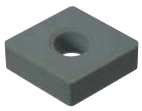
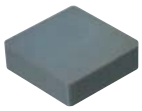
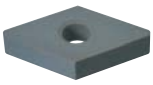
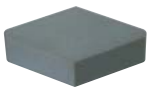
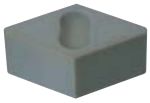
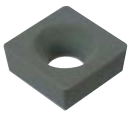
Insert: CNGA 120412 TNF (T02025)

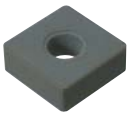
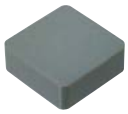
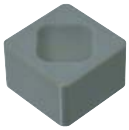
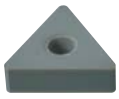
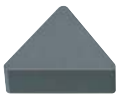
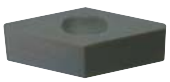
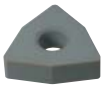


Cutting speed (m/min)	188~374
Feed (mm/rev)	0.3
Depth of cut (mm)	2.5
Coolant	Dry

SX1	200 pcs
Competitor's CBN	120 pcs

SX1

Shape	Item-No. IC T R		SX1
	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		SX1
	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	●

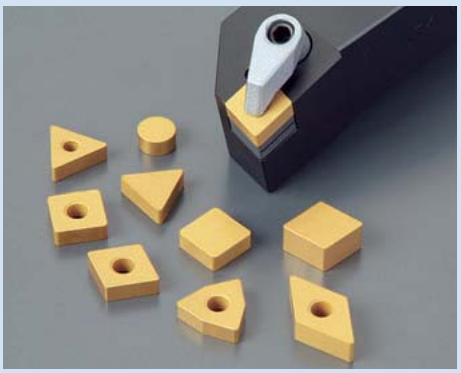
Edge-Preparation

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

Improved Flank Wear Resistance SP2

Feature

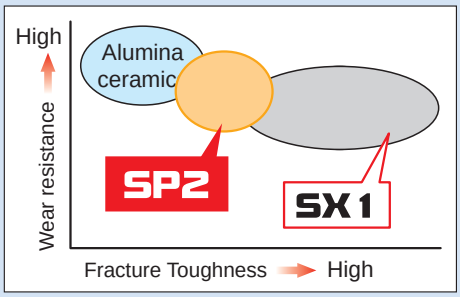
- Greatly improved flank wear resistance
- Excellent heat resistance
- High-speed rough turning of gray cast iron



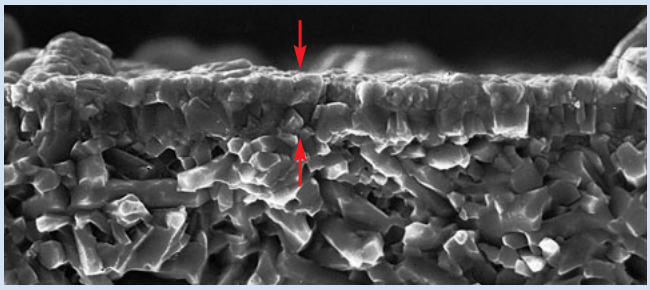
Recommended Cutting Conditions

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

Data



Coating layer of SP2



Case Study

Brake drum	250 (Gray Cast Iron)

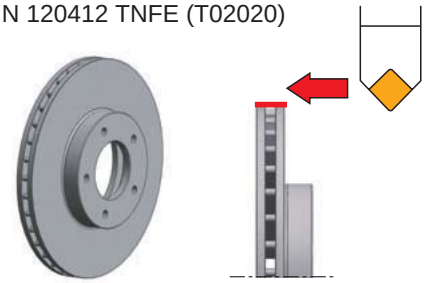
Insert: SNGN 120420 TNF (T02025)

Cutting speed (m/min)	200
Feed (mm/rev)	0.4
Depth of cut (mm)	2
Coolant	WET

SP2	200 pcs
Cermet	100 pcs

Disc brake	250 (Gray Cast Iron)

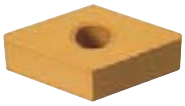
Insert: SNGN 120412 TNFE (T02020)

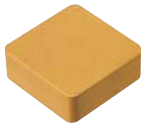


Cutting speed (m/min)	600
Feed (mm/rev)	0.32
Depth of cut (mm)	3.0
Coolant	Dry

SP2	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	●

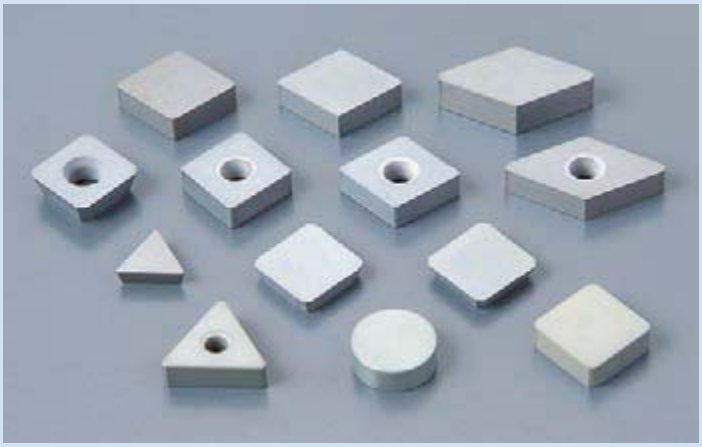
Edge-Preparation

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)
SX8	Cast Iron	Milling and Interrupted cutting	~600	~0.5

Case Study

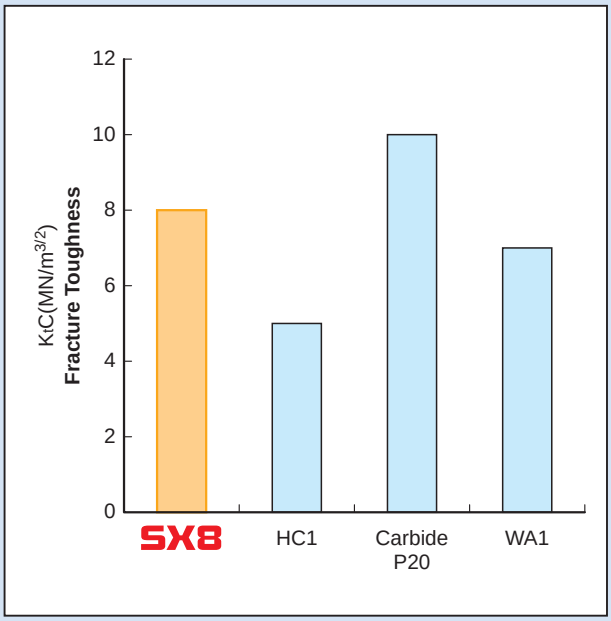
Cylinder block 250 (Gray Cast Iron)

Insert: SPGN 120432 TN (T01025)

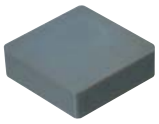
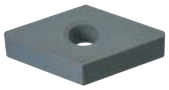
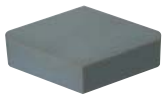
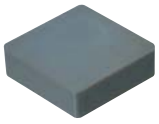
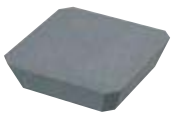
Cutting speed (m/min)	150
Feed (mm/rev)	0.15
Depth of cut (mm)	5.0
Coolant	Wet

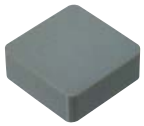
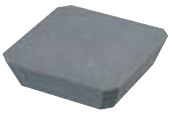
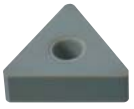
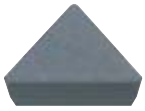
SX8	630 pcs
Cermet	180 pcs

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	●

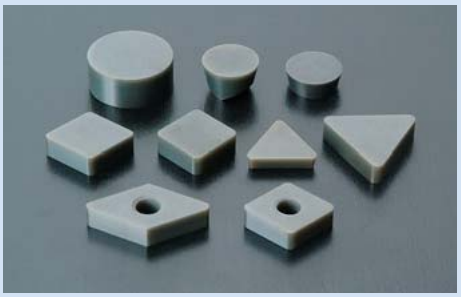
Edge-Preparation

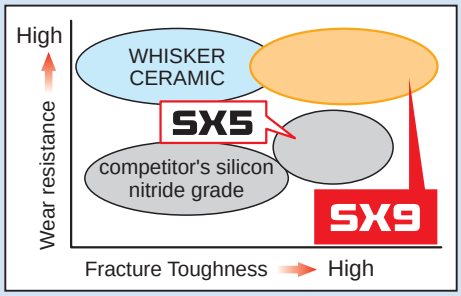
Description	ISO	T
TN	T01025	04
	T02025	06. 07
TNCE	T01020	–
TNF	T02025	–
TNFE	T02020	–
TR	T01025	–
FNX08	Without E.P	–

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





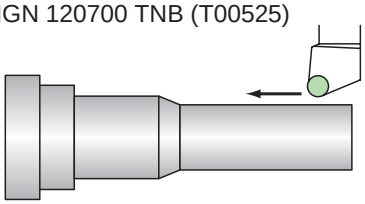
Recommended Cutting Conditions

Material	Work piece	Applications		Cutting speed (m/min)	Feed (mm/rev)
SX9	Nickel Based Alloys	Turning	Continuous	~300	~0.5
	(Inconel, etc.)		Scale Cut (roughing)	~230	~0.4
	Cobalt Based Alloys		Lightly Interrupted	~200	~0.3
	(Stellite, etc.)	Milling		~1000	~0.2

Case Study

Aircraft part — Inconel 718

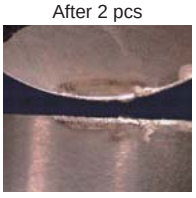
Insert: RNGN 120700 TNB (T00525)



Cutting speed (m/min)	180
Feed (mm/rev)	0.2
Depth of cut (mm)	0.6
Coolant	WET

SX9	2 pcs
Whisker ceramics	1 pc

SX9 After 2 pcs



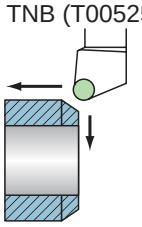
Whisker ceramics After 1 pc

Competitor's tool chipped frequently due to notch wear

SX9 excelled in notch wear resistance and obtained double tool life

Aircraft part — Inconel 600

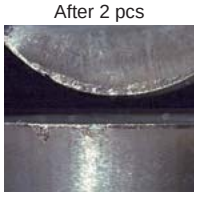
Insert: RNGN 120700 TNB (T00525)



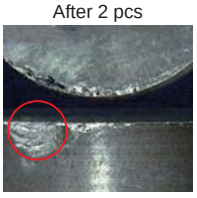
Cutting speed (m/min)	250
Feed (mm/rev)	0.2
Depth of cut (mm)	2.0
Coolant	WET

SX9	2 pass
Competitor's ceramics	2 pass

SX9 After 2 pcs



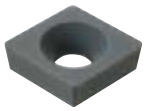
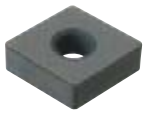
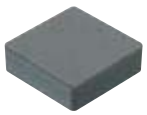
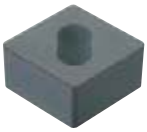
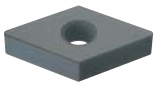
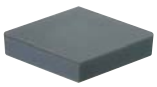
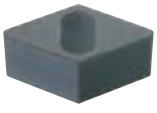
Competitor's ceramics After 2 pcs

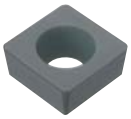
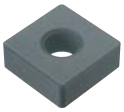
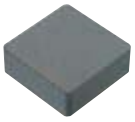
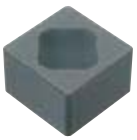
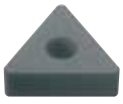
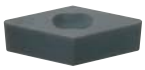
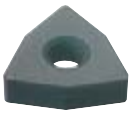


Competitor's ceramic tool showed inconsistent tool life

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)
HC1 HW2	Cast Iron	Finish turning	~1,000	~0.4

HC1

HW2

Case Study

Disc brake — 250 (Gray Cast Iron)

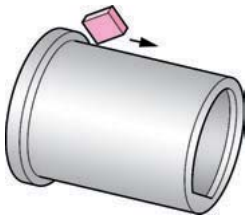
Insert: TNGN 160412 TNF (T02025)

Cutting speed (m/min)	360
Feed (mm/rev)	0.3
Depth of cut (mm)	0.5
Coolant	DRY

HW2	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

HW2	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	●	●
		120716 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	●	●
		150730 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

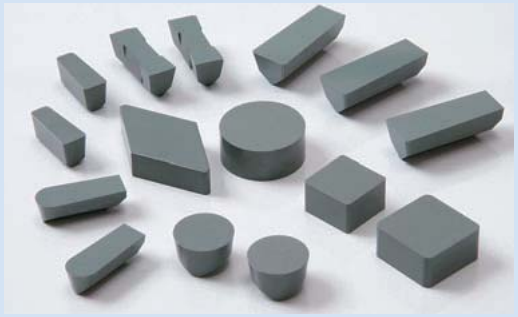
Description	ISO	T
TN	T01025	04
	T02025	07
TNB	T00525	–
TNFE	T02020	–

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.



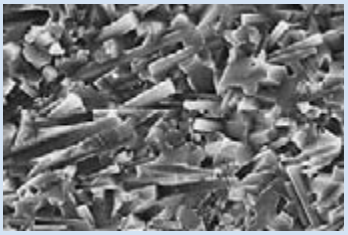
Recommended Cutting Conditions

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_2O_3-based
Density	(g/cm^3)	3.7	4.0
Hardness	(HRA)	94.5	94.0
Fracture toughness	($MPa \cdot m^{1/2}$)	7.0	4.0

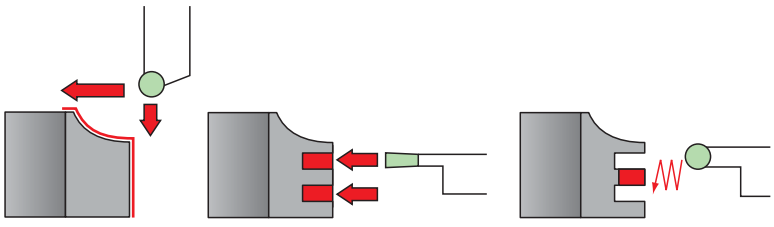
Structure



Case Study

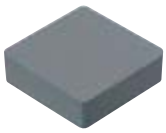
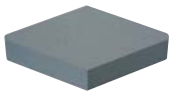
Ring for bearing housing

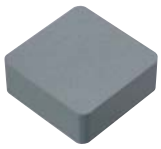
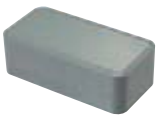
Inconel 718 (Aircraft parts)



		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

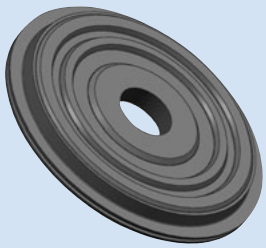
WA1

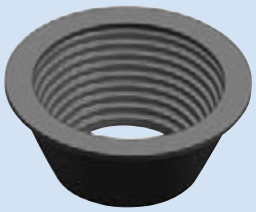
Shape	Item-No.		WA1
	CNGN	120404 TN	
		120408 TN	●
		120408 TNB	●
		120412 TN	●
		120412 TNB	●
		120416 TNB	●
		120708 TNB	●
		120712 TNB	●
		160712 TNB	●
		160716 TNB	●
	DNGN	150412 TNB	●
		150708 TN	●
		150708 TNB	
		150712 TN	●
		150712 TNB	●
		150716 PN9	●
		190612 TNB	●
	RBGX	16S SN2	
		26S SN3	
	RCGX	0608 TNB	●
		0908 TNB	●
		0908 PN	●
		1208 TNB	●
		1510 PN	
		1910 PN	●
		2512 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.		WA1
	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	
		190720 TN	
		190724 TN	●
	TNGN	160404 TN	●
		160408 TN	
		160412 TN	
	LNMN	6688 PN	

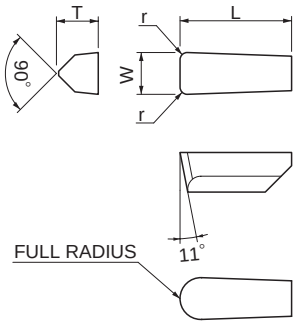
Edge-Preparation

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	25.4	8.56	○
	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

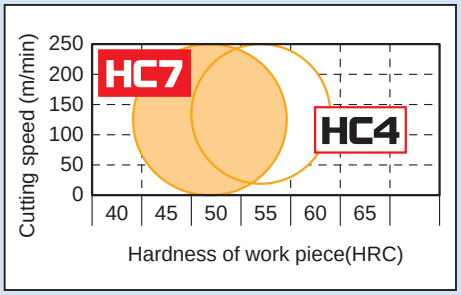
Continuous Cutting for High-Hardness Materials HC7,ZC7

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)
HC7 HC4	Carburized steel Hardened steel Die steel	Turning (Continuous)	~150	0.2

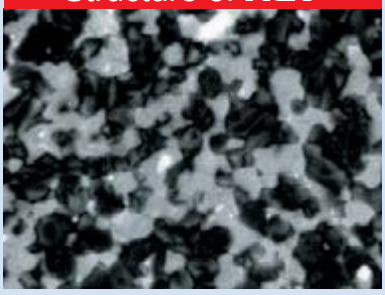


Data

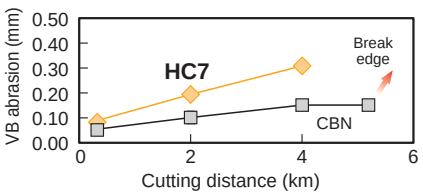
Physical Characteristics

Material	Density (g/m³)	Hardness (HRA)	Bending strength (M Pa)	Thermal expansion coefficient
HC7	4.6	95.0	1,100	7.9
HC4	4.6	95.5	1,000	7.8

Structure of HC7



Cutting Performance



Replaceable with a CBN tool, because of no nicks or other damage occurring, despite significant wear

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

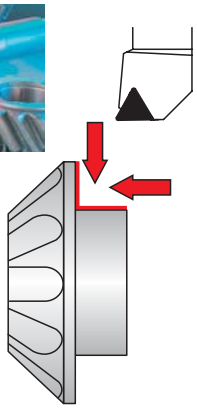
Photos of tool damage

HC7	CBN
	
VB = 0.30 m/mn	Break edge

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

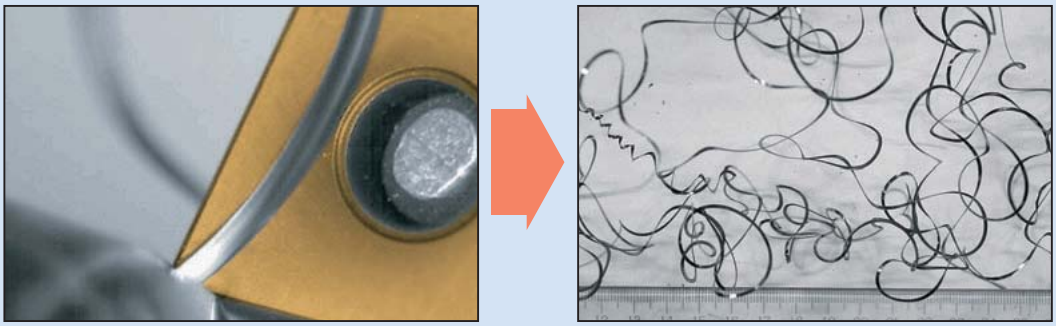
Highly cost-effective because of tool life equivalent to CBN's

Hardened-Steel Chip Control

Ceramic "ZC7" AG Chipbreaker

With AG chipbreaker

Without AG chipbreaker

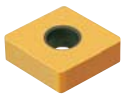
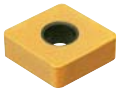
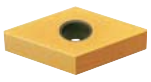
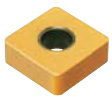
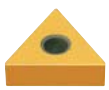


"AG chipbreaker", when added to any **"ZC7"** ceramic tool develops excellent wear resistance in a wide hardness range, during machining operations such as carburized-layer removal, improves surface-machining defects and machine stoppage due to poor formation of chips, thus allowing extended operation.

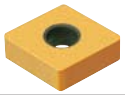
Recommended Cutting Conditions

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

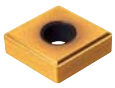
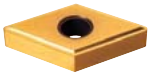
Standard Insert

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	●
	DNGG 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	–

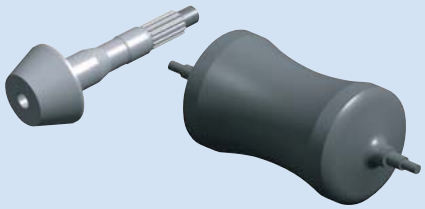
Continuous Cutting for High-Hardness Materials HC2,HC4,ZC4

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	HC2 / HC7
	Surface removal			
High-hardened materials	Less than HRC60	Finishing	～150	HC7
	HRC65 or less			HC4
Mill Rolls	HS85 or less	Semi-finishing and finishing	～100	HC2 / HC7

Case Study

Roll — 210Cr12 (Alloy Steel)

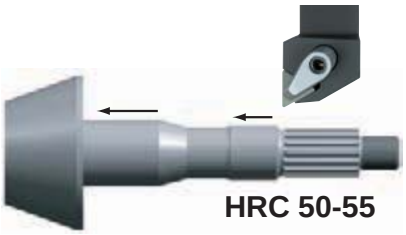
Insert: RCGX 1208 PN HC2 (Double T with R)

Cutting speed (m/min)	80
Feed (mm/rev)	0.2
Depth of cut (mm)	0.5～3.0
Coolant	WET

HC2	20 pcs
Competitor's Ceramic	10 pcs

Differential drive — C45 (Carbon Steel)

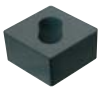
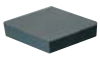
Insert: TNGA 160412 ZNF HC4 (S02025)



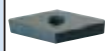
Cutting speed (m/min)	100
Feed (mm/rev)	0.06
Depth of cut (mm)	0.2
Coolant	WET

HC4	150 pcs
Competitor's CBN	150 pcs

HC2

Shape	Item-No. IC T R		HC2
	CNGA	120402 TN	●
		120404 TN	●
		120408 TN	●
		120412 TN	●
		120416 TN	●
		120708 TN	●
		120712 TN	●
		160612 TN	
		160616 TN	●
		190612 TN	●
		190616 TN	●
	CNGN	120408 TN	●
		120412 TN	●
		120416 TN	●
		120708 TN	●
		120712 TN	●
		120716 TN	●
		120720 TN	●
		160704 TN	●
		160708 TN	●
		160712 TN	●
		160716 TN	●
	CNGX	120704 TN DP5	●
		120708 TN DP5	●
		120712 TN DP5	●
		120716 TN DP5	●
	DNGA	150404 TN	●
		150408 TN	●
		150412 TN	●
		150416 TN	
		150608 TN	●
		150612 TN	●
		150616 TN	
		150704 TN	●
		150708 TN	●
		150712 TN	●
		150716 TN	
	DNGN	150404 TN	
		150408 TN	●
		150412 TN	
		150608 TN	●
		150612 TN	
		150616 TN	
		150704 TN	●
		150708 TN	●
		150712 TN	●
		150716 TN	●
		150720 TN	●
		150724 TN	
	DNGX	120704 TN DP5	●
		120708 TN DP5	●
		120712 TN DP5	●
		120716 TN DP5	●
		150708 TN DP5	●
		150712 TN DP5	●
		150716 TN DP5	●
		150720 TN	●

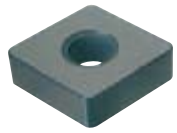
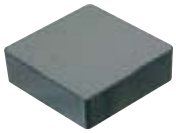
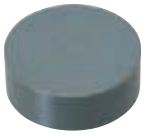
Shape	Item-No. IC T R		HC2
	ENGN	130704 TN	●
		130708 TN	●
		130712 TN	●
		130716 TN	●
		130720 TN	●
		130724 TN	●
		130732 TN	●
	RNGN	060400 TN	●
		090400 TN	●
		120400 TN	●
		120700 TN	●
		150700 TN	●
		190700 TN	●
		250700 TN	●
	SNGA	120404 TN	●
		120408 TN	●
		120412 TN	●
		120416 TN	●
		120420 TN	●
	SNGN	120404 TN	●
		120408 TN	●
		120412 TN	●
		120416 TN	●
		120420 TN	
		120424 TN	
		120430 TN	
		120704 TN	●
		120708 TN	●
		120712 TN	●
		120716 TN	●
		120720 TN	●
		120724 TN	●
		120730 TN	●
		120732 TN	●
		150408 TN	●
		150412 TN	
		150416 TN	
		150708 TN	●
		150712 TN	●
		150716 TN	●
		150720 TN	●
		190712 PN	●
		190716 PN	●
		190720 PN	●
	TNGA	160404 TN	●
		160408 TN	●
		160412 TN	●
		160416 TN	
		160420 TN	
		220408 TN	●
		220412 TN	●
		220416 TN	●
		220420 TN	●

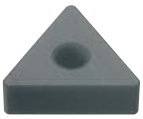
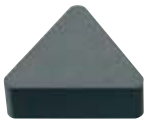
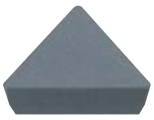
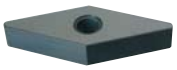
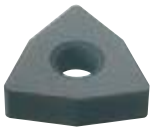
Shape	Item-No. IC T R		HC2
	TNGN	110304 TN	●
		110308 TN	●
		110312 TN	●
		220404 TN	●
		220408 TN	●
		220412 TN	
		220416 TN	●
		220708 TN	●
		220712 TN	●
		220716 TN	●
	TPGN	060102 TN	●
		060104 TN	●
		090202 TN	●
		090204 TN	●
		090208 TN	●
		110302 TN	●
		110304 TN	●
		110308 TN	●
		110312 TN	●
		160302 TN	●
		160304 TN	●
		160308 TN	●
		160312 TN	●
		160316 TN	
	VNGA	160404 TN	●
		160408 TN	●
		160412 TN	●
		160416 TN	●

Edge-Preparation

Description	ISO	T
TN	T01025	04
	T02025	06. 07
PN	W-T land with R-horn	—
		—

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

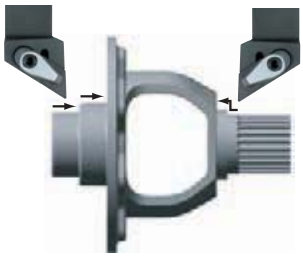
- Excellent wear-resistance for Ductile cast iron
- TiC-based ceramic

Recommended Cutting Conditions

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

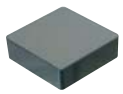
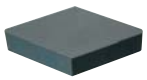
Case Study

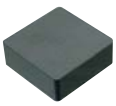
Case	Ductile cast iron
Insert: DNGN 120412 TN (T01025)	
Cutting speed (m/min)	300
Feed (mm/rev)	0.2
Depth of cut (mm)	0.5
Coolant	WET



HC6	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