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**NTK**

**ИНСТРУМЕНТ**

**ДЛЯ АЭРОКОСМИЧЕСКОЙ  
ПРОМЫШЛЕННОСТИ**

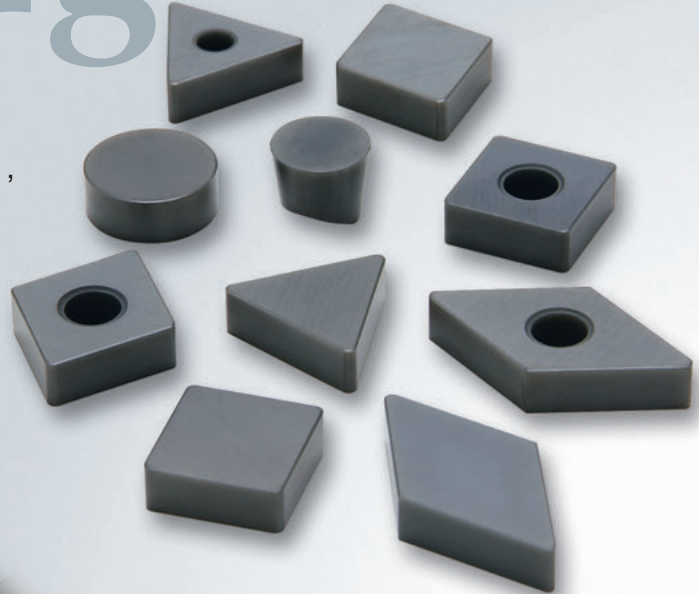


# Turning

- Excellent notch wear resistance
- For machining of Aerospace alloys Inconel , Waspalloy , Hastelloy and also Stellite

**SiAlON ceramics**

**SX9, SX5** → P.08

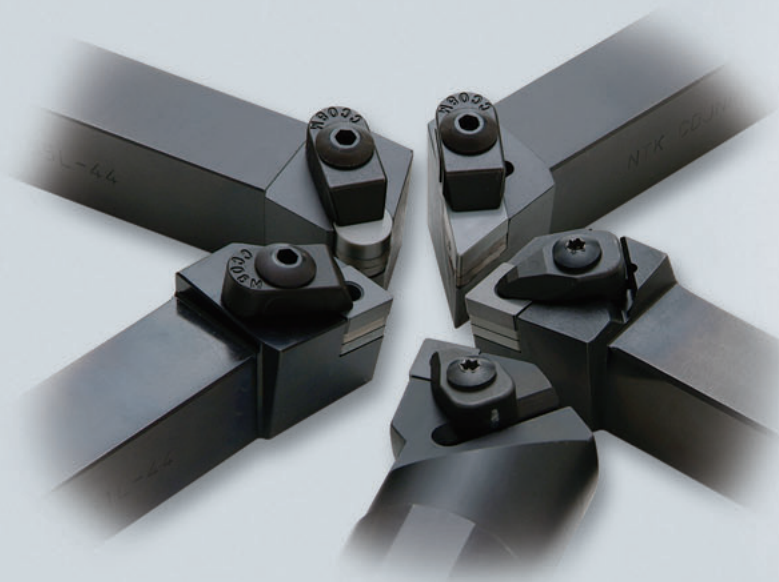


- For stable machining

**Double clamp, Top clamp**

**Tool Holder**

→ P.21



- ZM3 with sharp cutting edge
- QM3 for heavy machining

**PVD coated micro grain carbide**

**ZM3, QM3** → P.10

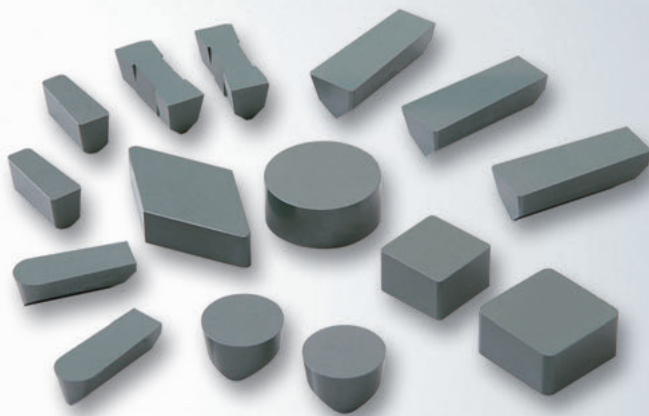
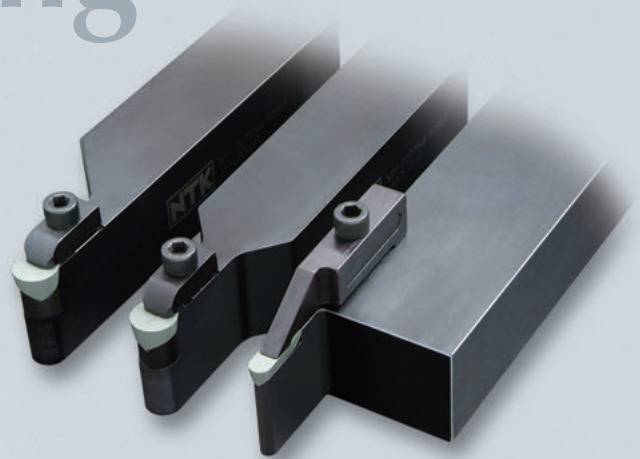


# Profiling & Grooving

- Excellent surface finish

## Tool Holder

→ P.33



- Excellent wear resistance
- High productivity with high cutting speed

**Whisker ceramics**

**WA1** → P.09

# Milling



- High performance milling with a wide variety of cutters

→ P.39

## Guide to This Catalogue

This catalogue lists products as of February 2009.

### Inventory status symbols:

- : Service stock for left- and right- handed products and neutral products.
- : Custom made product.

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### Safety Notice

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We make a particular effort to manufacture safe products. However, NTK cutting tools may be broken due to a sudden increase of the cutting load or excessive tool wear, which could possibly cause injuries to operators. To protect the operators from such accidents, please note the following when operating a cutting tool:



**WARNING**

- ⊙ Install shielding plates or wear protective clothes and glasses.
- ⊙ Do not touch the cutting edge with bare hand because it is sharp.
- ⊙ Use genuine NTK parts for parts and drivers, etc.
- ⊙ Check sharpness and replace the tool early if necessary.
- ⊙ Check the sharpness of tools and exchange them at an early stage.

We do not recommend you to grind cutting tools because grinding may cause cracks and improper finishing, possibly resulting in breakage of the tool.

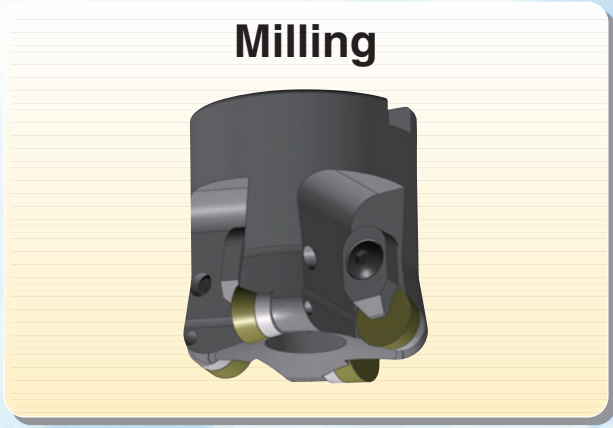
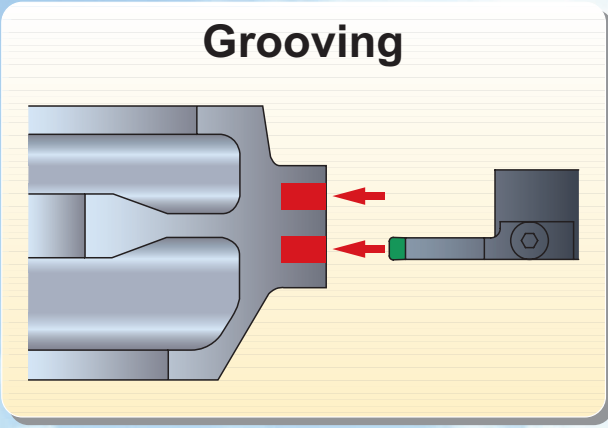
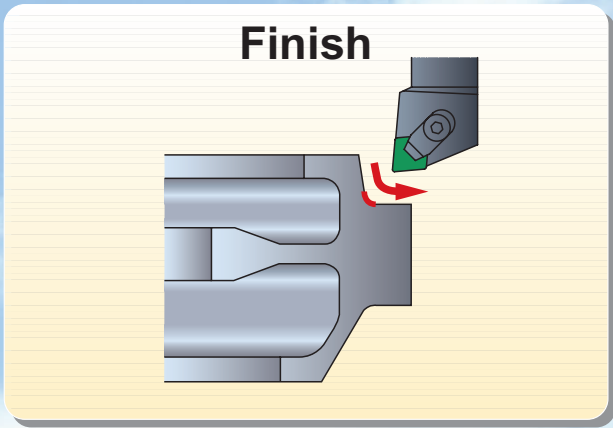
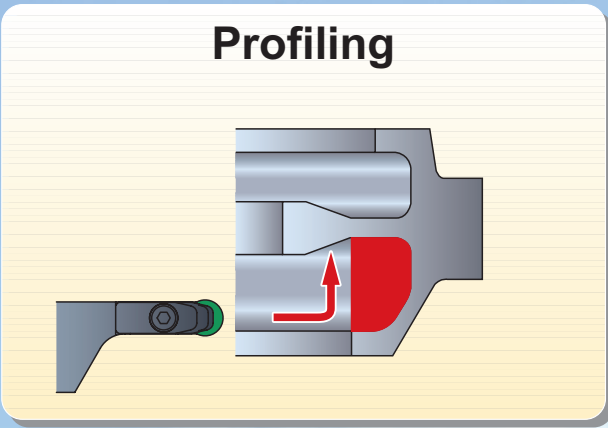
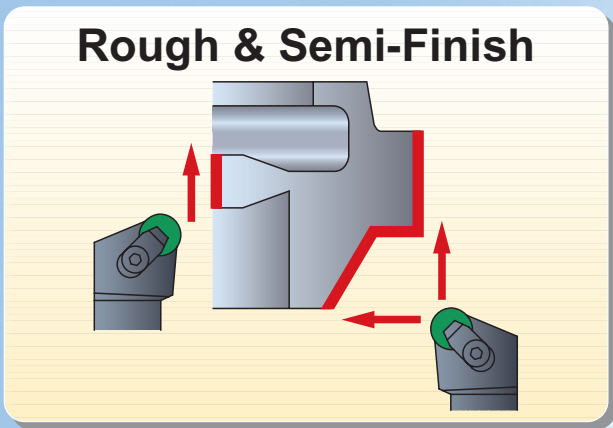
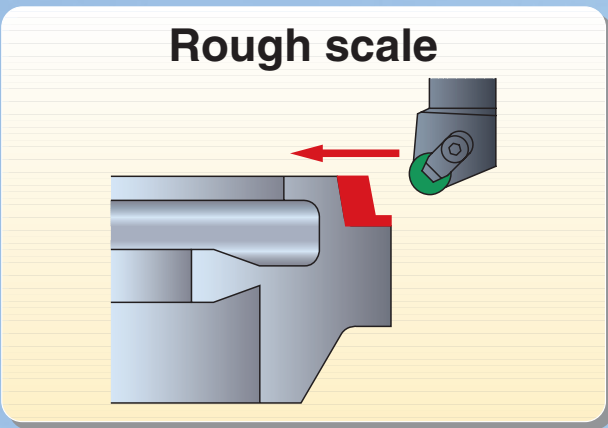
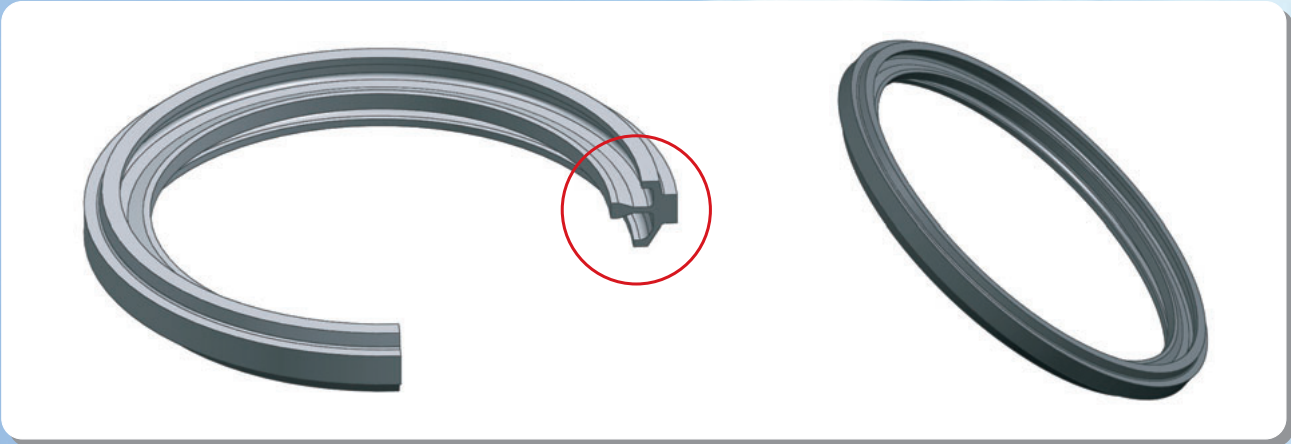


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# NTK

# Grade Selection



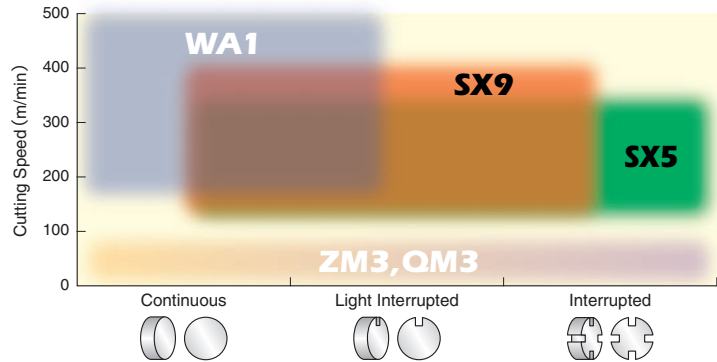


# SX9/SX5 SiAlON Ceramics

## Feature

**SX9 / SX5** are a SiAlON ceramic for high speed machining of high temperature alloys. SiAlON is a combination of silicon nitride ceramic and alumina ceramic.


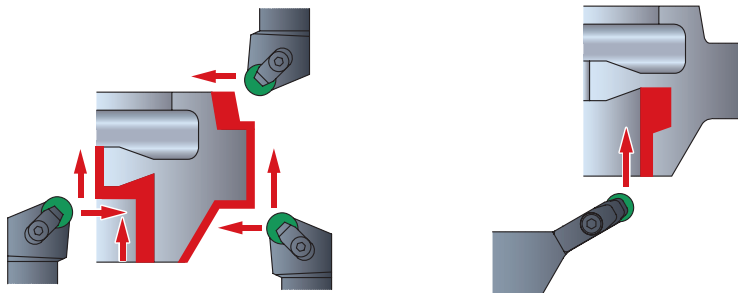




- Dramatically increase notch wear resistance , toughness and thermal shock resistance
- For **Inconel , Waspalloy, Hastelloy and Stellite**
- Drastic cost reduction in comparison to whisker reinforced ceramics



## Recommendation

Grade	Work Material	Conditions	Cutting speed (m/min)	Feed(mm/rev)	
<b>SX9</b> <b>SX5</b>	Nickel Based Alloys (Inconel, etc.)	Turning	Continuous	- 300	- 0.5
			Scale Cut (roughing)	- 230	- 0.4
<b>SX9</b>	Cobalt Based Alloys (Stellite, etc.)	Milling	Lightly Interrupted	- 200	- 0.3
				- 1000	- 0.2

## ● Case Study

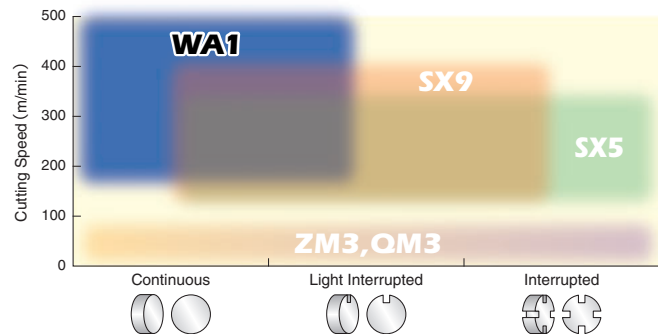
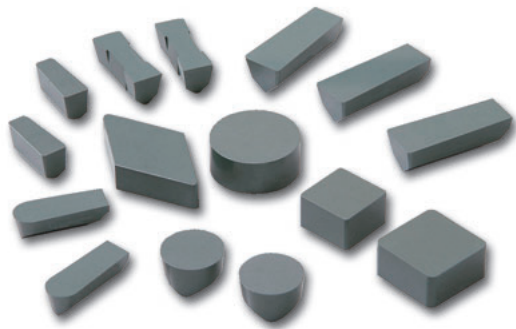
Low Pressure Turbine Disc		Inconel 718 (Aerospace parts)		
				
Insert Grade	Rough RNGN 190700 T01020		Semi-Finish RCGX 1208 T01020	
	<b>SX9</b>	<b>SX9</b>	<b>SX5</b>	<b>SX5</b>
Cutting speed (m/min)	180		250	
Feed (mm/rev)	0.25	Competitor's Whisker	0.2	Competitor's Ceramics
Depth of cut (mm)	- 7		2 - 3	
Coolant	WET		WET	
Tool life (min)	20		20	



## Feature

WA1 is a whisker-reinforced ceramic material with silicon-carbide whisker added to alumina, the main component Alumina ceramic offers the best wear resistance at high cutting speeds.

- Toughness and notch wear resistance dramatically increases
- Whisker-reinforcing technology for **Heat-resistant alloys**



## Recommendation

Grade	Work Material	Conditions	Cutting speed (m/min)	Feed(mm/rev)
<b>WA1</b>	Nickel Based Alloys (Inconel, etc.)	Continuous	- 500	- 0.5
		Scale Cut (roughing)	- 300	- 0.4
	Cobalt Based Alloys (Stellite, etc.)	Lightly Interrupted	- 200	- 0.3
			- 1000	- 0.2

### ● Case Study

Ring for bearing housing		Inconel 718 (Aerospace parts)		
		Outside Turning	Grooving	Ramping
		RNGN 120700 T00520	VGW8375-2 E002	RPGX 0908 T00520
		<b>WA1</b>	<b>WA1</b>	<b>WA1</b>
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
Tool life	(min)	20	20	20

# ZM3/QM3 For Finish Machining

## Feature

PVD Coated Micro Grain Carbide for Aircraft Parts

**ZM3** has sharp cutting edge.

**QM3** is for heavy machining and turning of steel.

TiN coated  
**ZM3**

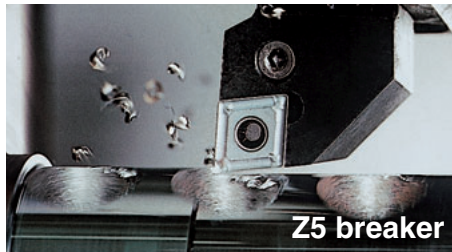


U2 breaker



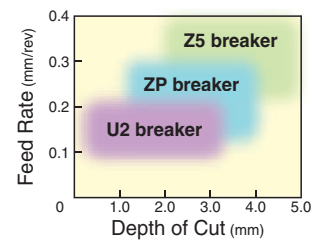
ZP breaker

TiCN coated  
**QM3**



Z5 breaker

### • Chip Control



## Recommendation

Grade	Work Material	Conditions	Cutting speed (m/min)	Feed(mm/rev)
<b>ZM3</b>	Stainless	Rough and finish	- 150	- 0.3
	Carbon Steel		- 150	- 0.3
	Titan , Inconel		40 - 120	- 0.25
<b>QM3</b>	Alloy Steel		50 - 200	- 0.3
	Titan , Inconel		40 - 120	- 0.3

### • Case Study

Small Disc		Titanium
Insert: CNGG 120404 FNZP		
Cutting speed (m/min)		40
Feed (mm/rev)		0.2
Depth of cut (mm)		1.5
Coolant		WET
<b>ZM3</b>	45pcs	
Competitor's Carbide	20pcs	

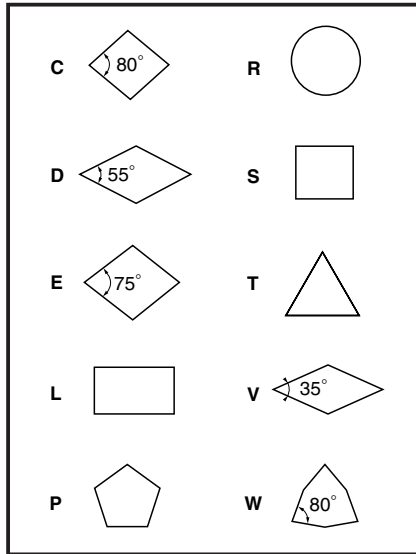
Ring for bearing housing		Inconel 718
Insert: CNGG 120408 FNZP		
Cutting speed (m/min)		40
Feed (mm/rev)		0.2
Depth of cut (mm)		0.5
Coolant		WET
<b>QM3</b>	20 min	
Competitor's Carbide	10 min	

# Insert Stock List



# Insert Identification System

## 1 Shape

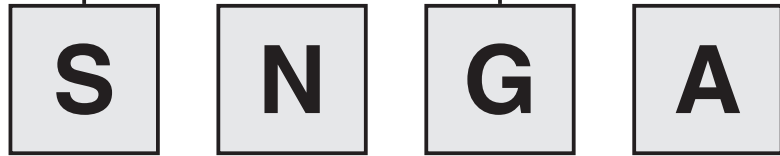


## 3 Tolerance Class

Symbol	d (mm)	m (mm)	s (mm)
A	± 0.025	± 0.005	± 0.025
F	± 0.013	± 0.005	± 0.025
C	± 0.025	± 0.013	± 0.025
H	± 0.013	± 0.013	± 0.025
E	± 0.025	± 0.025	± 0.025
G	± 0.025	± 0.025	± 0.13
J	± 0.05	± 0.05	± 0.13
K	± 0.05~± 0.13	± 0.013	± 0.025
L	± 0.05~± 0.13	± 0.025	± 0.025
M	± 0.05~± 0.13	± 0.08~± 0.18	± 0.13
N	± 0.05~± 0.13	± 0.08~± 0.18	± 0.025
U	± 0.08~± 0.25	± 0.13~± 0.38	± 0.13

Symbol	M tolerance	
	d (mm)	m (mm)
C S T	Inscribed Circle	
	6.35	± 0.05 ± 0.08
	9.525	± 0.05 ± 0.08
	12.7	± 0.08 ± 0.13
	15.875	± 0.10 ± 0.15
	19.05	± 0.10 ± 0.15
	25.40	± 0.13 ± 0.18
D K	d (mm)	m (mm)
	6.35	± 0.05 ± 0.11
	9.525	± 0.05 ± 0.11
	12.7	± 0.08 ± 0.15
	15.875	± 0.10 ± 0.15
	19.05	± 0.10 ± 0.18

**Inch**



1

2

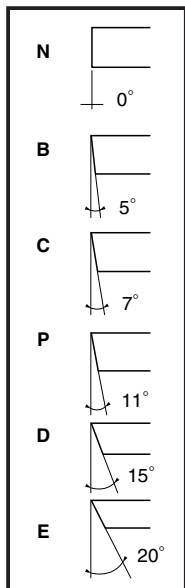
3

4

**Metric**



## 2 Clearances



## 4 Type

Type	Symbol		Type	Symbol	
	≤ 6.35mm	Inscribed Circle (Including 7.94mm) ≤ 5.56mm		Inscribed Circle ≤ 6.35mm	
	N	E		H	
	F	L		B	
	R	S			
	A	D		T	
	G	K			
	M	P		W	
Special design	X	X			

## 6 Thickness

Thick-ness S(mm)	Inch		Metric
	Normal ≥ 6.35(mm)	Small ≤ 5.556	
3.18	2	4	03
4.76	3	6	04
6.35	4		06
7.94	5		07
9.52	6		09
12.70	8		12

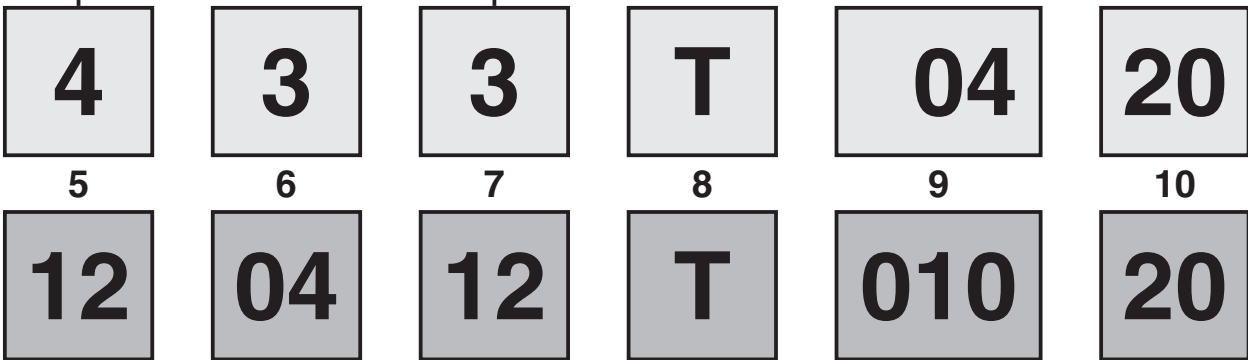
### 5 Cutting Edge Length

Inscribed Circle (mm)	Inch		Metric						
	Normal series	Small-size series	C	D	R	S	T	V	W
3.97	-	5		04	03	06			02
4.76	-	6	04	05	04	08			L3
5.56	-	7	05	06	05	09	09		03
6.35	2	(8)	06	07	06	11	11		04
7.94	-	0	08	09	07	13	13		05
9.525	3	-	09	11	09	16	16		06
12.7	4	-	12	15	12	22	22		08
15.875	5	-	16	19	15	27	27		10
19.05	6	-	19	23	19	33	33		13
22.23	7	-	22	27	22	38	38		
25.40	8	-	25	31	25	44	44		17
31.75	03	-	32	38	31	54	54		

### 7 Nose Radius

Corner Radius	Inch	Metric	
		M0(※)	00(※)
Round Insert			
Sharp	0	00	
0.2	y	02	
0.4	1	04	
0.8	2	08	
1.2	3	12	
1.6	4	16	
2.0	5	20	
2.4	6	24	
2.8	7	28	
3.2	8	32	

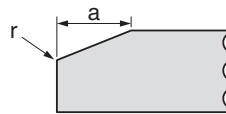
※M0 = Round insert (Metric)  
※00 = Round insert (Inch)



### 8 Edge Condition

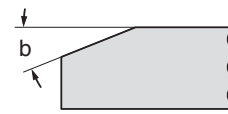
Sharp	F
Chamfered	T
Honed	E
Chamfered and Honed	S
	Z
Special Honed	K
Double Chamfer	P

### 9 Negative land width



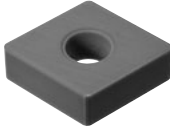
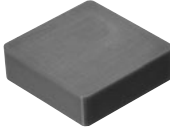
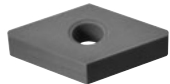

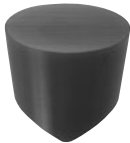
	metric	inch	a (mm)	r (mm)
T	005	02	0.05	-
	010	04	0.1	-
	015	06	0.15	-
	020	08	0.2	-
E	002	01	-	0.02
	004	02	-	0.04
S	010	04	0.1	0.04
	015	06	0.15	0.04
Z	010	04	0.1	0.02
	015	06	0.15	0.02

### 10 Negative land angle




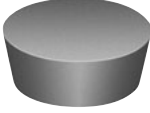

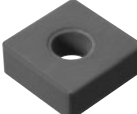
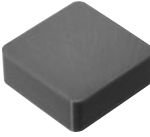
Description	b°
15	15°
20	20°
25	25°
30	30°

# Insert Stock List

Shape	NTK Part Number			Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1	
	CNGA 120408	T00520	12.7	4.76	0.8	●	○	○	
		T01020				○	○	○	
	120412	T00520	12.7	4.76	1.2	●	○	○	
		T01020				○	○	○	
	120416	T00520	12.7	4.76	1.6	●	○	○	
		T01020				○	○	○	
	160612	T00520	15.88	6.35	1.2	○	○	○	
	160616	T01020			1.6	○	○	○	
190612	T00520	19.05	6.35	1.2	○	○	○		
190616	T00520			1.6	○	○	○		
	CNGN 120408	T00520	12.7	4.76	0.8	●	○	○	
		T01020				○	○	●	
	120412	T00520	12.7	4.76	1.2	●	○	●	
		T01020				○	○	●	
	120416	T00520	12.7	4.76	1.6	●	○	●	
	120708	T00520			0.8	○	○	●	
	120712	T00520	15.88	7.94	1.2	○	●	●	
	160712	T00520			1.6	○	○	○	
160716	T00520	15.88	7.94	1.6	○	○	●		
190624	T00520			19.05	6.35	2.4	○	○	○
	DNGA 150408	T00520	12.7	4.76	0.8	●	○	○	
		T01020				○	○	○	
	150412	T00520	12.7	4.76	1.2	●	○	○	
	T01020	○				○	○		
	150416	T00520	12.7	4.76	1.6	●	○	○	
T01020	○	○				○			
150424	T00520	12.7	4.76	2.4	○	○	○		
T01020	○			○	○				
	DNGN 150408	T00520	12.7	4.76	0.8	●	○	○	
		T01020				○	○	○	
	150412	T00520	12.7	4.76	1.2	●	○	●	
	T01020	○				○	○		
	150416	T00520	12.7	4.76	1.6	●	○	○	
	T01020	○				○	○		
	150708	T00520	15.88	7.94	0.8	○	○	○	
T02020	○	○			○				
150712	T00520	15.88	7.94	1.2	○	○	●		
T02020	○				○	○			
190612	T00520	15.88	6.35	6.35	○	○	●		
	RCGX 060400	T00520	6.35	4.76	-	○	○	○	
		T00520				○	○	●	
	060700	T00520	9.525	7.94	-	○	○	○	
	T00520	○				○	○		
	090700	T01020	9.525	7.94	-	○	○	○	
T01020	○	○				○			
120700	T00520	12.7	-	-	○	○	○		
T01020	○				○	○			

● : Stock ○ : Available

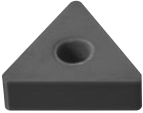
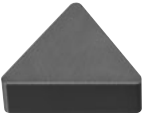
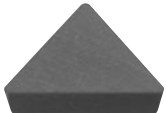
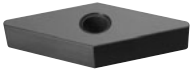
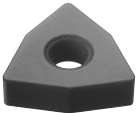
E.P. : Edge Preparation

Shape	NTK Part Number			Dimensions			Ceramics			
		Metric	E.P.	IC	T	R	SX9	SX5	WA1	
	RNGN	090300	T00520	9.525	3.18	—	○	○	●	
		120400	T00520 T01020	12.7	4.76	—	○	○	●	
		120700	E002 T00520 T01020 T02020		7.94	—	○	○	○	
		150700	T00520	15.88	—	○	●	●		
		190600	T00520	19.05	6.35	—	○	○	○	
		190700	T00520 T01020		7.94	—	●	●	○	
		250700	T00520		—	—	○	●	○	
		250900	S15015 T00520	25.4	—	○	○	○		
		250900	T00520	9.525	—	○	●	○		
			RPGN	060200	T00520	6.35	2.38	—	○	○
090300	T00520			9.525	3.18	—	○	○	○	
120400	T00520 T01020			12.7	4.76	—	○	○	○	
190700	T00520			19.05	7.94	—	○	○	○	
	RPGX	060400	T00520	6.35	4.76	—	○	○	●	
		090700	T00520	9.525	—	○	○	●		
		120700	T00520 T01020	12.7	7.94	—	○	○	○	
	SNGA	120408	T00520	12.7	4.76	0.8	○	○	○	
		120412	T00520			1.2	○	○	○	
		150612	T00520	15.875	6.35	1.6	○	○	○	
		150616	T02020 T00520				○	○	○	
	SNGN	120408	T00520 T01020	12.7	4.76	0.8	○	●	○	
		120412	T00520 T01020			1.2	○	○	●	●
		120416	T00520 T01020			1.6	○	○	●	●
		120708	T00520	7.94	15.875	0.8	○	○	●	
		120712	T00520			1.2	○	○	●	
		120716	T00520			1.6	○	●	●	
		150712	T02020			1.2	●	○	○	
		150716	T02020	1.6	●	○	○			
		190616	T00320 T00520	19.05	6.35	1.6	○	○	○	
		190712	T02020			1.2	○	○	●	
		190724	T00320 T02020	7.94	2.4	○	○	○		

● : Stock ○ : Available

E.P. : Edge Preparation

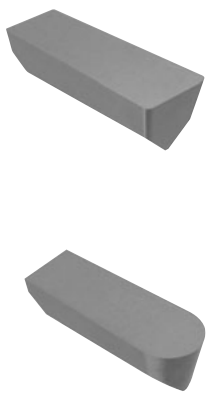
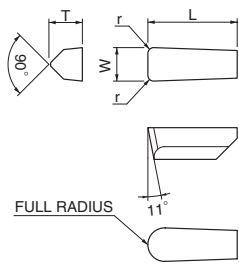
# Insert Stock List

Shape	NTK Part Number		Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1
	TNGA 220408	T00520	12.7	4.76	0.8	○	○	○
	TNGN 160404	T01020	9.525	4.76	0.4	○	○	●
	160408	T01020			0.8	○	○	●
	160412	T01020			1.2	○	○	●
	220408	T00520	12.7	4.76	0.8	○	○	○
		T01020			1.2	○	○	○
	220412	T00520			1.6	○	○	●
	220416	T00520			1.6	○	○	●
	220708	T00520	7.94	7.94	0.8	○	○	○
	220712	T00520			1.2	○	○	○
	270616	T00320	15.88	6.35	1.6	○	○	○
	TPGN 160308	T00520	9.525	3.18	0.8	○	○	○
	160312	T00520			1.2	○	○	○
	220408	T00520	12.7	4.76	0.8	○	○	○
	220412	T00520			1.2	○	○	○
	220416	T00520			1.6	○	○	○
	VNGA 160404	T00520	9.525	4.76	0.4	○	○	○
	160408	T00520			0.8	○	○	○
	160412	T00520			1.2	○	○	○
	220424	T01020	12.7	2.4	○	○	○	
	WNGA 080408	T00520	12.7	4.76	0.8	○	○	○
	080412	T00520			1.2	○	○	○
	080416	T01020			1.6	○	○	○

● : Stock ○ : Available

E.P. : Edge Preparation



Shape	NTK Part Number		Dimensions				Ceramics		
		Metric	W	R	T	L	SX9	SX5	WA1
 	VGK	8250-2	6.35	0.8	8.33	25.4	○	○	○
		8312-R	7.92	FULL-R			○	○	○
		8312-2		0.8			○	○	○
		8312-4		1.6			○	○	○
		8375-2		9.525			0.8	○	○
		8375-4	1.6				○	○	○
	VGW	4125-R	3.18	FULL-R	4.75	12.7	○	○	●
		4125-1		0.4			○	○	●
		4125-2		0.8			○	○	●
		4156-R	3.96	FULL-R	○	○	●		
		4156-1		0.4	○	○	●		
		4156-2		0.8	○	○	●		
		4187-R	4.75	FULL-R	○	○	●		
		4187-1		0.4	○	○	●		
		4187-2		0.8	○	○	●		
		6250-R	6.35	FULL-R	6.35	19.05	○	○	●
		6250-1		0.4			○	○	●
		6250-2		0.8			○	○	●
		6250-3		1.2			○	○	●
		6281-R	7.14	FULL-R	○	○	●		
		6281-1		0.4	○	○	○		
		6281-2		0.8	○	○	○		
		6281-3		1.2	○	○	○		
		8312-R	7.92	FULL-R	8.56	25.4	○	○	●
		8312-1		0.4			○	○	○
		8312-2		0.8			○	○	●
		8312-3		1.2			○	○	○
		8312-4	1.6	○	○	●			
		8344-R	8.74	FULL-R	○	○	●		
		8344-1		0.4	○	○	○		
	8344-2	0.8		○	○	○			
	8344-3	1.2		○	○	○			
8344-4	1.6	○	○	○					
8375-R	9.525	FULL-R	○	○	●				
8375-1		0.4	○	○	○				
8375-2		0.8	○	○	●				
8375-3		1.2	○	○	○				
8375-4		1.6	○	○	●				

● : Stock ○ : Available

E.P. : Edge Preparation



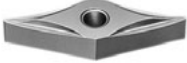



Standard Edge Preparation for WA1 is EX0001 which means 0.05mm or less honing only.  
 Standard Edge Preparation for SX5 & SX9 are T00520 chamfer only.  
 Standard Edge Preparations are not listed in this grooving inserts.

# Insert Stock List

Shape	NTK Part Number	Dimensions			ZM3	QM3
		IC	T	R		
	CNGG 120404 FN ZP 120408 FN ZP	12.7	4.76	0.4 0.8	● ●	● ●
	CNMG 120408 TNB Z5	12.7	4.76	0.8	○	●
	DNGG 150404 FN ZP 150408 FN ZP	12.7	4.76	0.4 0.8	● ●	● ●
	DNMG 150404 TN G	12.7	4.76	0.4	○	○
	DNMG 150408 TNB Z5	12.7	4.76	0.8	○	●
	SNMG 120408 TNB Z5	12.7	4.76	0.8	○	●
	TNGG 160402 FR C	9.525	4.76	0.2	○	○
	TNGG 160401 FR DA	9.525	4.76	0.1	○	○
	TNGG 160401 FR U2 160402 FR U2 160404 FR U2 160408 FR U2 160402 FL U2 160404 FL U2 160408 FL U2	9.525	4.76	0.1 0.2 0.4 0.8 0.2 0.4 0.8	● ● ● ● ○ ● ●	○ ○ ○ ○ ○ ○ ○

● : Stock ○ : Available

E.P. : Edge Preparation

Shape	NTK Part Number	Dimensions			ZM3	QM3
		IC	T	R		
	TNGG 160402 FN ZP			0.2	○	●
	160404 FN ZP	9.525	4.76	0.4	●	●
	160408 FN ZP			0.8	●	●
	TNMG 160404 TNB Z5	9.525	4.76	0.4	○	○
	160408 TNB Z5			0.8	○	○
	VNGG 160402 FN ZP			0.2	○	●
	160404 FN ZP	9.525	4.76	0.4	○	●
	160408 FN ZP			0.8	○	○
	VNMG 160404 TNB AM1	9.525	4.76	0.4	○	○
	160408 TNB AM1			0.8	○	○
	WNGG 080404 FN ZP	12.7	4.76	0.4	○	●
	080408 FN ZP			0.8	○	●
	WNMG 080408 TNB Z5	12.7	4.76	0.8	○	○
	080412 TNB Z5			1.2	○	○

● : Stock ○ : Available

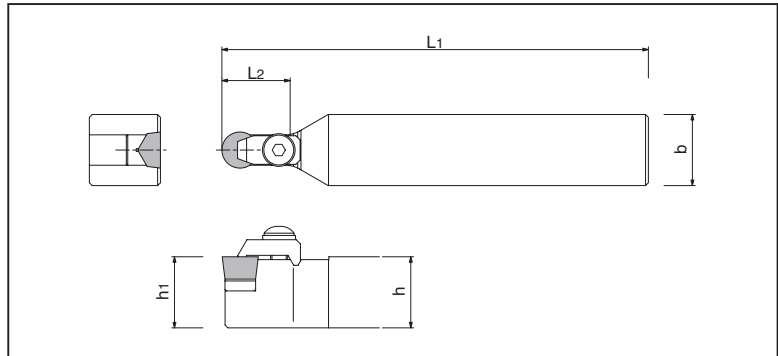
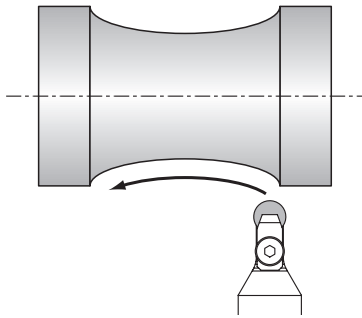
E.P. : Edge Preparation

NIJK

# Holder Turning / Boring



## CRDC



### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)					Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	L <sub>2</sub>		
<b>CRDCN 2525M06</b>	25	25	150	25	20	RCGX / RPGX 0607	RCGN 0607
<b>2525M09</b>	25	25	150	25	20	RCGX / RPGX 0907	RCGN 0907
<b>2525M12</b>	25	25	150	25	25	RCGX / RPGX 1207	RCGN 1207
<b>3225P06</b>	32	25	170	32	20	RCGX / RPGX 0607	RCGN 0607
<b>3225P09</b>	32	25	170	32	20	RCGX / RPGX 0907	RCGN 0907
<b>3225P12</b>	32	25	170	32	25	RCGX / RPGX 1207	RCGN 1207
<b>3232P15</b>	32	32	170	32	30	RCGX / RPGX 1510	
<b>3232P19</b>	32	32	170	32	42	RCGX / RPGX 1910	
<b>3232P25</b>	32	32	170	32	42	RCGX / RPGX 2512	

### • Inserts

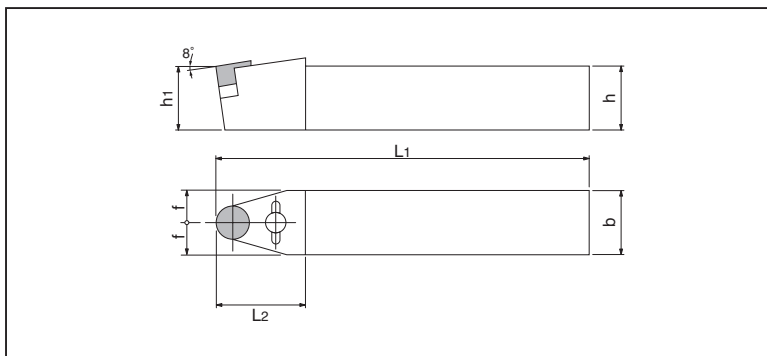
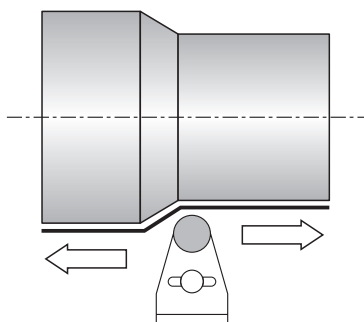
Shape	NTK Part Number	Dimensions (mm)		
		d	s	$\theta$
	<b>RCGX / RPGX 060700</b>	6.35	7.94	120°
	<b>090700</b>	9.525		
	<b>120700</b>	12.70		
	<b>151000</b>	15.875		
	<b>191000</b>	19.05		
	<b>251200</b>	25.4	12.70	

Shape	NTK Part Number	d	s	Shim
				HARCGN
	<b>RCGN 060700</b>	6.35	7.94	<b>0607-15</b>
	<b>090700</b>	9.525		<b>0907-15</b>
	<b>120400</b>	12.70	4.76	<b>1204-15</b>
	<b>120700</b>	12.70	7.94	<b>1207-15</b>

### • Parts

Parts	Clamp	Shim	Clamping screw	Spring Pin	Washer	Wrench
<b>Toolholder</b>						
<b>CRDCN3225P06 / 2525M06</b>	HC35KR-4099	HARCGX06	BS0520		WS-5	LW-3
<b>CRDCN3225P09 / 2525M09</b>	HC35KR-6075	HARCGX0908V	BS0625	2X8AW	WS-6	LW-4
<b>CRDCN3225P12 / 2525M12</b>	HC35KR-6076	HARCGX1208V	BS0625	2.5X8AW	WS-6	LW-4
<b>CRDCN3232P15</b>	CC08M	HARCGX1510V	BS0835W	2.5X8AW	SR08	LW-4
<b>CRDCN3232P19</b>	CC08M	HARCGX1910V	BS0835W	2.5X8AW	SR08	LW-4
<b>CRDCN3232P25</b>	AMS-10	HARCGX2512V	AOB-10S	2.5X8AW		LW-6

# CRDN



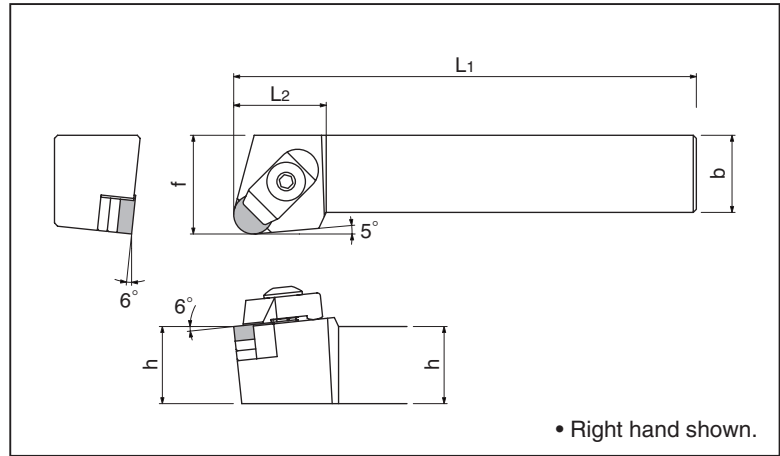
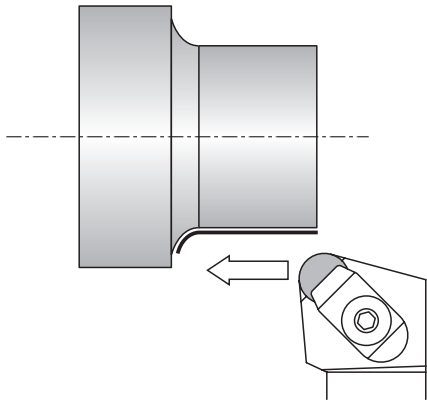
## • Holders and Applicable Inserts

Toolholder	Dimensions (mm)					Insert	
	$h=h_1$	b	$L_1$	$L_2$	f		
<b>CRDNN 2525M09</b>	25	25	150	25	12.5	RNGN0904	RNGN0907
<b>3225P09</b>	32	25	170	30	12.5		
<b>2020K12</b>	20	20	125	34	10	RNGN1204	RNGN1207
<b>2520M12</b>	25	20	150	34	10		
<b>2525M12</b>	25	25	150	34	12.5		
<b>3225P12</b>	32	25	170	34	12.5		
<b>3232P12</b>	32	32	170	34	16	RNGN1504	RNGN1507
<b>2525M15</b>	25	25	150	40	12.5		
<b>3225P15</b>	32	25	170	40	12.5		
<b>3225P19</b>	32	25	170	40	12.5	RNGN1904	RNGN1907

## • Parts

Parts	Clamp	Clamping screw	Shim	Shim screw	Washer	Wrench	
<b>Toolholder</b>							
<b>CRDNN 2525M09</b>	CC08MS	BS0835W	ARN32	M3×12	SR08	LW-4	
<b>3225P09</b>		BS0829W	ARN42				
<b>2020K12</b>	CC08M	BS0835W					ARN42
<b>2520M12</b>			HARN52				
<b>2525M12</b>			HARN62				
<b>3225P12</b>							
<b>3232P12</b>							
<b>2525M15</b>							
<b>3225P15</b>							
<b>3225P19</b>							

## CRGN

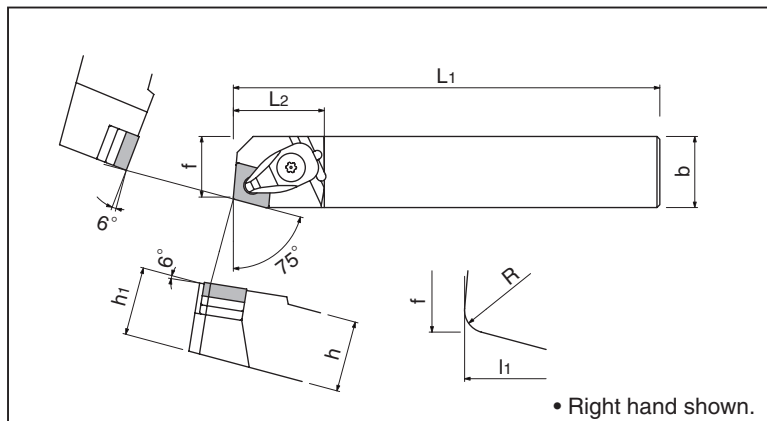
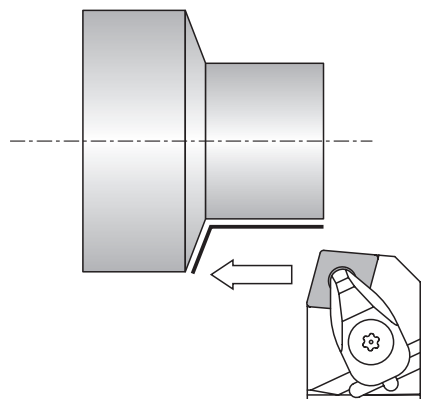


### • Holders and Applicable Inserts

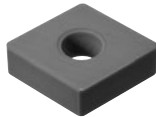
Toolholder	Dimensions (mm)					Shim	Shim screw	Clamp	Clamp Screw	Insert
	h	b	L <sub>1</sub>	L <sub>2</sub>	f					
<b>CRGN<sup>®</sup>/L 2020 K12</b>	20	20	125	30	25	ARN42	M3 × 12	CC08M	BS0829W	RNGN1204
<b>2520 M12</b>	25	20	150	30	25				RNGN1204	
<b>2525 M12</b>	25	25	150	30	32				RNGN1207	
<b>3225 P12</b>	25	25	170	30	32					
<b>3225 P15</b>	32	25	170	32	32	HARN52	M4 × 8		RNGN1504 / RNGN1507	
<b>3225 P19</b>	32	25	170	33	32	HARN62			RNGN1904 / RNGN1907	



## WCBN



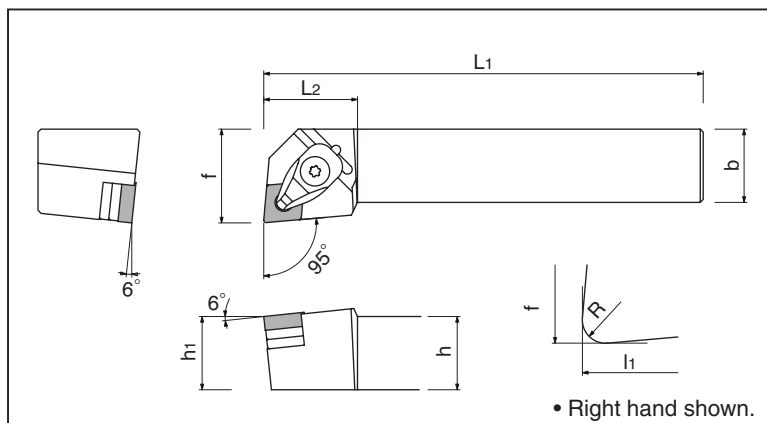
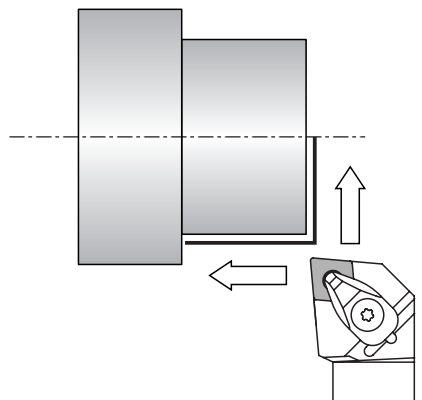
### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
WCBN <sup>®</sup> /L 2525M12	25	25	150	25	22	32	CNGA1204	CNGA1207
3225P12	32	25	170	32	22	32		

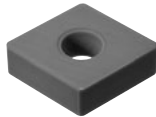
\* Conform to master insert which has 0.8mm corner R.

• A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## WCLN



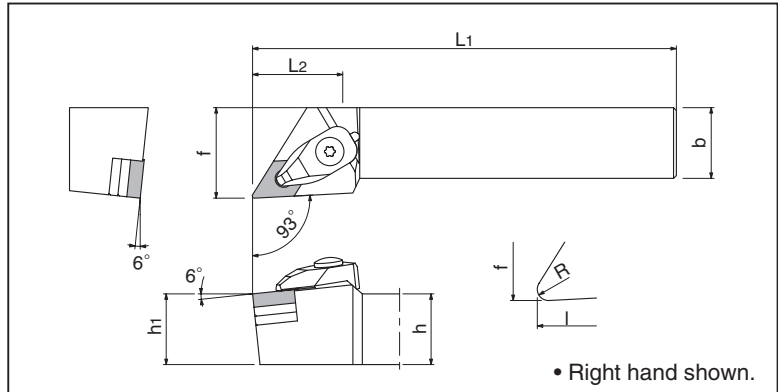
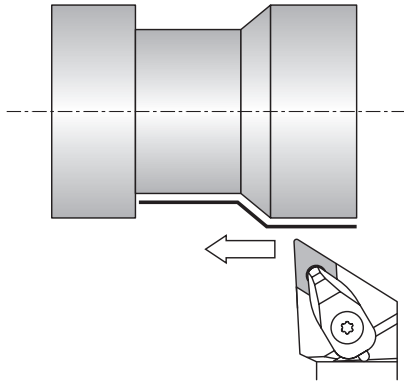
### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
WCLN <sup>®</sup> /L 2525M12	25	25	150	25	32	32	CNGA1204	CNGA1207
3225P12	32	25	170	32	32	32		

\* Conform to master insert which has 0.8mm corner R.

• A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## WDJN



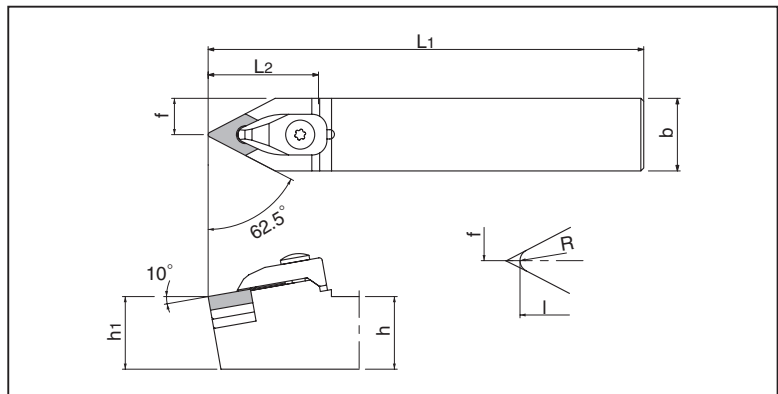
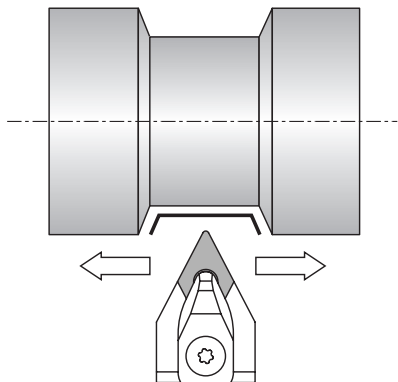
### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WDJN<sup>®</sup>/L 2525M15</b>	25	25	150	25	32	32	DNGA1504	DNGA1507
<b>3225P15</b>	32	25	170	32	32	32		
<b>3232P15</b>	32	32	170	32	39	32		

\* Conform to master insert which has 0.8mm corner R.

• A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## WDNN



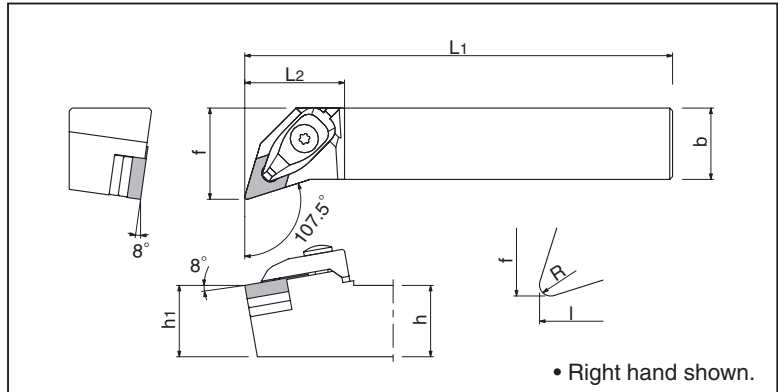
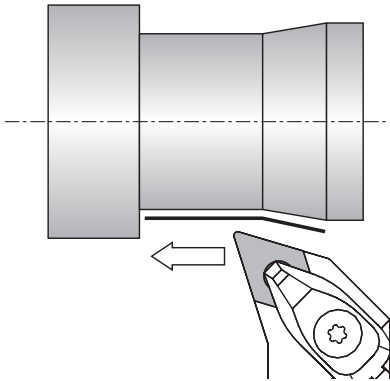
### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WDNNN 2525M15</b>	25	25	150	25	16	38	DNGA1504	DNGA1507
<b>3225P15</b>	32	25	170	32	16	38		
<b>3232P15</b>	32	32	170	32	23	38		

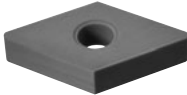
\* Conform to master insert which has 0.8mm corner R.

• A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

# WDQN



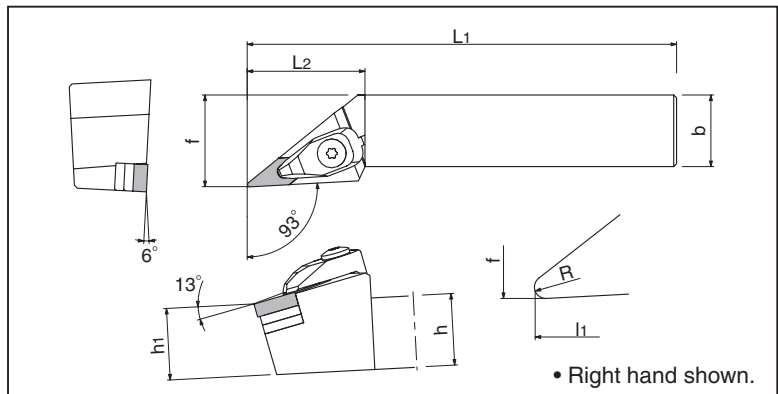
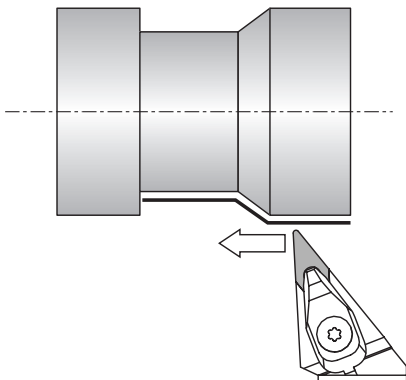
## • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WDQN<sup>R</sup>/L2525M15</b>	25	25	150	25	32	35	DNGA1504	DNGA1507
<b>3225P15</b>	32	25	170	32	32	35		
<b>3232P15</b>	32	32	170	32	39	35		


\* Conform to master insert which has 0.8mm corner R.

· A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

# WVJN



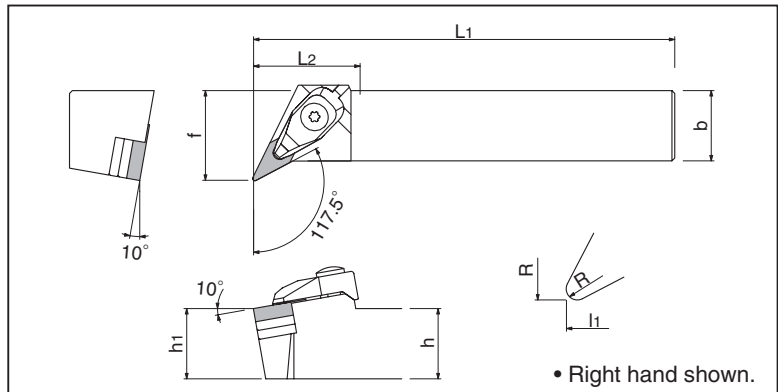
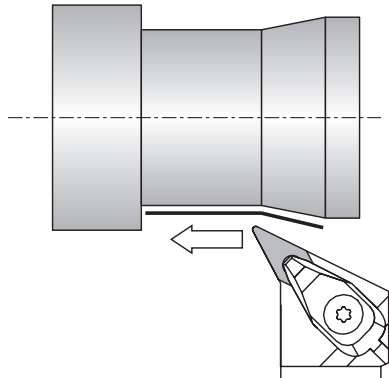
## • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WVJN<sup>R</sup>/L2525M16</b>	25	25	150	25	32	35	VNGA1604	VNGA1607
<b>3225P16</b>	32	25	170	32	32	35		
<b>3232P16</b>	32	32	170	32	39	35		


\* Conform to master insert which has 0.8mm corner R.

· A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## WVQN



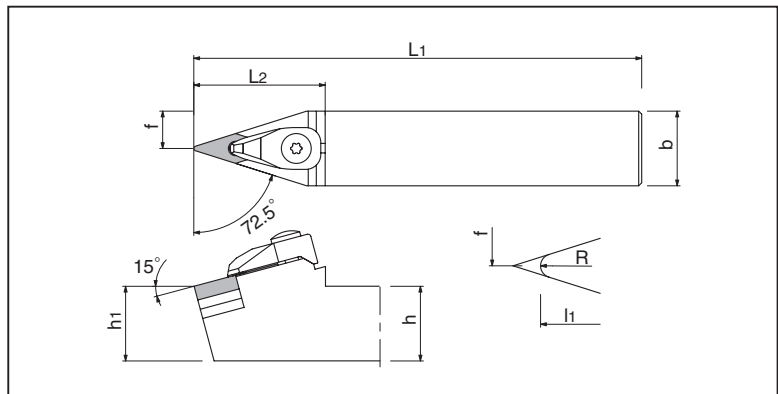
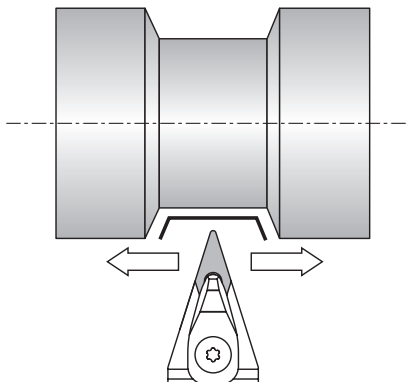
### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WVQN<sup>R</sup>/L2525M16</b>	25	25	150	25	32	38	VNGA1604	VNGA1607
<b>3225P16</b>	32	25	170	32	32	38		
<b>3232P16</b>	32	32	170	32	39	38		

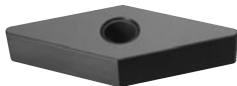
\* Conform to master insert which has 0.8mm corner R.

· A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## WVVN



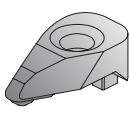
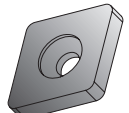
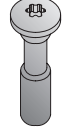

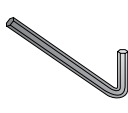

### • Holders and Applicable Inserts

Toolholder	Dimensions (mm)						Insert	
	h	b	L <sub>1</sub>	h <sub>1</sub>	f	L <sub>2</sub>		
<b>WVNN 2525M16</b>	25	25	150	25	16	38	VNGA1604	VNGA1607
<b>3225P16</b>	32	25	170	32	16	38		
<b>3232P16</b>	32	32	170	32	23	38		

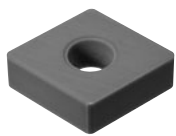
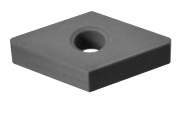


\* Conform to master insert which has 0.8mm corner R.

· A holder comes with two shims. An insert 7.94 mm thick can likewise be mounted by removing one shim.

## • Parts

Parts	Clamp	Shim	Clamp screw	Shim screw	Wrench	Spring
<b>Toolholder</b>						
WCBN WCLN	DC6CN	ACN 423	AOS-6×30W	FSS15-3.0×12	LLR-T20 LLR-T10	ASGL6-D
WDJN WDNN WDQN	DC6DN	ADN 422				
WVJN WVQN WVVN	DC6VN	AVN 323				

## • Inserts

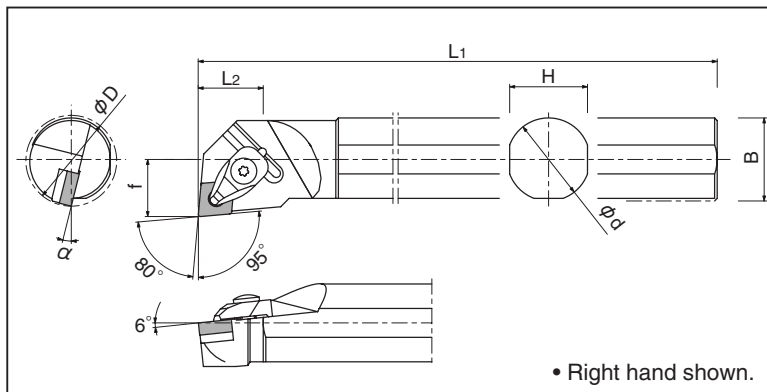
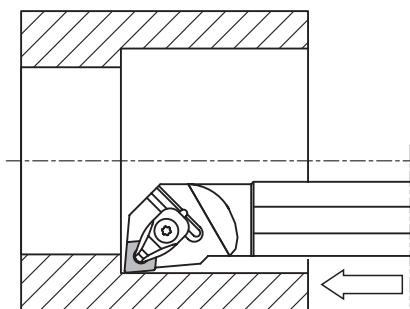
Shape	NTK Part Number		Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1
	CNGA 120408 120412 120416	T00520	12.7	4.76	0.8	●	○	○
		T01020				○	○	○
		T00520				●	●	○
		T01020			1.2	○	○	○
		T00520			1.6	●	○	○
		T01020				○	○	○
	DNKA 150408 150412 150416	T00520	12.7	4.76	0.8	●	○	○
		T01020				○	○	○
		T00520				●	○	○
		T01020			1.2	○	○	○
		T00520			1.6	●	○	○
		T01020				○	○	○
	RNGN 120400	T00520	12.7	4.76	—	○	○	●
		T01020				●	○	●
	120700	E002	7.94	—	○	○	○	
		T00520			●	●	●	
		T01020			○	●	●	
		T02020	—	●	○	●	●	
	150700	T00520	15.88	—	○	●	●	
190600	T00520	19.05	6.35	—	○	○	○	
190700	T00520	7.94	—	●	●	○		
	T01020			●	●	●		
	VNGA 160404 160408 160412	T00520	9.525	4.76	0.4	○	○	○
		T00520			0.8	○	○	○
		T00520			1.2	○	○	○

● : Stock ○ : Available

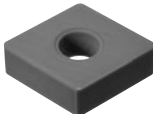
E.P. : Edge Preparation

## WCLN

Minimum machining diameter  $\phi 32 \sim$



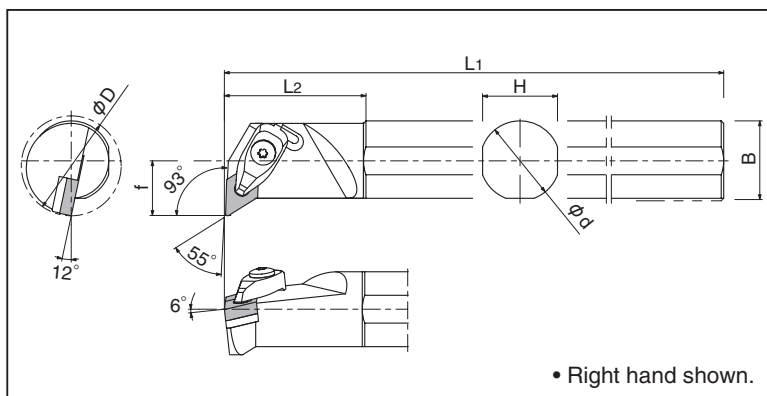
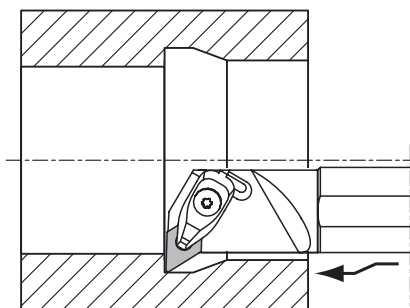
• Right hand shown.

Holder	Minimum machining diameter	Dimensions (mm)							Insert 
		$\phi D$	$\phi d$	H	B	$L_1$	f	$L_2$	
S25R-WCLN <sup>®</sup> /L12	32	25	24	24.5	200	17	40	14	CNGA1204
S32S-WCLN <sup>®</sup> /L12	40	32	30	31	250	22	50	12	
S40T-WCLN <sup>®</sup> /L12	50	40	38	39	300	27	60	10	
S50U-WCLN <sup>®</sup> /L12	63	50	47	48.5	300	35	65	8	

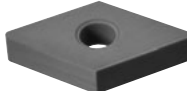
\* Conform to master insert which has 0.8mm corner R.

## WDUN

Minimum machining diameter  $\phi 40 \sim$


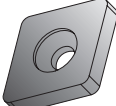
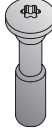

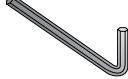
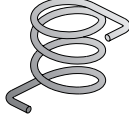


• Right hand shown.

Holder	Minimum machining diameter	Dimensions (mm)							Insert 
		$\phi D$	$\phi d$	H	B	$L_1$	f	$L_2$	
S32S-WDUN <sup>®</sup> /L15	40	32	30	31	250	22	50	12	DNAG1504

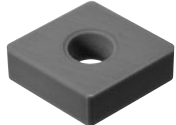
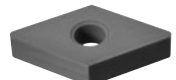
\* Conform to master insert which has 0.8mm corner R.

## • Parts

Parts	Clamp	Shim	Clamp screw	Shim screw	Wrench	Spring
<b>Toolholder</b>						
<b>WCLN</b>	DC6CN	ACN 423	AOS-6×30W	FSS15-3.0×12	LLR-T20 LLR-T10	ASGL6-D
<b>WDUN</b>	DC6DN	ADN 422				

Note: Special shim is needed for insert nose radius 1/16" or larger.

## • Inserts

Shape	NTK Part Number		Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1
	CNGA 120408	T00520	12.7	4.76	0.8	●	○	○
		T01020				○	○	○
	120412	T00520			1.2	●	●	○
		T01020				○	○	○
	120416	T00520			1.6	●	○	○
		T01020				○	○	○
	DNGA 150408	T00520	12.7	4.76	0.8	●	○	○
		T01020				○	○	○
	150412	T00520			1.2	●	○	○
		T01020				○	○	○
	150416	T00520			1.6	●	○	○
		T01020				○	○	○

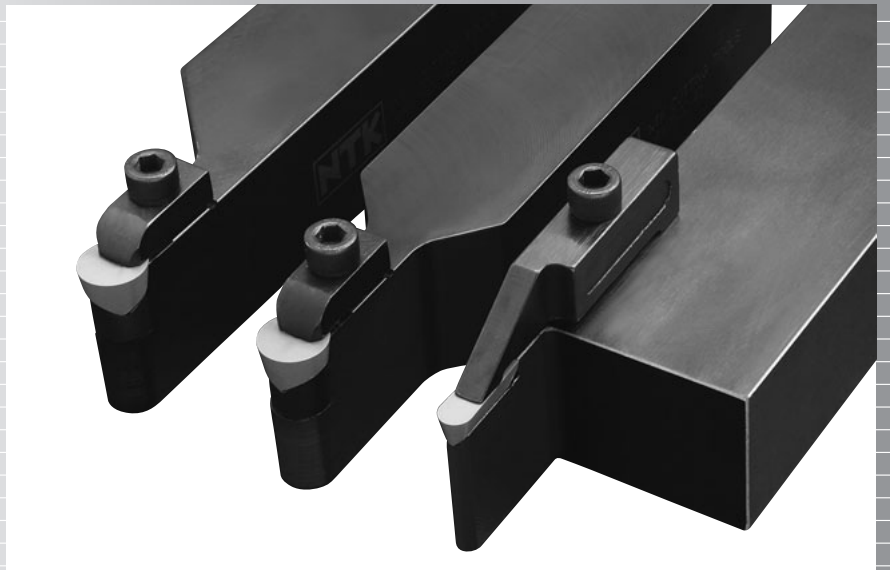
● : Stock ○ : Available

E.P. : Edge Preparation

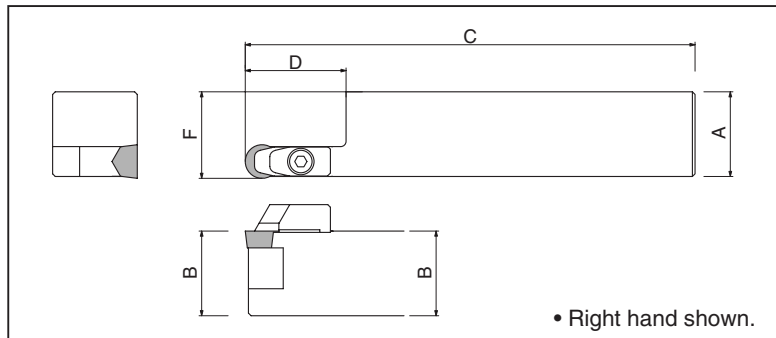
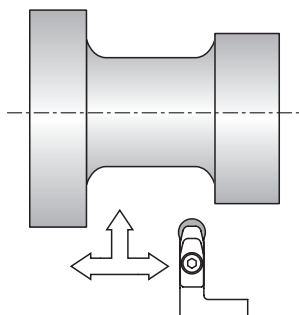
NIPT



# Holder Profiling & Grooving



## CRCP

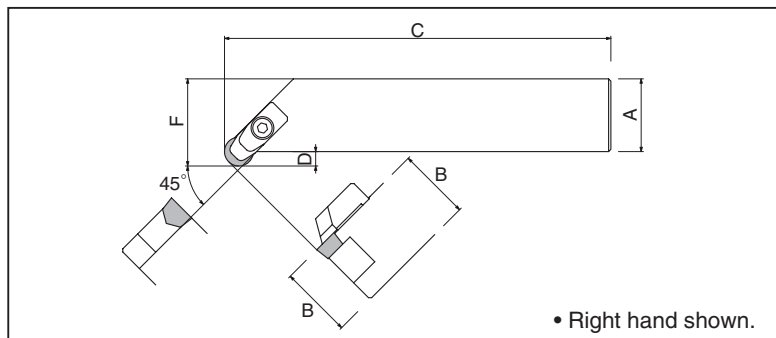
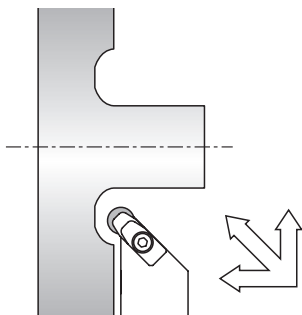


### • Toolholders

(INCH)

NTK Toolholder NO.	Dimensions(INCH)					Shim	Shim Screw	Clamp	Clamp Screw	Inserts
	A	B	C	D	F					
CRCP <sup>®</sup> /L16-2V-D	1.00	1.00	6.00		1.25	ARCGX23-0	3-48x3/8 B.H.C.S.	R.H. CRR-2V L.H. CRL-2V	1/4-20x1 S.H.C.S	RCGX0607 and RPGX0607
CRCP <sup>®</sup> /L20-2V-D	1.25	1.25	6.00	0.75	1.50					
CRCP <sup>®</sup> /L24-2V-F	1.50	1.50	8.00		1.75					
CRCP <sup>®</sup> /L16-3V-D	1.00	1.00	6.00		1.25	ARCGX35-0	6-32x1/2 B.H.C.S.	CRN-3V	#10-32x1/2 S.H.C.S	RCGX0907 and RPGX0907
CRCP <sup>®</sup> /L20-3V-D	1.25	1.25	6.00	1.13	1.50					
CRCP <sup>®</sup> /L24-3V-F	1.50	1.50	8.00		1.75					
CRCP <sup>®</sup> /L16-4V-D	1.00	1.00	6.00		1.25	ARCGX45-0	10-32x5/8 B.H.C.S.	CRN-4V	1/4-20x3/4 S.H.C.S	RCGX1207 and RPGX1207
CRCP <sup>®</sup> /L20-4V-D	1.25	1.25	6.00	1.50	1.50					
CRCP <sup>®</sup> /L24-4V-F	1.50	1.50	8.00		1.75					

## CRSP

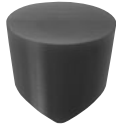
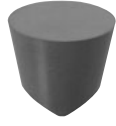


### • Toolholders

(INCH)

NTK Toolholder NO.	Dimensions(INCH)					Shim	Shim Screw	Clamp	Clamp Screw	Inserts
	A	B	C	D	F					
CRSP <sup>®</sup> /L16-2V-D	1.00	1.00	6.00		1.25	ARCGX23-11	3-48x3/8 B.H.C.S.	R.H. CRR-2V-GC L.H. CRL-2V-GC	1/4-20x1 S.H.C.S	RCGX0607 and RPGX0607
CRSP <sup>®</sup> /L20-2V-D	1.25	1.25	6.00	0.25	1.50					
CRSP <sup>®</sup> /L24-2V-F	1.50	1.50	8.00		1.75					
CRSP <sup>®</sup> /L16-3V-D	1.00	1.00	6.00		1.25	ARCGX35-13	6-32x1/2 B.H.C.S.	CRN-3V	#10-32x1/2 S.H.C.S	RCGX0907 and RPGX0907
CRSP <sup>®</sup> /L20-3V-D	1.25	1.25	6.00	0.25	1.50					
CRSP <sup>®</sup> /L24-3V-F	1.50	1.50	8.00		1.75					
CRSP <sup>®</sup> /L16-4V-D	1.00	1.00	6.00		1.25	ARCGX45-15	10-32x5/8 B.H.C.S.	CRN-4V	1/4-20x3/4 S.H.C.S	RCGX1207 and RPGX1207
CRSP <sup>®</sup> /L20-4V-D	1.25	1.25	6.00	0.25	1.50					
CRSP <sup>®</sup> /L24-4V-F	1.50	1.50	8.00		1.75					

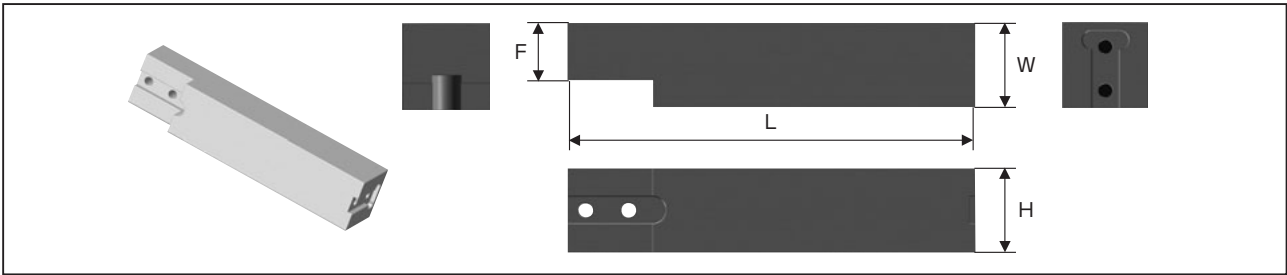
## • Inserts

Shape	NTK Part Number		Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1
	RCGX 060400	T00520	6.35	4.76	—	○	○	○
		T00520			—	○	○	●
	090700	T00520	9.525	7.94	—	●	○	●
		T01020			○	○	●	
	120700	T00520	12.7	—	●	●	●	
T01020	○	○			●			
	RPGX 060400	T00520	6.35	4.76	—	○	○	●
		T00520			9.525	—	○	○
	120700	T00520	12.7	7.94	—	○	○	●
		T01020			○	○	○	

● : Stock ○ : Available

E.P. : Edge Preparation

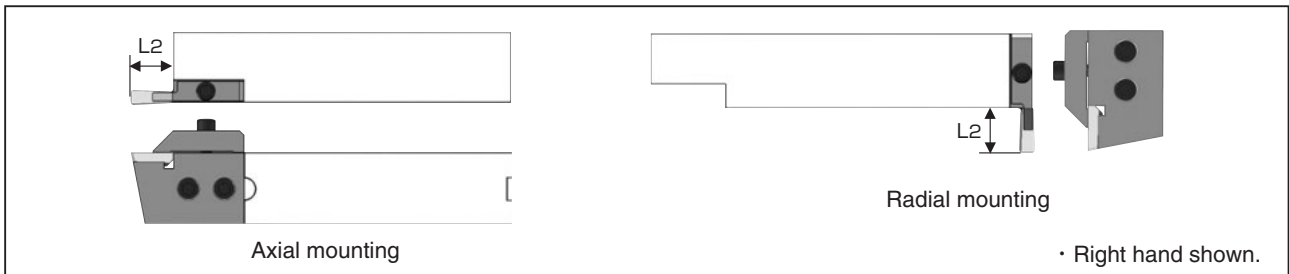
## BGV



### • Shank

Shank	Dimensions (inch)			Anvil Screw
	H	W	L	
<b>BS 20</b>	1.25	1.38	5.5	<b>BAS 20</b>

Note: Shank comes with anvil screws - order anvil separately



### • Anvil

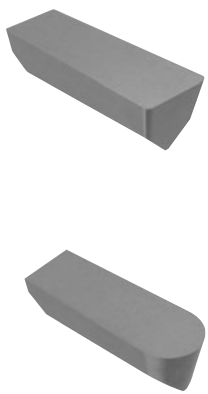
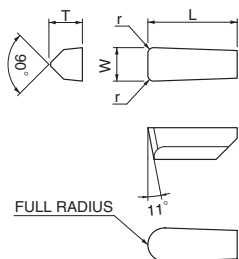
Right hand

	Dimensions	Clamp	Clamp Screw	Insert
	L2 (inch)			
<b>BGVR 043020</b>	.375	<b>BGCR 04</b>	BRCS 2V	<b>VGW 4125</b> <b>4156</b>
<b>054520</b>	.562	<b>BGCR 05</b>		<b>VGW 4156</b> <b>4187</b>
<b>074520</b>	.562	<b>BGCR 07</b>		<b>VGW 6218</b> <b>6250</b>
<b>086020</b>	.750	<b>BGCR 08</b>		<b>VGW 6250</b> <b>6281</b>
<b>106020</b>	.750	<b>BGCR 10</b>		<b>VGW 8312</b> <b>8344</b>
<b>119020</b>	1.125	<b>BGCR 11</b>		<b>VGW 8344</b> <b>8375</b>

Left hand

	Dimensions	Clamp	Clamp Screw	Insert
	L2 (inch)			
<b>BGVL 043020</b>	.375	<b>BGCL 04</b>	BRCS 2V	<b>VGW 4125</b> <b>4156</b>
<b>054520</b>	.562	<b>BGCL 05</b>		<b>VGW 4156</b> <b>4187</b>
<b>074520</b>	.562	<b>BGCL 07</b>		<b>VGW 6218</b> <b>6250</b>
<b>086020</b>	.750	<b>BGCL 08</b>		<b>VGW 6250</b> <b>6281</b>
<b>106020</b>	.750	<b>BGCL 10</b>		<b>VGW 8312</b> <b>8344</b>
<b>119020</b>	1.125	<b>BGCL 11</b>		<b>VGW 8344</b> <b>8375</b>

Note: Anvil comes with clamp & clamp screw

Shape	NTK Part Number		Dimensions				Ceramics		
		Metric	W	R	T	L	SX9	SX5	WA1
 	VGK	8250-2	6.35	0.8	8.33	25.4	○	○	○
		8312-R	7.92	FULL-R			○	○	○
		8312-2		0.8			○	○	○
		8312-4		1.6			○	○	○
		8375-2		9.525			0.8	○	○
		8375-4	1.6				○	○	○
	VGW	4125-R	3.18	FULL-R	4.75	12.7	○	○	●
		4125-1		0.4			○	○	●
		4125-2		0.8			○	○	●
		4156-R	3.96	FULL-R	○	○	●		
		4156-1		0.4	○	○	●		
		4156-2		0.8	○	○	●		
		4187-R	4.75	FULL-R	○	○	●		
		4187-1		0.4	○	○	●		
		4187-2		0.8	○	○	●		
		6250-R	6.35	FULL-R	6.35	19.05	○	○	●
		6250-1		0.4			○	○	●
		6250-2		0.8			○	○	●
		6250-3		1.2			○	○	●
		6281-R	7.14	FULL-R	○	○	●		
		6281-1		0.4	○	○	○		
		6281-2		0.8	○	○	○		
		6281-3		1.2	○	○	○		
		8312-R	7.92	FULL-R	8.56	25.4	○	○	●
		8312-1		0.4			○	○	○
		8312-2		0.8			○	○	●
		8312-3		1.2			○	○	○
		8312-4	1.6	○	○	●			
		8344-R	8.74	FULL-R	○	○	●		
		8344-1		0.4	○	○	○		
	8344-2	0.8		○	○	○			
	8344-3	1.2		○	○	○			
8344-4	1.6	○	○	○					
8375-R	9.525	FULL-R	○	○	●				
8375-1		0.4	○	○	○				
8375-2		0.8	○	○	●				
8375-3		1.2	○	○	○				
8375-4		1.6	○	○	●				

● : Stock ○ : Available

E.P. : Edge Preparation

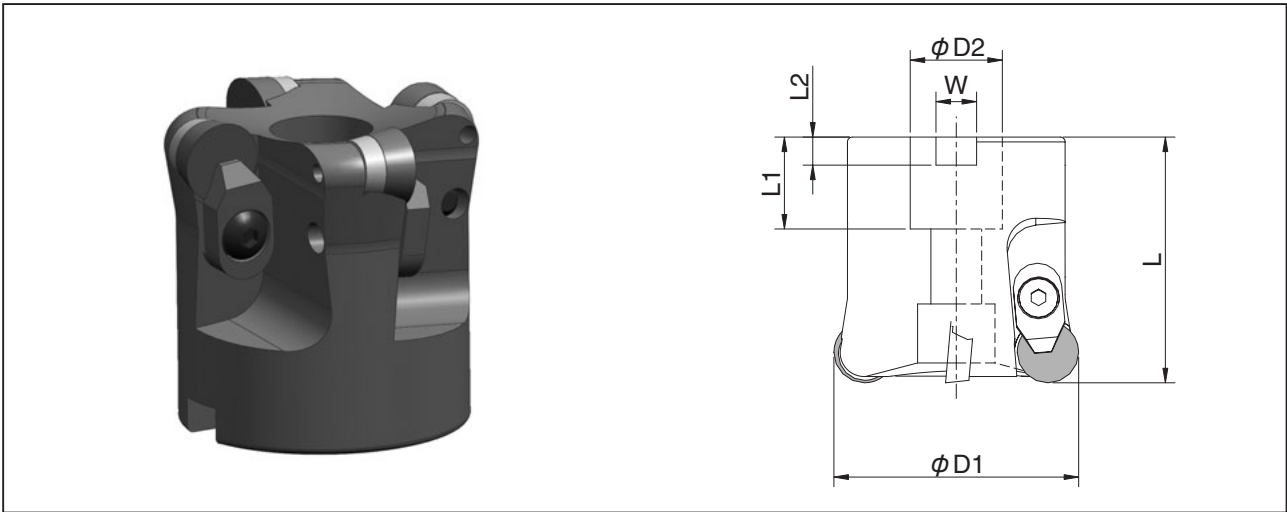
Standard Edge Preparation for WA1 is EX0001 which means 0.05mm or less honing only.  
 Standard Edge Preparation for SX5 & SX9 are T00520 chamfer only.  
 Standard Edge Preparations are not listed in this grooving inserts.

NIPT

# Holder Milling



## RPIW

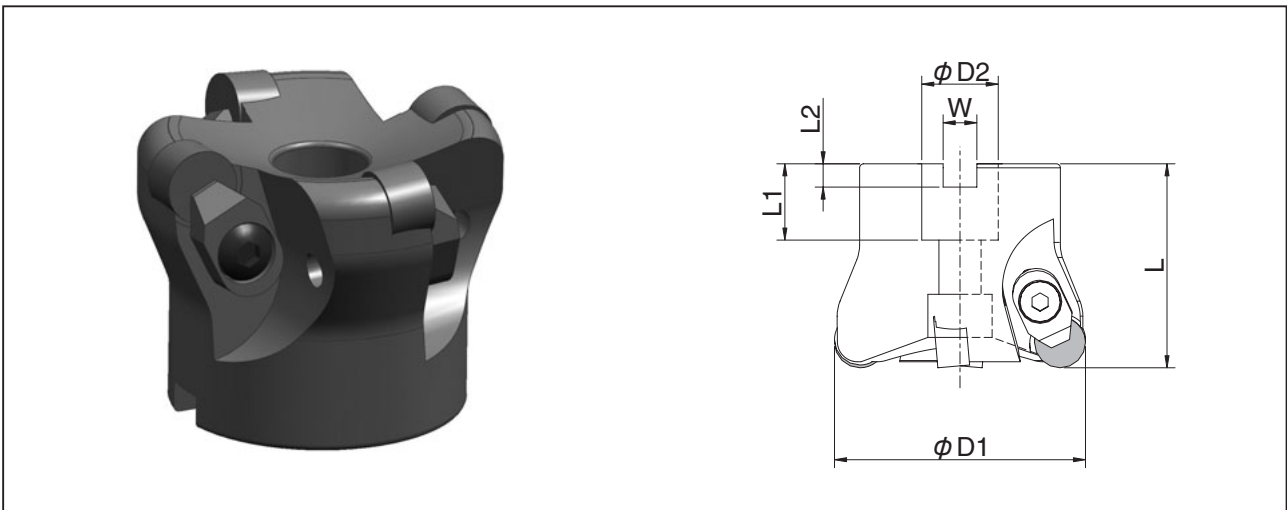


### • Shell Type (Positive Insert)

(INCH)

Cutter	Effective Cutting Dia. $\phi D1$	No. of Inserts	Mounting				Shim	Shim Screw	Clamp	Clamp Screw	Insert	
			Height L	Bore $\phi D2$	Keyway W	L1						L2
RPIW200S075R04	2.000	4	2.000	.750	.310	.748	.216	ARP42A	M3×8	AMS-5ST	AOB-5S-T25	RPGN 1204
RPIW300S100R05	3.000	5		1.000	.380							

## RNIW



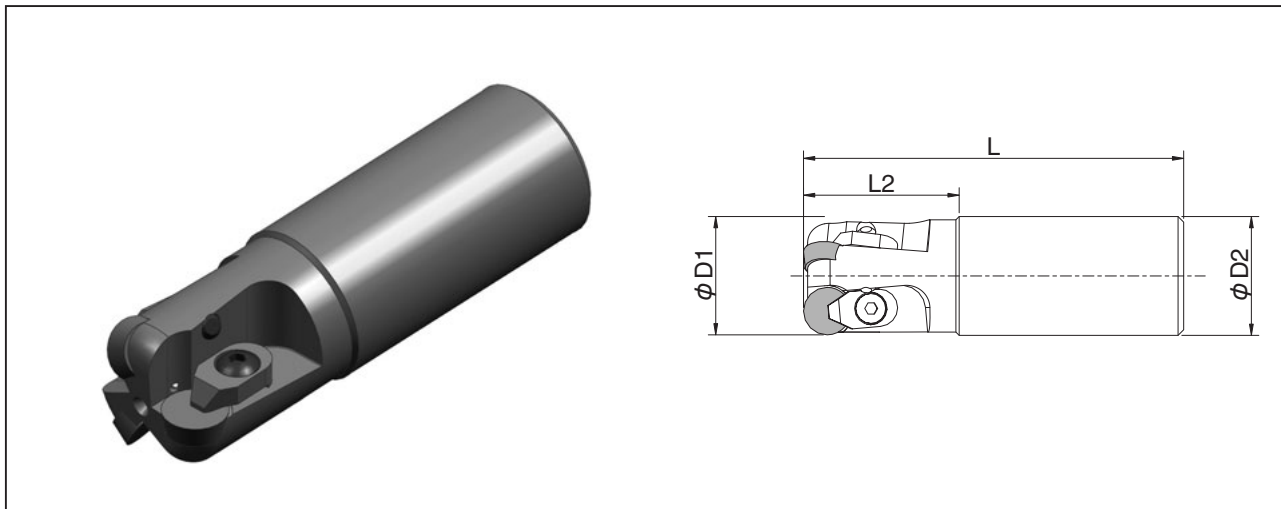
### • Shell Type (Negative Insert)

(INCH)

Cutter	Effective Cutting Dia. $\phi D1$	No. of Inserts	Mounting				Clamp	Clamp Screw	Insert	
			Height L	Bore $\phi D2$	Keyway W	L1				L2
RNIW200S075R03	2.000	3	2.000	.750	.310	.748	.216	AMS-6T	AOB-6S-T30	RNGN 1207
RNIW250S075R04	1pcs	4								
RNIW300S100R05	3.000	5		1.000	.380	.236				



# RPIW





## • End Mill Type (Positive Insert)

(INCH)

Cutter	Effective Cutting Dia. $\phi$ D1	No. of Inserts	Shank Diameter $\phi$ D2	Overall Length L	Head Length L2	Clamp	Clamp Screw	Insert
RPIW125E125R03	1	3	1.250	4.000	1.640	AMT-5T	AOB-5S-T25	RPGN1204
RPIW150E150R03	1.500		1.500		1.830			

## • Inserts

Shape	NTK Part Number		Dimensions			Ceramics		
	Metric	E.P.	IC	T	R	SX9	SX5	WA1
	RNGN 120700	E002	12.7	7.94	-	○	○	○
		T00520				●	●	●
		T01020				○	●	●
		T02020				○	○	○
	RPGN 120400	T00520	12.7	4.76	-	○	○	○
		T01020				○	○	○

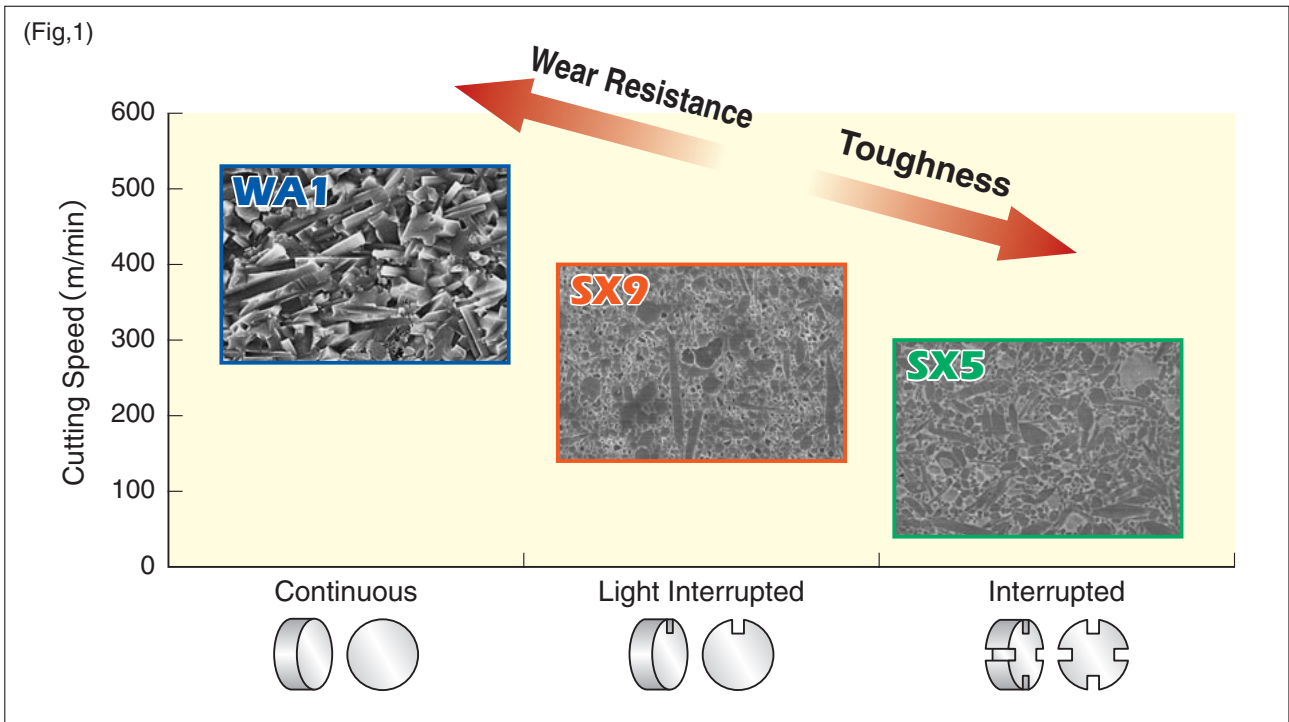
● : Stock ○ : Available

E.P. : Edge Preparation

NIPT

# **Technical Information**

## Introduction of NTK Ceramic Grade



Grade	Application		
SiAlON <b>SX9</b>	<b>Rough</b> 	<b>Semi-Finishing</b> 	<b>Milling</b> 
SiAlON <b>SX5</b>	<b>Rough</b> 	<b>Semi-Finishing</b> 	
Whisker - Reinforced <b>WA1</b>	<b>Grooving</b> 	<b>Finishing</b> 	

## Selection for Successful use

### ■ Use strong Insert shapes.

Maximize geometry for strength productivity



### ■ Use largest Nose Radius

Maximize insert nose radius for strength and longer tool life.

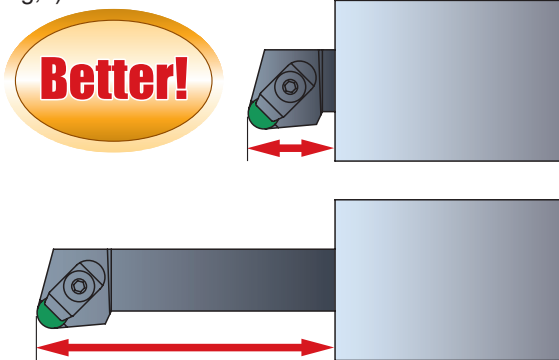
Take into account that the larger the nose radius the greater the tool pressure.

Typical application machining nickel-based alloys use RNG1207 insert for roughing and CNG1204 for finishing.

### ■ Minimise overhang

Too much overhang may cause chatter or insert breakage

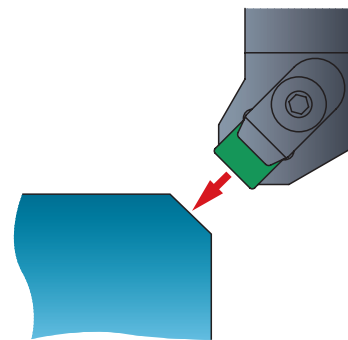
(Fig,2)



### ■ Pre-Chamfering

Pre-chamfering the part reduces the potential for insert chipping or breaking upon entry or exit point of work material.

(Fig,3)



### ■ No dwelling

Inserts wear out when rubbing the part instead of cutting.

### ■ Coolant

When turning with SX9 ,SX5 ,WA1 ,ZM3 & QM3 a flood coolant condition should be used.

In some cases where a high interruption is encountered it may be best to cut-off the coolant.

No coolant should be used while milling with SX5 & SX9.

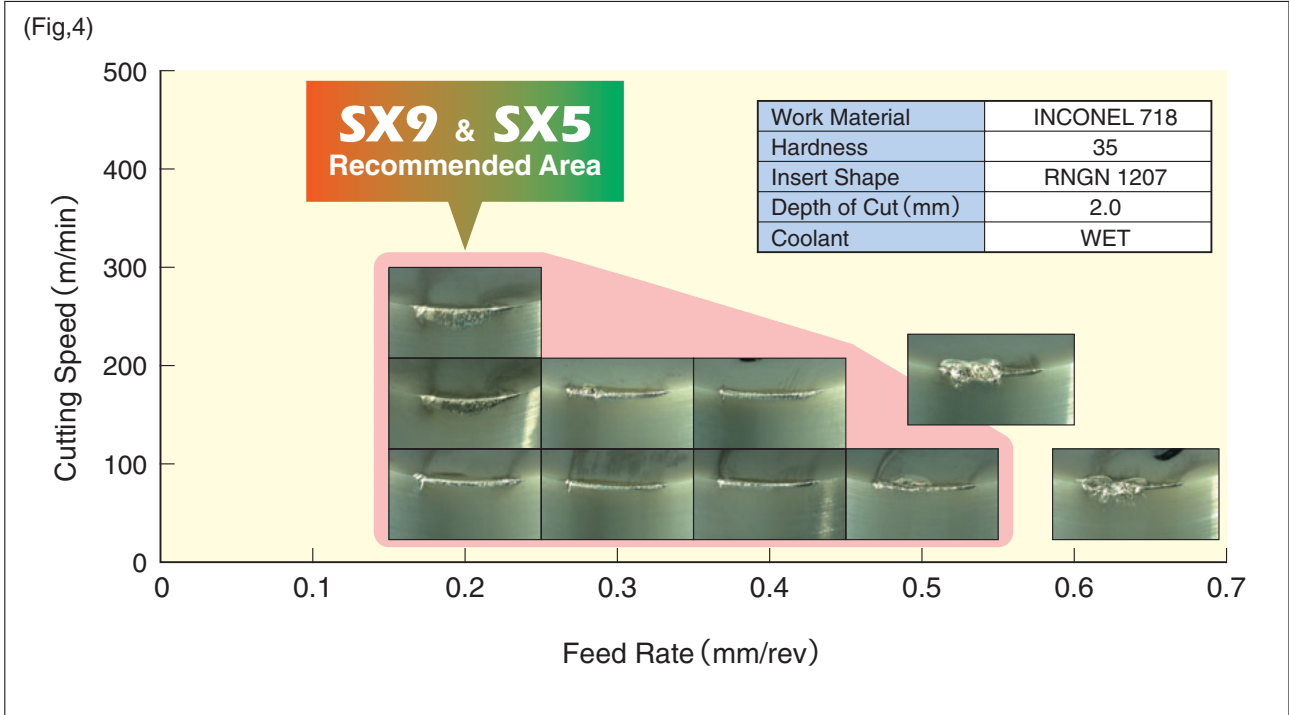
### ■ Edge preparations.

Typical cutting tool applications machining nickel-based alloys require the insert cutting edge to be sharp.

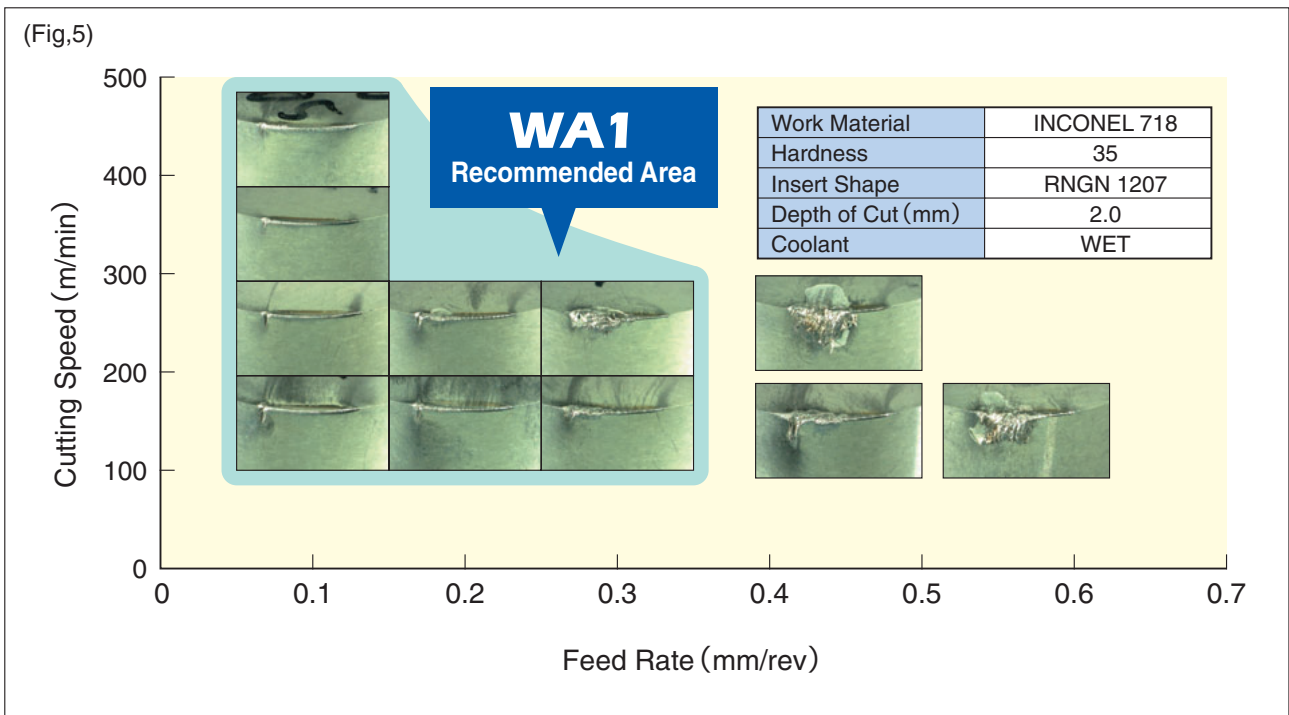
Using slight T-land is effective to reducing notching.

## Application Range For Nickel Based Alloys

### ● SX9 & SX5



### ● WA1



## Recommended Grades for High Temperature Alloys

Machinability rating and recommended insert grades for machining various High temperature alloys are shown in Table1.

Table1

Work Material	Rating <b>B</b>	Rough Turning Scale		Rough no scale & semi Finish		Grooving		Milling	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Airesist	1.6	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Astrology	0.8	SX5	SX9	WA1	SX9	WA1	SX5	SX9	SX5
Hastelloy C	1.8	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Inco625	0.8	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Inco713	1.0	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Inco718	1.0	SX5	SX9	WA1	SX9	WA1	SX5	SX9	SX5
Inco738	1.2	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Inco909	1.5	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Inco925	1.0	SX5	SX9	WA1	SX9	WA1	SX5	SX9	SX5
Mar M247	1.0	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Udimet720	0.8	SX9	SX5	WA1	SX9	WA1	SX5	SX9	SX5
Waspalloy	0.8	SX5	SX9	WA1	SX9	WA1	SX5	SX9	SX5

## How To Find Recommended Insert Grade

Find recommended insert grade from above Table 1 in consideration of your work material & application. Contact your local NTK representative, if more information is needed.

## How To Find Recommended Cutting Speed

- 1) Find cutting speeds "A" shown in "Grade Selection" **on page 7**.
- 2) Find machinability rating "B" of your work material from above **Table 1**.
- 3) Find machinability rating "C" of your work hardness from **Table 2** below.

## Recommendation for Hardness

Table2

HRC (Hardness)	< 30	30	35	40	45
<b>C</b>	1.3	1.15	1	0.85	0.7

## Recommended Cutting Speed

$$A \times B \times C = \text{Recommended Cutting Speed (m/min)}$$

## How To reduce Notch Wear

The usual failure mode for ceramic inserts cutting Nickel-Based Alloys is "Notching". Notch wear can be reduced by re-programing. Tool life should improve with by following these guidelines. The following information should help to minimize this problem.

### 1 Depth of Cut

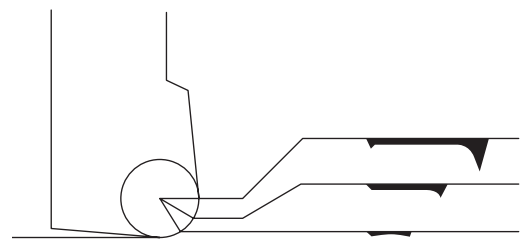
#### ● GUIDELINES FOR SUCCESSFUL USE OF SX9

**Depth of Cut Notching.** This mode of insert failure is typical when machining nickel based alloys. It must be controlled to prevent a catastrophic failure of the insert's cutting edge. The following information should help to minimize this problem.

**Depth of Cut.** Prime consideration should be given to the effect of depth of cut upon insert tool life.

There is a direct relationship between the insert radius size and the maximum depth of cut which should be taken. See the chart below for recommendations.

(Fig,6)



#### Recommended Depth of Cut Range

Round Insert	Maximum D. of C.	*Insert Radius	Maximum D. of C.
6.35	1.5	0.8	0.2
9.525	2.3	1.2	0.3
12.7	3.2	1.6	0.4
25.4	6.4	2.4	0.6

\*Optimum D. of C. is 5 -15% of the Insert diameter based on 0° lead angle

### 2 Lead Angle

#### Lead Angles.

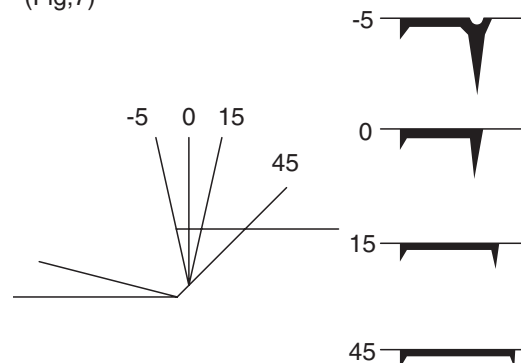
When cutting nickel based alloys consideration should be given to using the largest lead angle possible. When using large lead angles, the cutting forces are spread over a larger surface area of the insert. This will also improve tool life and surface finish while reducing notching. As the lead angle increases the chip will flow more easily.

#### Feeds.

Utilize the superior strength characteristic of SX9 silicon nitride ceramic. If excessive wear is encountered while machining high nickel based materials, increase the feed rate thus minimizing the cutting time.

#### ● Typical Insert Wear Pattern Showing the Effect of Various Lead Angle Changes and the Resulting increase of Depth of Cut Notching.

(Fig,7)

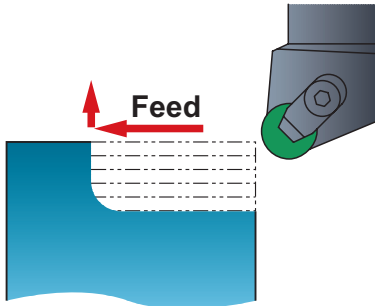




### 3 Programming for Rough machining

#### Same Depth of Cut

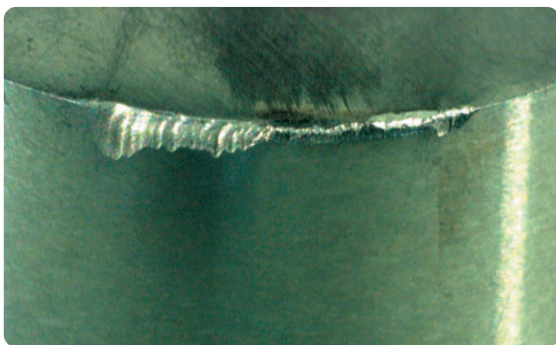
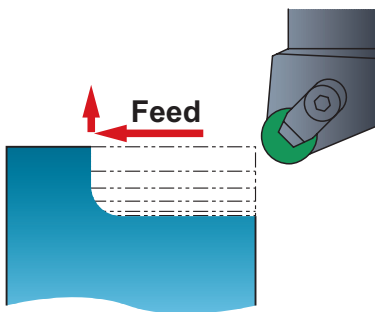
(Fig,8)



Note) Notch wear on the insert cutting edge as shown in (Fig,8) is the result of multiple passes being taken at the same depth of cut. This type of wear will minimize tool life. The following programming examples will help to minimize this mode of failure.

#### Varying Depth of Cut

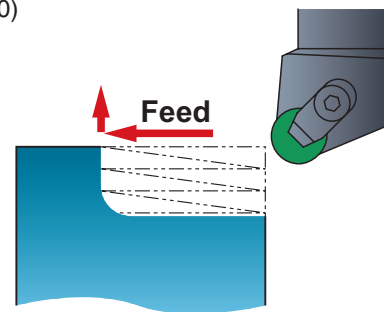
(Fig,9)



Note) Another programming change that may help to reduce notching is by varying the depth of cut. Again, the same principle applies, notching takes place at various points on the cutting edge rather than concentrated at one point as (Fig,9).

#### Ramping

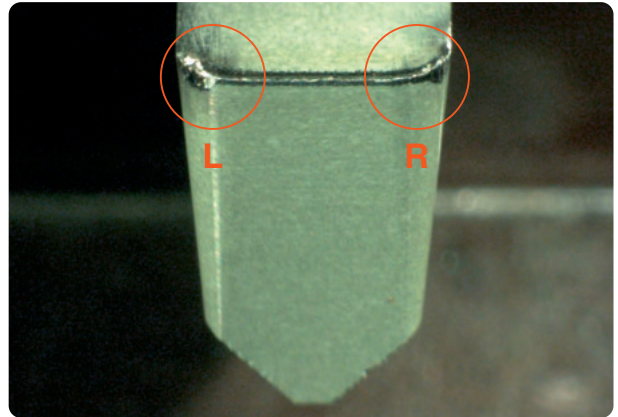
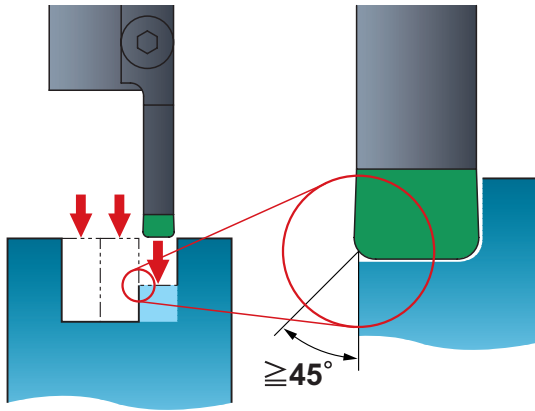
(Fig,10)



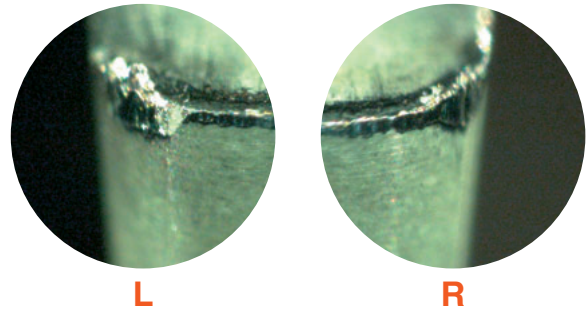
Note) Programming " Ramping " cuts in the same cutting direction is one of the best procedures to use to minimize notching. By varying the DOC, wear is distributed over the entire cutting edge not on one point.

## 4 Programming for Grooving

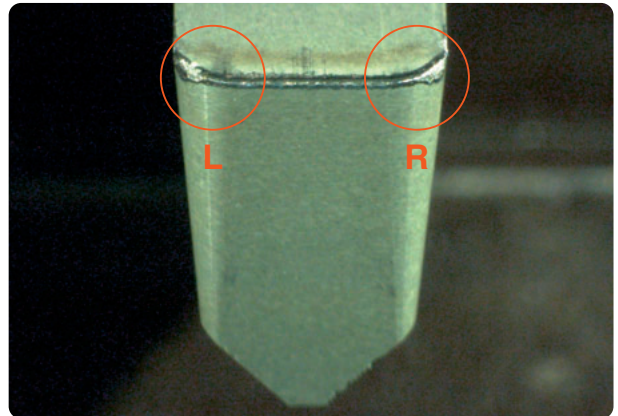
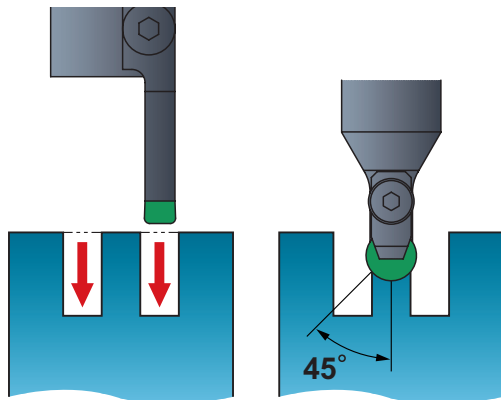
(Fig,11)



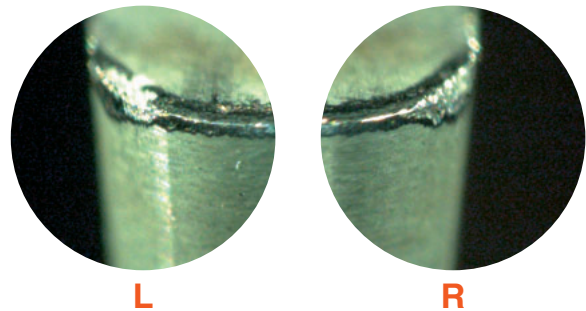
Note) When machining a grooved area with multiple passes during the last remaining plunge the insert radius engages a potentially work hardened area. This programming procedure sets up the potential of corner radius chipping (Ref. L) or notching. The procedure described below (Fig,11) would be a better programming alternative.



(Fig,12)

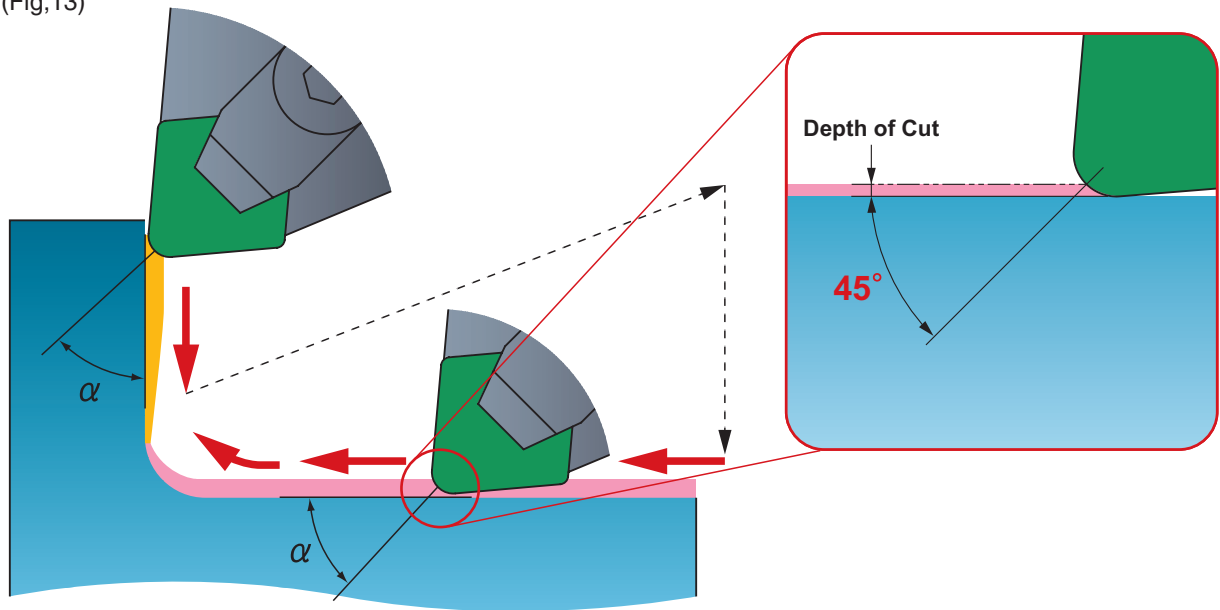


Note) Another option in removing a pocket of material would be shown in (Fig,12). The grooving insert is plunged down both outside walls thus maintaining a good finish. The remaining material can be removed by using a stronger insert shape such as a RCGX style.

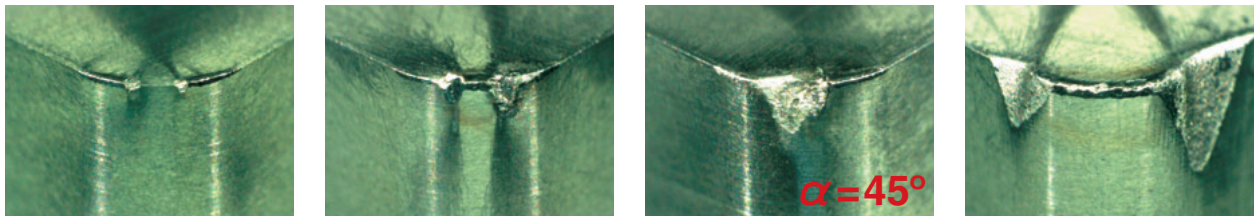


## 5 Programing for Finish machining

(Fig,13)



**Depth of Cut**



**Better**

Note) The correct procedure is to take more material off during the previous roughing application. Then remove the amount of stock suitable for the nose radius of the insert by staying **below the 45° mark of the corner radius**. This will minimize notching and allow a cut from both directions.

(Fig,14)

$\alpha=45^\circ$

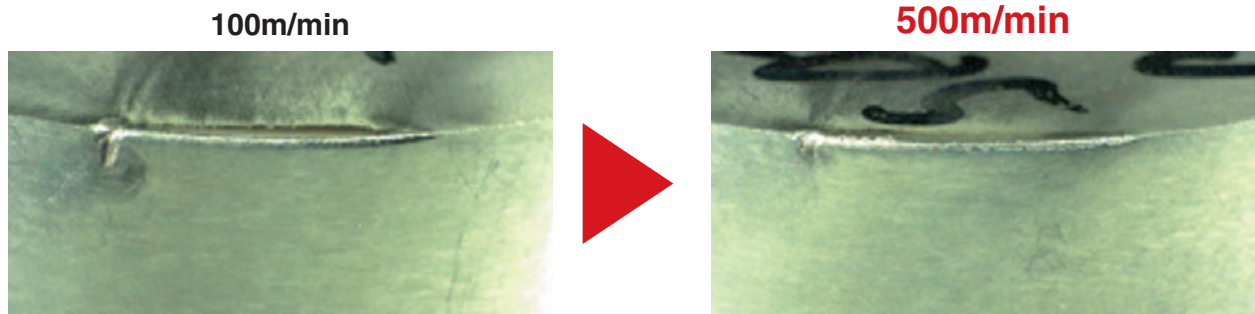
INSERT RADIUS		DEPTH OF CUT	
(mm)	(Inch)	(mm)	(Inch)
0.4	0.0157	0.12	0.0047
0.8	0.0315	0.23	0.0091
1.2	0.0472	0.35	0.0138
1.6	0.0630	0.47	0.0185
2.0	0.0787	0.59	0.0232
2.4	0.0945	0.70	0.0276
3.2	0.1260	0.94	0.0370

## How to reduce Flank Wear

### ● WA1

#### Increase cutting speed

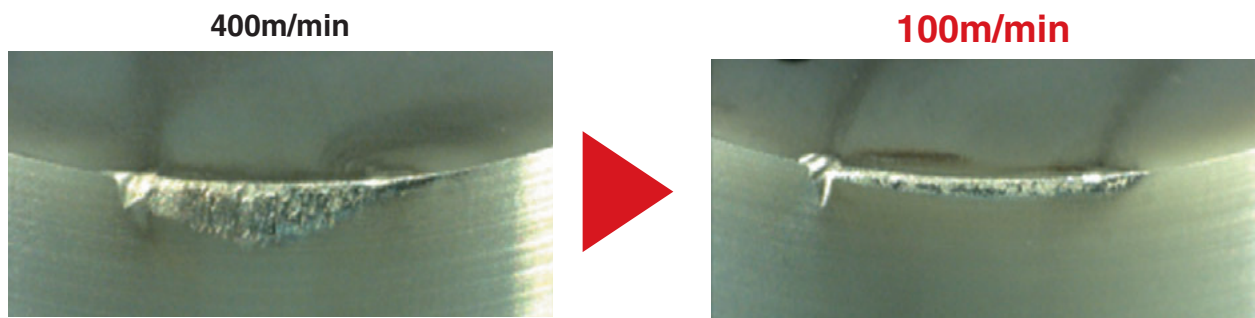
When the cutting speed is increased, less notch wear is noticeable.



### ● SX9 & SX5

#### 1) Decrease cutting speed

When the cutting speed is decreased, less wear is noticeable.

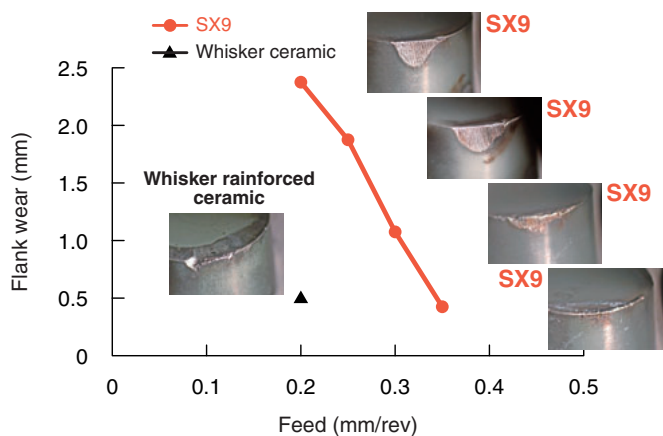


#### 2) Increase feed rate

(Fig.15)

In some case, in order to increase the wear resistance of both SX5 & SX9, the feed must be increased. By increasing the feed and utilizing the toughness of SX5 & SX9, the inserts are off the part sooner causing less wear. Increasing the feed also decreases cycle time and improves productivity and profitability.

Feed rate increased decreases wear amount of SX9



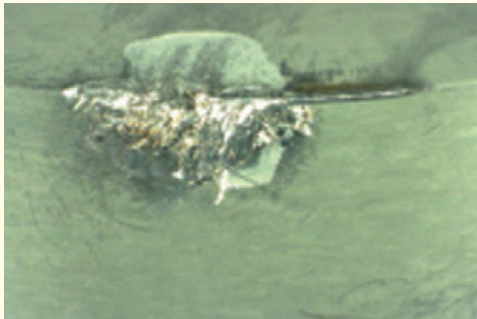
#### Cutting condition

Work material : INCO718  
Insert shape : RNG1207

Cutting Speed : 250m/min  
Depth of Cut : 2mm  
Coolant

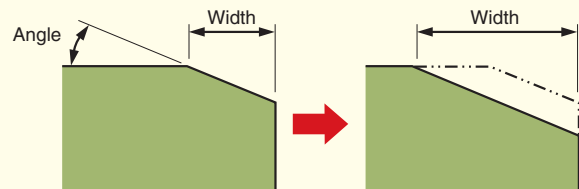
## 6 Problem and Solution

### Flaking



### Solution

Decrease Feed rate  
Use the slight bigger edge preparation



### Breakage



### Solution

Decrease Cutting speed and feed  
Use more Strength insert shape



If Material hardness is not known then more time is needed in the testing procedure trying to find the optimum speed and feed range. As the material hardness increases speed should decrease.

### Chatter

Chatter problem is often caused by too much cutting pressure when machining nickel-based alloys in especially profiling cut or grooving where over hang of holder needed, cutting thin-walled parts or no rigidity machine, and it causes excessive insert wear or insert breakage.

#### Increase speeds and decrease feeds

- Use WA1 with higher speed instead of SX5 or SX9
- Use smaller I.C round insert, or smaller nose radius
- Take insert shape with acute angle possible
- Use positive insert
- Reduce lead angle
- Reduce edge preparation or use sharp edge
- Minimize overhang
- Holder made from heavy metals is effective

# Technical Information

## Ni-based Heat Resistant Alloys

### Material Specifications Cross-Reference List - Aerospace Material Designation

Material condition	Commercial designation	Hardness Brinell HB		Nominal composition Approximate content in %										
		Ann.	Aged	Ni	Cr	Co	Fe	Mo	C	Mn	Si	Al	Ti	Others
Ni-based alloys	Haynes 80A	—	—	70.9	20.0	2.0	3.0	—	0.1	—	—	1.5	2.5	—
	Haynes 75	—	—	73.7	20.0	—	5.0	—	0.12	—	—	0.25	0.4	0.5
	Haynes 263	—	—	51.4	20.0	20.0	—	6.0	0.06	—	—	1.0	1.5	—
	Haynes 600	—	—	75.9	16.0	—	8.0	—	0.08	—	—	—	—	—
	Haynes 625	—	—	61.4	21.0	—	5.0	9.0	0.1	—	—	—	—	3.5
	Haynes X-750	—	—	74.9	16.0	—	7.0	—	0.08	—	—	0.8	0.25	1.0
	Haynes 718	—	—	53.5	18.0	—	19.0	3.0	0.08	—	—	0.5	0.9	5.0
	Inconel 781	—	—	70.0	16.0	—	8.0	—	0.07	2.25	0.15	0.1	3.0	0.2
	Nimocast PE10	—	—	56.4	20.0	—	—	6.0	—	—	—	—	—	9.0
	Nimocast PD16	—	—	43.8	16.5	—	34.0	3.3	0.06	—	—	1.2	1.2	—
	Nimocast PK24	—	—	61.1	9.5	15.0	—	3.0	0.17	—	—	5.5	4.7	1.0
	Nimocast 842	—	—	57.7	22.0	10.0	—	10.0	0.3	—	—	—	—	—
	Nimocast 713	—	—	72.6	13.4	—	—	4.5	0.12	—	—	6.2	1.0	2.3
	Nimonic 95	—	—	49.9	19.5	—	5.0	—	0.11	—	1.0	2.0	3.5	—
	Nimonic 242	—	—	58.0	21.5	10.0	—	10.5	—	—	—	—	—	—
	Nimonic PE13	—	—	49.0	21.8	1.5	18.5	9.0	0.1	0.5	0.5	—	—	0.6
	Nimonic PK25	—	—	49.9	19.0	19.5	—	4.0	0.08	0.8	0.8	2.9	2.9	—
	Nimonic PK31	—	—	53.8	20.0	14.0	—	4.5	—	—	—	0.4	2.3	5.0
	Refractaloy 26	—	—	38.0	19.0	20.0	16.0	3.2	0.03	0.8	1.0	0.2	2.75	—
	Rene 63	—	—	54.4	14.0	15.0	0.5	6.0	0.05	0.1	0.2	3.8	2.5	3.5
	Rene 77	—	—	57.6	15.0	15.0	0.4	4.2	0.17	0.1	0.1	4.3	3.3	—
	Rene 80	—	—	61.0	14.0	9.5	—	4.0	0.15	—	—	—	4.0	8.0
	Rene 95	—	—	64.5	14.0	8.0	—	3.5	0.15	—	—	—	2.5	3.5
	Rene 100	—	—	60.6	10.0	15.0	—	3.0	0.18	—	—	5.5	4.7	—
	Rene 125	—	—	60.0	8.9	10.0	—	2.0	0.1	—	—	4.7	2.5	7.0
	TRW 1800	—	—	70.0	13.0	—	—	—	0.1	—	—	6.0	0.06	10.5
	TRW V1 A	—	—	70.5	6.0	7.5	—	2.0	0.13	—	—	5.4	1.0	6.3
	Udimet 630	—	—	51.0	17.0	—	17.5	3.0	0.04	—	—	0.6	1.1	4.1
Udimet 700	—	—	54.6	15.0	17.5	—	—	0.1	—	—	4.4	3.4	—	
Udimet 710	—	—	55.0	18.0	15.0	0.5	1.5	0.07	—	—	2.5	5.0	1.5	
Annealed or solution treated	Hastalloy B*	140	—	64.3	0.6	1.25	5.5	28.0	0.1	0.8	0.7	—	—	—
	Hastalloy C*	200	—	54.1	16.0	1.25	5.75	17.0	0.07	0.8	0.7	—	—	4.0
	Hastalloy N*	—	—	72.2	7.0	0.25	3.0	16.5	0.06	0.4	0.25	0.5	—	0.21
	Hastalloy W*	—	—	62.7	5.0	1.25	5.5	24.5	0.06	0.5	0.5	—	—	—
	Hastalloy X*	160	—	47.1	22.0	1.5	18.5	9.0	0.1	0.6	0.6	—	—	0.6
	Incoloy 804*	—	—	41.0	29.5	—	26.0	—	0.1	1.0	0.75	0.25	0.6	0.5
	Incoloy 825*	180	—	42.0	21.0	—	30.0	3.0	0.04	—	—	—	1.0	2.0
	Inconel 600*	170	—	75.0	15.5	—	8.0	—	0.05	—	—	—	—	—
	Inconel 601*	150	—	60.0	23.0	—	14.0	—	0.05	—	—	1.4	—	—
	Inconel 604*	180	—	74.4	15.8	—	7.2	—	0.04	0.2	0.2	—	—	0.1
	Inconel 625*	180	—	61.0	21.5	—	2.5	9.0	0.04	0.5	0.5	0.4	0.4	3.6
	Monel 400*	110	—	65.0	—	—	1.5	—	0.12	1.0	—	—	—	32.0
	Monel R-405*	110	—	66.0	—	—	1.2	—	0.15	1.0	—	—	—	31.06
	Nimonic 75*	170	—	75.0	19.5	—	4.0	—	0.12	—	—	—	0.4	—

\* These alloys cannot be hardened by aging process.

USA		UK	France	Germany		Others	Customer designation
SAE	AMS	BS	AFNOR	Werkst.-Nr	DIN1706		
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	5542	—	NC15TNbA	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	5397	HC204	NK15CAT	LW2.4674	NiFe33Cr17Mo	—	
—	—	3146	—	—	—	—	
5391A	—	HC203	NC13AD	2.4670	S-NiCr13Al6MoNb	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
5536E	5754E	HR6,204	NC22FeD	2.4665	NiCr22Fe18Mo	—	
5751A	5753	—	NKOD20ATU	2.4666	NiCr18CoMo	—	
—	—	—	—	—	—	—	
—	—	—	Z6NKCDT38	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	NC14K8	—	—	—	
—	—	—	—	—	NiCo15Cr10MoAlTi	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	2.4668	NiTa9Co8W6CrAl	—	
—	—	—	—	—	NiCr19NbMo	—	
—	—	—	NCKD20AT	2.4636	NiCo15CrMoAlTi	—	
—	—	—	NC18TDA	—	—	—	
5396A	5396	—	ND37FeV	2.4800	S-NiMo30	N10001	
5388C	5388	—	—	2.4602	NiCr17Mo17FeW	N10002	
5771	5607	—	—	—	—	N10003	
—	5786	—	—	—	—	N10004	
5390A	5390	—	NC22FeD	2.4603	—	N06002	
—	—	—	—	—	—	—	
—	—	3072-76	NC21FeDU	2.4858	NiCr21Mo	N08825	
5540	5580	3072-76	NC15Fe	2.4816	NiCr15Fe	N06600	
—	5715	—	—	2.4851	NiCr23Fe	N06601	
—	—	—	—	—	—	—	
—	5666	—	NC22FeDNB	2.4856	NiCr22Mo9Nb	N06625	
4544	4574	3072-76	NU30	2.4360	NiCu30Fe	N04400	
4674	7234	—	—	—	—	N04405	
—	—	HR5,203-4	NC20T	2.4630	NiCr20Ti	—	

## Ni-based Heat Resistant Alloys

### Material Specifications Cross-Reference List - Aerospace Material Designation

Material condition	Commercial designation	Hardness Brinell HB		Nominal composition Approximate content in %										
		Ann.	Aged	Ni	Cr	Co	Fe	Mo	C	Mn	Si	Al	Ti	Others
Aged or solution treated and aged	Astroloy*	—	—	56.9	15.0	15.0	—	5.25	0.06	—	—	4.0	3.5	0.05
	Hastelloy R235*	—	—	61.0	15.0	2.5	10.0	5.5	0.15	0.25	0.6	3.0	2.0	—
	Incoloy 901*	180	300	44.3	12.5	—	34.0	6.0	0.05	0.24	0.12	0.15	2.7	0.15
	Incoloy 903*	—	380	39.0	—	15.0	41.0	—	0.02	—	—	0.7	1.4	3.0
	Inconel 700*	—	350	46.0	15.0	23.5	0.7	3.75	0.12	0.10	0.3	3.0	2.2	—
	Inconel 702*	—	—	79.6	15.6	—	0.35	—	0.04	0.05	0.2	3.0	0.7	—
	Inconel 706*	—	—	42.0	16.0	—	40.0	—	0.03	0.2	0.3	0.4	1.75	—
	Inconel 713*	—	—	75.0	12.5	—	—	4.2	0.12	—	—	6.1	0.8	—
	Inconel 718*	180	380	52.5	19.0	—	19.0	3.0	0.04	0.35	0.35	0.9	0.9	0.1
	Inconel 722*	—	380	74.8	15.0	—	6.5	—	0.04	0.55	0.2	0.6	2.4	—
	Inconel X-750*	—	390	73.0	15.5	—	7.0	—	0.04	0.35	0.35	0.7	2.5	—
	Inconel 751*	—	—	70.0	15.5	—	7.0	—	0.1	1.0	0.5	1.5	2.6	0.5
	Jethete M-252*	—	320	55.3	20.0	10.0	—	10.0	0.15	0.5	0.5	1.0	2.6	—
	MAR-M 246*	—	270	59.5	9.0	10.0	0.2	2.5	0.15	—	—	5.5	1.5	11.5
	MAR-M 421*	—	—	62.3	15.5	10.0	—	1.7	0.15	—	—	4.3	1.75	5.3
	MAR-M 432*	—	—	52.3	15.5	20.0	—	—	0.15	—	—	2.8	4.3	5.0
	Monel K-500*	120	290	64.0	—	—	1.0	—	0.13	0.8	—	2.8	0.6	30.0
	Nimocast 80*	—	—	69.9	20.0	2.0	5.0	—	0.1	—	—	1.0	2.0	—
	Nimocast 90*	—	—	52.9	20.0	18.0	5.0	—	0.1	—	—	1.5	2.5	—
	Nimonic 80A*	—	350	75.0	19.5	—	—	—	0.08	—	—	1.4	2.4	—
	Nimonic 90*	—	346	59.0	19.5	16.5	—	—	0.08	—	—	1.5	2.5	—
	Nimonic 105*	—	320	53.0	15.0	20.0	—	5.0	0.12	—	—	4.7	1.2	—
	Nimonic 115*	—	350	59.0	14.2	13.2	—	4.0	0.16	—	—	5.0	4.0	—
	Nimonic 901*	—	350	44.0	12.5	—	35.0	5.7	0.04	—	—	0.3	2.9	—
	Nimonic 263/C263*	—	275	51.5	20.2	20.0	—	6.0	0.06	—	—	0.5	2.0	—
	Nimonic PE16*	—	250	43.5	16.5	—	34.0	3.3	0.06	—	—	1.2	1.2	—
	Nimonic PK33*	—	350	55.9	18.0	14.0	0.5	7.0	0.05	0.25	0.25	2.1	2.2	—
	R-235*	—	—	63.3	15.0	1.2	10.0	5.5	0.12	0.1	0.3	2.0	2.5	—
	Rene 41	—	—	53.1	19.0	11.0	1.8	10.0	0.09	0.3	0.3	1.5	3.1	—
	Udimet 500*	—	—	51.7	19.0	19.0	—	4.0	0.1	0.1	0.1	3.0	3.0	—
	Udimet 718*	180	380	52.5	18.0	—	18.0	3.0	0.05	—	—	0.6	0.1	5.2
	Waspaloy*	—	—	56.9	19.8	13.5	0.8	4.45	0.07	0.1	0.1	1.4	3.0	—
Cast or cast and aged	GMR 235*	—	—	63.3	15.5	—	10.0	5.2	0.15	0.25	0.6	3.0	2.0	0.06
	GMR 235D	—	—	63.0	15.5	—	4.5	5.0	0.15	0.1	0.3	3.5	2.5	0.05
	IN-100*	—	—	61.6	10.0	15.0	—	3.0	0.18	1.2	0.5	5.5	4.75	—
	Jessop G39*	130	—	67.5	19.5	—	5.0	3.0	0.5	—	—	—	—	4.5
	Jessop G64*	220	—	60.7	11.0	—	2.0	3.0	0.15	—	—	6.0	—	4.0
	Jessop G81*	—	300	79.3	20.0	13.0	—	—	0.05	—	—	1.3	2.3	—
	MAR-M 200*	—	—	69.4	9.0	10.0	—	—	0.15	—	—	5.0	2.0	13.5

\* These alloys can be hardened by an aging process.

\*\* These alloys cannot be hardened by an aging process.



USA		UK	France	Germany		Others	Customer designation
SAE	AMS	BS	AFNOR	Werkst.-Nr	DIN1706		
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	5660	—	ZSNCDT42	LW2.4662	NiFe35Cr14MoTi	N09901	
—	—	—	—	—	—	—	
—	—	—	NK27CADT	—	NiCo29Cr15MoAlTi	—	
—	5550	—	—	—	—	N07702	
—	5702	—	—	—	—	N09707	
—	5391	3146-3	NC12AD	LW2.4670	S-NiCr13Al6MoNb	—	
5383	5589	HR8	NC19FeNB	LW24668	NiCr19Fe19NbMo	N07713	
—	5541	—	NC16FeTi	—	NiCr16FeTi	N07722	
5542G	5582	—	NC16FeTNb	2.4669	NiCr16FeTi	N07750	
—	—	—	—	—	—	N07751	
—	5551	—	—	2.4916	S-NiCr19Co	N07252	
—	—	—	—	2.4675	NiCo10W10Cr9AlTi	—	
—	—	—	—	—	NiCr16Co10WAlTi	—	
—	—	—	—	—	NiCo20Cr16WAlTi	—	
4676	—	3072-76	—	2.4375	NiCu30Al	N05500	
—	—	3146	—	—	—	—	
—	—	—	—	—	—	—	
—	—	Hr401,601	NC20TA	2.4631	NiCr20TiAk	N07080	
—	—	Hr2,202	Nc20ATV	2.4632	NiCr20Co18Ti	N07090	
—	—	HR3	NCKD20ATV	2.4634	NiCo20C15MoAlTi	—	
—	—	HR4	NCK15ATD	2.4636	NiCo15Cr15MoAlTi	—	
5660C	5661A	—	ZSNCDT42	2.4662	NiCr15MoTi	—	
—	—	HR10	NCK20D	2.4650	NiCr15Co19MoTi	—	
—	—	HR207	NW11AC	—	NiFe33Cr17Mo	—	
—	—	—	NC19KDUV	—	NiCr20Co16MoTi	—	
—	—	—	—	—	—	—	
—	5399	—	NC19KDT	2.4973	NiCr19Co11MoTi	N07041	
—	5751	—	NCK19DAT	2.4983	NiCr18Co18MoTi	N07500	
5383	5589	HR8	NC19FeN	LW2.4668	NiCr19Fe19NbMo	N07718	
—	5544	—	NC20K14	LW2.4668	NiCr19Fe19NbMo	N07001	
—	—	—	—	—	—	AISI:686	
—	—	—	—	—	NiCr16MoAl	—	
—	5397	—	—	LW2.4674	NiCo15Cr10MoAlTi	N13100	
—	—	—	—	—	NiCr20MoW	—	
—	—	—	—	—	NiCr11AlWNb	—	
—	—	—	—	—	NiCr20Co18Ti	—	
—	—	—	—	—	NiW13Co10Cr9AlTi	—	

# Technical Information

## Co-based Heat Resistant Alloys

### Material Specifications Cross-Reference List - Aerospace Material Designation

Material condition	Commercial designation	Hardness Brinell HB		Nominal composition Approximate content in %										
		Ann.	Aged	Ni	Cr	Co	Fe	Mo	W	Mn	Si	Al	Ti	Others
Co-based alloys	Air Resist 13			1.0	—	79.6	2.5	—	11.0	—	—	3.5	—	4.12
	Air Resist 213			—	19.0	65.8	—	—	4.7	—	—	3.5	—	6.68
	Altemp S 816			20.0	20.0	47.6	—	4.0	4.0	—	—	—	—	0.4
	FSX 414	—	—	10.0	29.0	52.8	1.0	—	7.0	—	—	—	—	0.25
	Haynes 36			10.0	18.5	52.8	2.0	—	14.5	1.2	0.6	—	—	0.4
	Haynes 151			—	20.0	65.6	—	—	12.8	0.5	0.5	—	0.15	0.47
	HS 25			10.0	20.0	48.4	3.0	—	15.0	1.5	2.0	—	—	0.1
	HS 30			16.0	24.0	51.4	1.0	6.0	—	0.6	0.6	—	—	0.4
	HS 31			10.0	25.0	53.8	1.5	—	8.0	0.6	0.8	—	—	0.4
	HS 36			10.0	18.0	53.1	2.0	—	15.0	1.5	—	—	—	0.4
	Jessop 832	—	—	12.0	19.0	44.0	17.0	2.0	—	0.8	0.3	—	—	3.5
	Jessop 834			12.0	19.0	42.0	20.0	2.0	—	—	—	—	—	6.5
	Jessop 865			10.5	25.5	53.0	2.0	—	7.5	0.6	0.6	—	—	0.45
	Jessop 875			—	21.0	66.0	—	—	11.0	—	—	—	—	2.45
	Jessop 887			10.0	20.0	50.0	3.0	—	15.0	0.5	1.5	—	—	0.1
	Jetalloy 209			10.0	20.0	52.0	1.0	—	15.0	—	—	—	2.0	0.02
	L-251			10.0	19.0	56.0	1.0	—	14.0	—	—	—	—	0.4
	L-605	—	—	10.0	20.0	51.0	1.6	—	15.0	1.5	0.6	—	—	0.1
	M 203			25.0	20.0	38.0	1.6	—	12.0	0.8	1.0	0.7	2.0	1.67
	M 204			25.0	18.0	42.0	1.6	—	12.0	—	—	—	—	1.27
	M 205			25.0	18.0	40.0	1.6	—	12.0	—	—	2.7	—	1.67
	MAR-M 302			—	21.5	57.0	0.75	—	10.0	0.1	0.2	—	—	10.0
	MAR-M 322			—	21.5	60.0	0.75	—	9.0	0.1	0.1	—	0.75	7.7
	MAR-M 509			10.0	23.0	55.0	—	—	7.0	0.05	0.05	—	0.2	4.6
	MAR-M 905	—	—	20.0	20.0	55.0	—	—	—	—	—	—	0.5	7.65
	MAR-M 918			20.0	20.0	52.0	0.4	—	—	0.1	0.1	—	0.5	7.65
	Refractaloy 70			20.0	21.0	46.0	0.5	8.0	4.0	—	—	—	—	0.08
	V-36			20.0	25.0	43.2	2.4	4.0	2.0	0.6	0.5	—	—	2.29
	WI-52			0.5	21.0	62.6	2.0	—	11.0	0.25	0.25	—	—	2.45
	Jessop X-40			10.5	25.5	53.0	1.5	—	7.5	0.75	0.75	—	—	0.5
	Jessop X-45			10.5	25.5	54.7	2.0	—	7.0	—	—	—	—	0.25
	Jessop X-50			20.5	25.5	40.3	4.0	—	12.0	—	—	—	—	0.75
	Jessop X-63			10.0	25.0	57.6	1.0	6.0	—	—	—	—	—	0.45
Annealed or solution treated	J 1650	—	—	27.0	19.0	38.0	—	—	12.0	—	—	—	—	0.2
In aged condition	Haynes 25*			10.0	20.0	49.0	3.0	—	15.0	1.5	0.5	—	—	0.1
	Haynes 188*			22.0	22.0	38.0	2.5	—	14.0	1.0	0.4	—	—	0.1
	HS 6*	—	—	2.5	28.0	60.5	3.0	—	5.0	—	—	—	—	1.0
	HS 21*			3.0	27.0	62.6	2.0	5.0	—	0.6	0.6	—	—	0.25
	J1570*			28.0	19.0	39.0	2.0	—	7.0△	—	—	—	—	—

\* These alloys can be hardened by an aging process.

\*\* These alloys cannot be hardened by an aging process.

USA		UK	France	Germany		Others	Customer designation
SAE	AMS	BS	AFNOR	Werkst.-Nr	DIN1706		
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	(5534)	—	—	LW2.4989	CoCr20Ni20W	—	
—	—	—	—	—	—	—	
—	—	—	—	—	CoCr19W14NiB	—	
—	—	—	—	—	CoCr20W13	—	
—	5759	—	KC20WN	LW2.4964	CoCr20W15Ni	—	
5380	—	—	—	—	CoCr25NiW	R30030	
5382	—	3146	—	LW2.4670	CoCr25NiW	R30031	
—	—	—	—	—	CoCr19W14NiB	—	
—	—	—	—	—	CoCr19Fe16NiMoVNb	—	
—	—	—	—	—	CoCr19Fe20NiMoVNb	—	
—	—	—	—	—	CoCr25NiW	—	
—	—	—	—	—	CoCr21W11Nb	—	
—	—	—	—	—	CoCr20W15Ni	—	
—	—	—	—	—	—	—	
—	5759	—	—	2.4964	CoCr20W15Ni	R30605	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	3146-3	—	—	CoCrW10TaZrB	—	
—	—	—	—	—	CoCr22W9TaZrNb	—	
—	—	—	—	—	CoCr24Ni10WTaZrB	—	
—	—	—	—	—	—	—	
—	—	—	—	—	CoCr20Ni20Ta	—	
—	—	—	—	—	—	—	
—	—	—	—	—	CoCr25NiMoWNB	—	
—	—	—	—	—	CoCr12MoW	—	
—	5382	3156-2	—	LW2.4670	CoCr25NiW	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	
5537C	5759	—	KC20WN	LW2.4964	CoCr20W15Ni	—	
—	5772	—	KC22WN	—	CoCr22W14Ni	—	
—	5373	—	—	—	—	R30006	
—	5385	3531	—	—	CoCr29Mo	R30021	
—	—	—	—	—	—	—	

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# ***For safe use of the Extra Hard Tool Product safety.***

## **1. To use extra hard tool product.**

In accordance with the Product Liability Law (PL law) that has been in effect since July 1, 1995, we affix warning labels or caution labels to the packages of the products which are covered by the law. However, we don't affix specific caution labels onto the tool itself. Therefore, please read this leaflet before using extra hard tool products and extra hard tool materials. In addition, we would like to ask you to inform your operators of the content of this leaflet as part of your safety training.

## **2. Basic features of extra hard tool materials**

### **2-1. Meaning and usage of terms in this leaflet**

Extra hard tool material: Generic name for tool materials such as extra hard alloys, cermet, ceramic, CBN sintering material and diamond sintering material.

Extra hard alloy : Tool material which is mainly made of WC (Carbonized tungsten)

Extra hard : Abbreviation for extra hard tool materials, or the abbreviation for extra hard alloy in the narrow sense.

Extra hard tool : Generic name of tools which are made of extra hard tool material.

### **2-2. Physical characteristics**

Appearance: Each material is different. Example: Gray, black, gold color, etc. Odor: None

Hardness : Extra hard cermet: HV500 to 3000kg/mm<sup>2</sup>, Ceramic : HV1000 to 4000kg/mm<sup>2</sup>

Hardness : CBN sintering material : HV 2000 to 5000 kg/mm<sup>2</sup>, Diamond sintering material: HV8000 to 12000kg/mm<sup>2</sup>

Gravity: Extra hard: 9 to 16, cermet: 5 to 9, cerami : 2 to 7, CBN and diamond sintering material 3 to 5

### **2-3. Component**

Carbide, nitride, carbonitride, oxide such as W, Ti, Al, Si, Ta, B, and materials that contain Co, Ni, Cr, Mo, etc. in addition to those compounds.

## **3. Cautions for handling extra hard tool materials**

- Extra hard materials can sometimes be quite fragile, although they are normally very hard. The materials may be damaged by sharp impact or excessive tightening.
- Since extra hard materials have high specific gravity, care should be taken when handling large products or large amounts of the products which are made of those materials.
- Extra hard materials have different thermal expansion ratios from other metallic materials. Therefore, cracks may occur in the product after shrinkage fit or cold shrinkage fit because the temperature for use is significantly higher or lower than the specification temperature.
- If the extra hard material has corrosion due to liquid for grinding, lubricant or water, etc., the strength of the material will be deteriorated significantly. Be sure to store the material where it will not come in contact with liquids or water.

## **4. Cautions for machining extra hard tools**

- Extra hard tools may lose strength significantly depending on the surface condition. Be sure to use diamonds for grinding.
- Extra hard tools may generate dust during grinding. If you inhale a great deal of the dust, it may affect your health. Please make sure to have equipment for disposal and wear protective devices such as a mask, etc. If the dust comes in contact with your bare skin gets into your eyes, wash thoroughly with water.
- When grinding the extra hard material or soldered material, heavy metal component will be included in the waste fluid. So, make sure to dispose of the waste fluid properly.
- When regrinding extra hard tools, do a post check to be sure that no cracks have occurred.
- If you use a laser or electric pen, etc. to mark the extra hard material or products, it may cause cracks. Do not make markings at places where stress will be applied.
- If electric discharge machining is conducted on the extra hard material, remnant cracks may occur on the surface which cause the material to weaken. Be sure to remove any cracks by grinding, if necessary.
- When soldering the extra hard materials, if the material temperature is much lower or higher than the melting temperature of the soldering material, it may cause defluxion or breakage of the product. Be careful about the temperature.

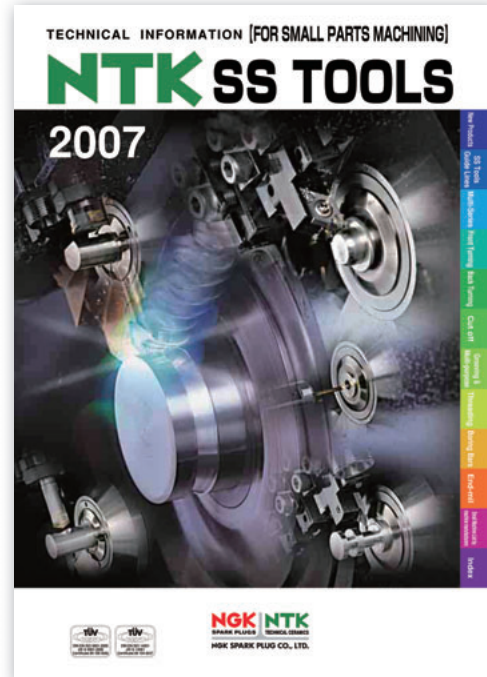
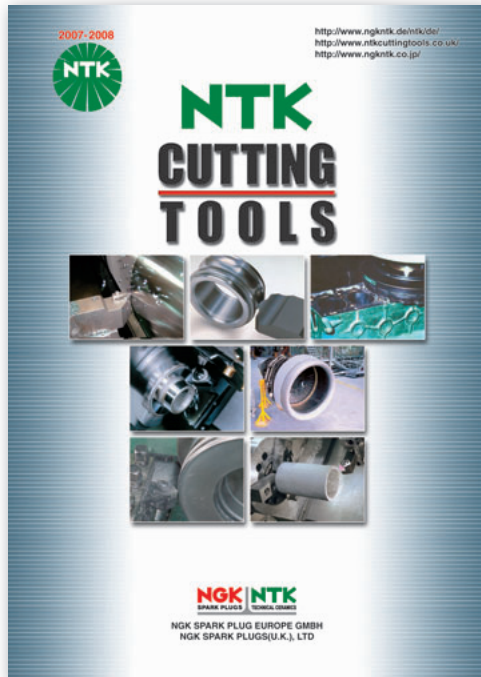


## Cautions for using cutting tools

Objective product	Danger	Countermeasure
<b>Cutting tools in general</b>	◎This type of tool has very sharp blade. If you touch it directly, you may get injured.	*Wear protective gear, such as protective gloves, etc., especially when taking out the product from the case or attaching the tool to a machine.
	◎If you use it improperly or if the conditions for use are inappropriate, it may cause breakage or shattering of the tool, which may result in injury.	*Wear protective gear such as safety covers or protective glasses. *Use within the recommended purpose of usage. Refer to the operation manual, catalogue, etc.
	◎Sudden increase of cutting resistance due to a mixture of impact and burden or excessive abrasion may cause breakage or shattering of the tool, which may result in injury.	*Wear protective gear such as safety cover or protective glasses. *Stop the machine, wear the protective gloves and use tools such as nipper or clipper, etc. to remove cutting chips.
	◎Tools or workpieces will be very hot while cutting. Therefore, if you touch them immediately after the machining, you may get burn injury.	*Wear protective gear such as protective gloves.
	◎Sparks, heat generated due to breakage while cutting, cutting chips may also cause a fire.	*Do not use the tool where there is a possibility of fire or explosion. *If you use insoluble cutting lubricant, be sure to have antifire provisions.
	◎When using the tool at high speed rotation if the whole machine including the holder of the machine is not well balanced, the tool may get broken due to tremor or vibration, which may result in injury.	*Wear protective gear such as safety cover or protective glasses. *Make sure to have a trial operation in advance in order to confirm that there is no vibration or abnormal sound.
	◎Touching burrs on the machined product directly may result in injury.	*Do not touch with bare hands.
<b>Throw-away type (blade change type) tools in general</b>	◎If the chip or parts are not clamped securely, those may fall down or scatter while cutting, which may cause injury.	*Clean the surface for attachment of an insert or the part for fixture of the insert completely before attaching the insert. *Make sure that the insert or the part is clamped securely using a spanner provided with the product before attachment. Also, do not use any inserts or parts other than the ones provided with the products.
	◎If the tool is tightened too tightly using a tool such as pipe, etc., the chip or tool may fall down or shatter while cutting. This is dangerous.	*Do not use a tool such as a pipe. Use the spanner which is provided with the product.
	◎When using the tool at high speed rotation, a part or chip may be thrown out by centrifugal force, which is very dangerous. Be careful about handling the tool safely.	*Use the tools only for the recommended purposes. Refer to the operation manual, catalog, or other source of information.
<b>Cutters and other tools that are rotated for use</b>	◎The sharp cutter blades may cause injury if you touch them directly with your hands.	*Wear protective gear such as protective gloves, etc.
	◎The tool may be deflected due to eccentric rotation or bad balance that will cause vibration, breakage or scattering of the tool, which may result in injury.	*Use the tool within the recommended rotation speed. *Check and adjust the accuracy of rotating section or balance periodically so that eccentric rotation or deflection does not occur due to abrasion of the bearings, etc.
<b>Soldering tool</b>	◎You may get injured due to defluxion or breakage of the chips, etc.	*Confirm that the soldering is secure before use. *Do not use under conditions which may cause the tool to reach high temperatures.
<b>Others</b>	◎Repeating soldering many times may cause the chip to be broken easily. This is dangerous.	*Do not use the chip which has been soldered many times because the strength will be lower.
	◎Using the tool for other than its intended purposes may cause breakage of the machine or tool. This is very dangerous.	*Use the tools only as specified.

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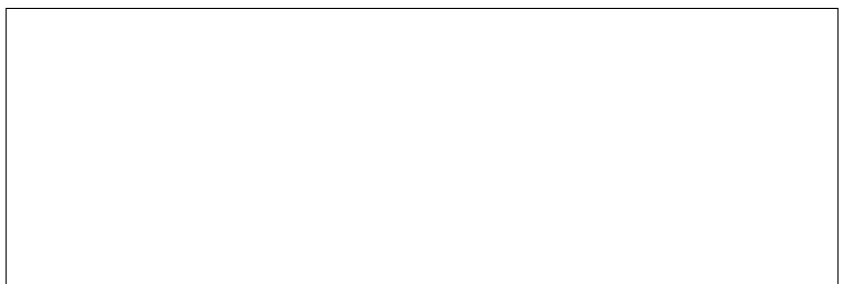


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