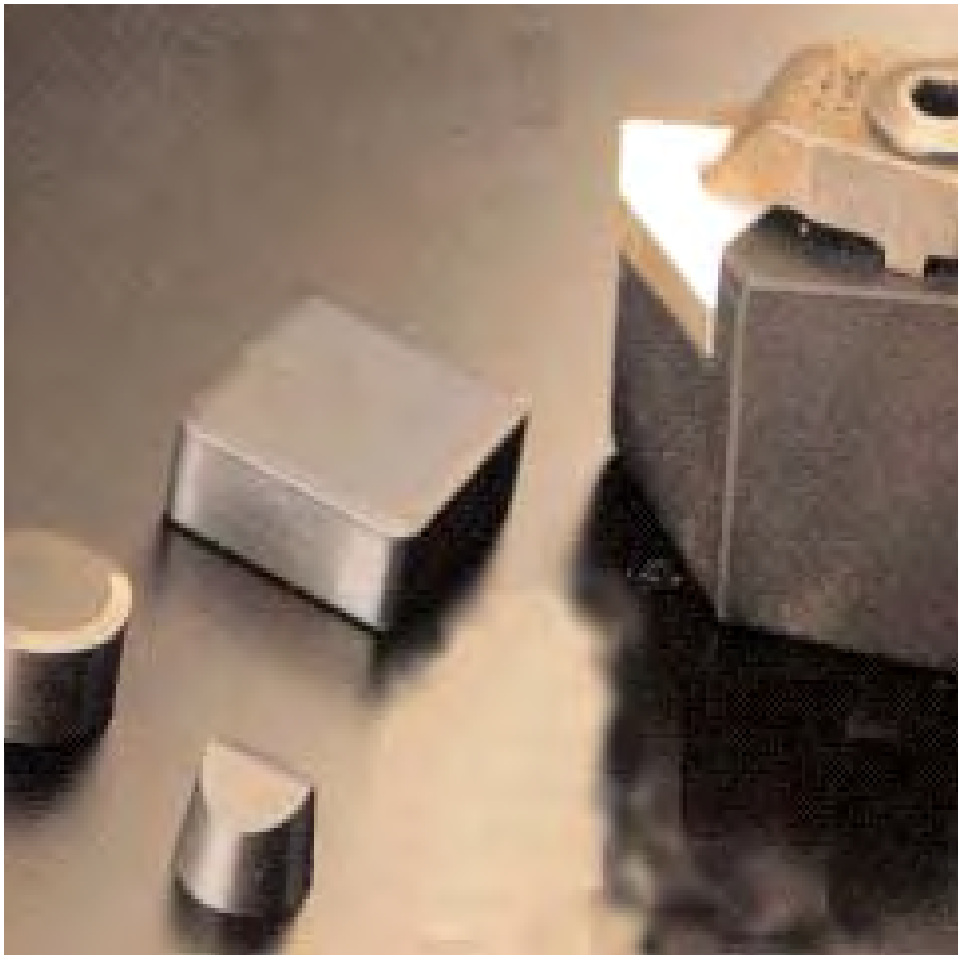
Ceramics

IMPORTMETAL

TOOLING SOLUTIONS



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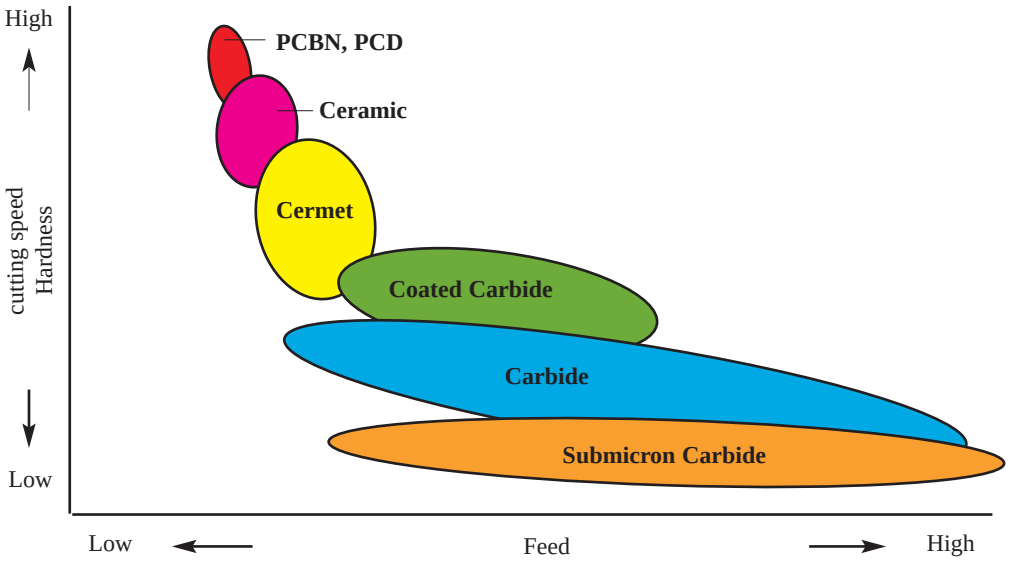
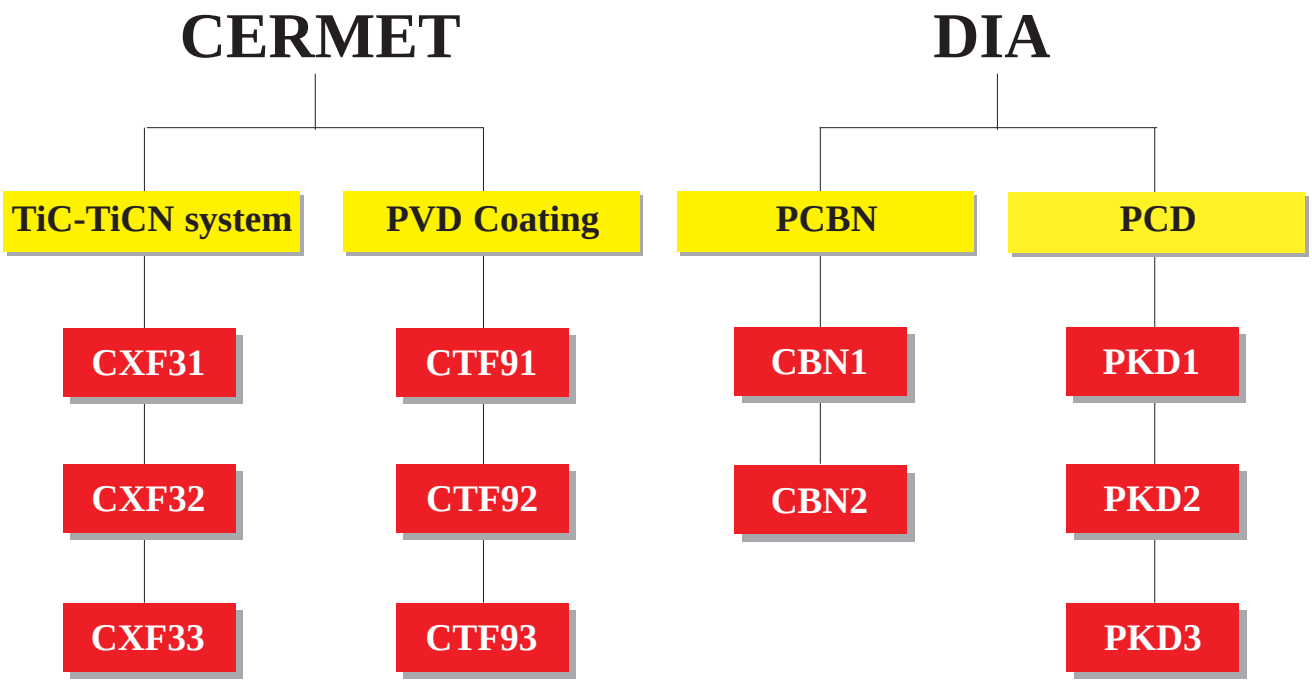
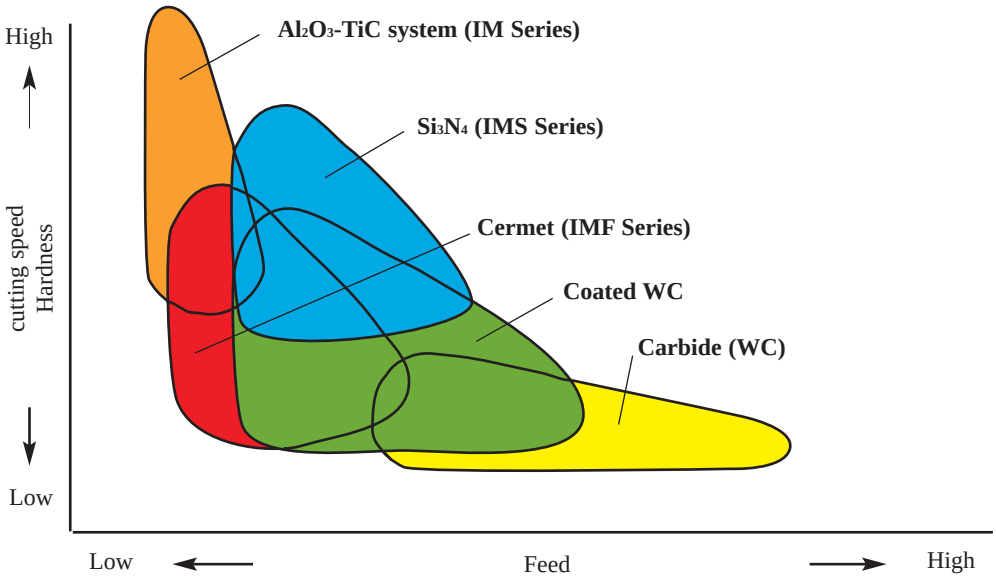
Application of cutting tool materials



For Whisker please look page 8 and 9



Application of Ceramic Grade



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Ceramics

Importmetal Ceramic Cutting Tool is an inorganic materials, die-pressed and sintered using very fine and pure raw materials. These are oxide, carbide and nitride with high purity and fine microstructure. Since the Importmetal ceramics is prepared by HIP process to condense completely, it is highly wear resistant and very strong against the fracture.

Characteristics

-High cutting speed based on high strength at high temperature.
-Capable of difficult cutting.
-Precise cutting and superior surface roughness on workpiece due to stable thermo-chemical properties.
-Longer tool life due to excellent wear resistance.

Physical Properties

Materials	Grade	Composition	Color	Density (g/cm^3)	Hardness (Hv)	Toughness ($MN/m^{2/3}$)	Heat Transfer (cal/cm. sec.
CERAMIC	IM1	Al_2O_3+TiC	Black	4.2	2100	4.0	0.08
	IM8	Al_2O_3+TiCN	Black	4.6	2300	4.8	0.08
	IMD2	TiC+Al_2O	Black	4.6	2200	4.5	0.07
	IMZ2	Al_2O_3+ZrO_2	White	4.0	1800	4.5	0.07
	IMS2	Si_3N_4	Black	3.3	1600	5.0	0.06
	IMS3	Si_3N_4	Gray	3.2	1600	6.0	0.05
	IMS4	Si_3N_4	Gray	3.2	1650	6.0	0.05
	IMS5	Si_3N_4	Gray	3.2	1700	6.0	0.05
	IMS7	Si_3N_4	Brown	3.5	1750	6.5	0.05

Materials	Grade	Composition	Color	Density (g/cm^3)	Hardness (Hv)	Toughness ($MPa/m^{1/2}$)	Therm. Cond. ($X10^{-6}/K$)
	IMW4	Al_2O_3+SiC	Green	3.8	2100	7.0	7.8
	IMW8	Al_2O_3+SiC	Green	3.7	2100	7.0	7.6

For Whisker please look specifications page 8 and 9

Application and Characteristics of Ceramics (I)

Grade		Application	Characteristics
IM Series	IM1	-Hardened steel -Finish and medium cutting for steel and cast-iron	-Excellent wear resistant -High thermal shock resistance
	IM8	-Hardened steel -Heat treated hardened steel and alloy steel	-Superior wear resistant -Alternative to CBN
IMD	IMD2	-Finish and Medium cutting for ductile cast-iron -Finish for hardened steel	-High thermal shock resistant -Usable with coolant
IMZ	IMZ2	-Finish/Medium/rough cutting for cast iron -finish/Medium cutting for steel	-Toughened by ZrO2 -High chemical stability
IMS Series	IMS2	-Rough and interrupted cutting for cast iron -Rough cutting for roll turning cast iron and steel -Milling for cast iron	-High toughness and thermal schock resistant -Well balanced wear resistance and toughness
	IMS3	-High speed cutting for cast iron with heavy interruption	-High toughness and thermal shock resistant -Excellent toughness and wear resistant -High speed cutting and severe interruption
	IMS5	-High speed cutting for cast iron with interruption -High speed milling for cast iron	-Pure silicon nitride grade -Superior wear resistant at extremely high cutting speed
	IMS7	-Rough and interrupted cutting for cast iron -Cutting for Ni-base alloy -Ductile cast iron	-Good termal shock resistance and good termal conductivity -Excellent wear resistant against the long chip for Ni-base alloy -Needs cutting fluids
	IMW 4	- High Speed Steel, High Crom Steel in medium or low speed cutting Roughing and Medium cutting with heavy interruption	- Superior wear resistance
	IMK	- Nickel Base Alloys, Cobalt Base Alloys in High speed cutting Roughing and Finishing with continuous or light interruptio	- Superior wear resistance

For Whisker please look specifications page 8 and 9

Grade Applications and Characteristics (II)

IM Series (Al_2O_3 +TiC, TiCN)

IM1

IM1 shows excellent thermal shock resistance and wear resistance. It is general purpose machining grade for hardened steel and difficult cutting. It can be used for finish and medium cutting for soft cast iron without interruption.

IM3

CK3 was developed for extremely hardened steel and high hardness alloyd steel. It is a Al-TiCN grade with micrograin structure.

IMD Series (TiC + Al_2O_3)

IMD2

IMD2 is TiC major (70%) Al-TiC grade for medium and finish cut of ductile cast iron. It shows excellent wear resistance and strong edge even for finish cutting for cast iron. It is recommended using coolants.

IMS Series (Si_3N_4)

IMS2

Well known grade for general purpose machining of rough and medium cutting of cast iron with interruption. It shows excellent wear resistance during milling operation of cast iron.

IMS3

It was designed for high cutting speed of cast iron with heavy interruption.

IMS5

The edge hardness was improved for extremely high cutting speed for cast iron cutting with normal interruption.

IMS7

IMS7 is a composite with addition of TiN into Si_3N_4. It shows excellent wear resistance of edge during cutting for long chip forming work piece and Ni-Based Alloy. It can be used also for cast iron cutting but coolant recommended.

IMZ (Al_2O_3+ZrO_2)

IMZ2

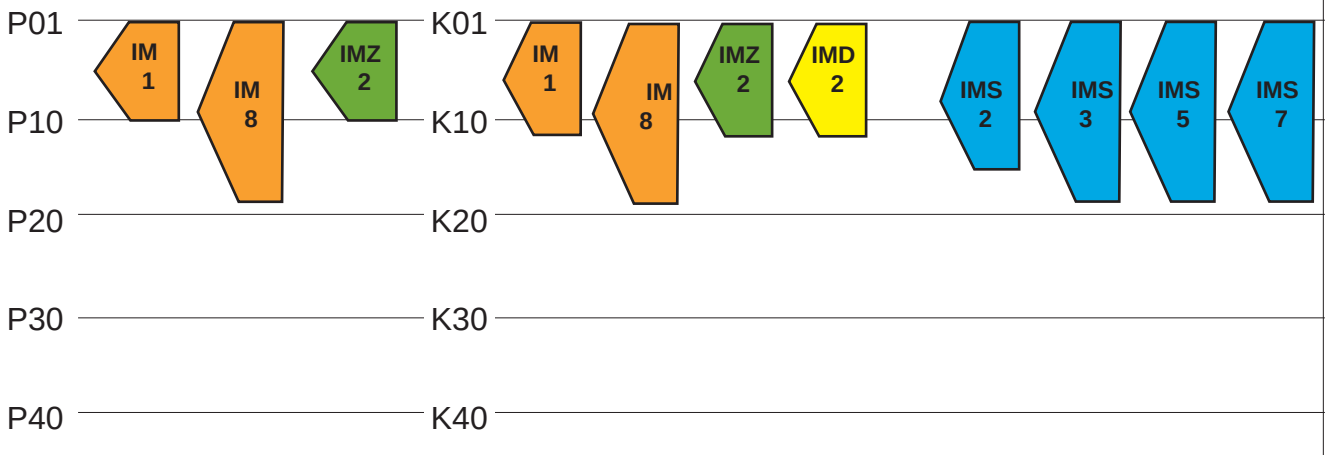
IMZ2 is a Al_2O_3 grade, which was toughened by Zirconia. This is the most stable grade and can be used for general rough, medium and finish cutting for cast iron with normal interruption.

For Whisker please look page 8 and 9

Recommended cutting condition

Machining Type	Grade	Workpiece		Cutting Style	Velocity(V) (m/min)	Feed(f) (mm/rev)	Depth(D) (mm)
Turning	IM1 IM8	GRAY CAST IRON	-Gray cast Iron (FC) -Malleable (FCMB) -Ductile cast Iron (FCD)	Rough Finish	150~800 200~1,200	0.2~0.5 0.3~0.5	3~6 0.1~0.5
			-Chilled cast iron	Rough Finish	30~100 50~200	0.1~0.2 0.05~0.15	0.5~1.5 0.1~0.5
		STEEL	-Carbon steel -Alloy steel -Bearing steel	Rough Finish	150~400 200~800	0.2~0.5 0.05~0.2	2~5 0.1~0.5
			-Hard steel (HRC 45 >)	Rough Finish	20~100 40~200	0.1~0.2 0.05~0.5	0.5~1.5 0.1~0.5
	IM2	-DUCTILE CAST IRON		Rough Finish	100~400 200~800	0.1~0.2 0.05~0.25	1~2 0.1~0.5
	IMZ2	-GRAY CAST IRON (fc)		Rough Finish	200~700 300~1,200	0.2~0.4 0.05~0.3	2~5 0.1~0.5
		-STEEL (HRC 45 <)		Rough Finish	200~400 300~1,200	0.2~0.4 0.05~0.3	2~4 0.1~0.5
	IMS2 IMS3 IMS5	GRAY CAST IRON	-Gray cast iron (FC) -Malleable (FCMB) -Ductile cast iron (FCD)	Rough Finish	150~1,100 250~1,200	0.3~0.8 0.15~0.4	<5 <1
			-Chilled cast iron	Rough Finish	20~100 60~200	1.0~2.0 0.5~1.0	<5 <1
	IMS7	-Ni-BASED ALLOY -NON-FERROUS METAL		Rough Finish	150~250 150~450	0.2~0.4 0.1~0.2	<5 <1
Milling	IMS2 IMS3 IMS5 IMS7	-GRAY CAST IRON (FC)		Rough Finish	100~1,200 150~1,500	0.3~0.5 0.3~0.7	<5 <3
		-DUCTILE CAST IRON -ALLOY STEEL		Rough Medium Finish	90~500 100~700 200~1,500	0.1~0.3 0.1~0.4 0.1~0.5	<5 <3 <3

Turning



For Whisker please look page 8 and 9

Ceramics

Recommended cutting condition Wisker Ceramic

Work material	Grade IMW4	Grade IMW8	Condition	Cutting speed (m/min)	Feed (mm/rev)	Ap (mm)
Ni-based Alloy (inconel, Nimonic Rene, Hastalloy...)	❍	●	Interrupted	~250	~0.3	~3.0
			Roughing	~300	~0.4	~4.0
			Continuous	~500	~0.5	~5.0
Cobalt-Base Alloy (Stelite, M203...)	●	❍	Interrupted	~200	~0.2	~3.0
			Roughing	~250	~0.3	~4.0
			Continuous	~400	~0.4	~5.0
HSS	●		Roughing	~120	~0.4	~5.0
			Continuous	~150	~0.5	~3.0

● Excelent ❍ : Good

Applications

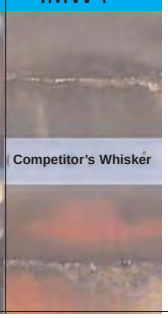
Inconel 718	
Internal turning	
Insert **RNGN 120700 T151 IMW8**	
V (m/min)	250
f (mm/rev)	0.15
ap (mm)	2.0
Coolant	Wet
Tool life	1 pcs / edge

Aircraft part (Engine Case)	IMW8
	

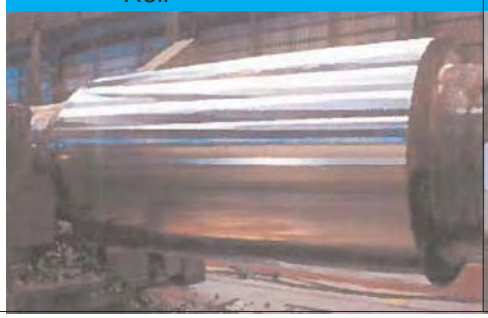
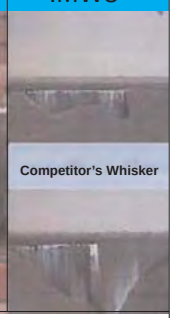
Co-based high temperature alloy	
Internal turning	
Insert **RPGX 090700 T05 IMW8**	
V (m/min)	245
f (mm/rev)	0.18
ap (mm)	2.5
Coolant	Wet
Tool life	3 passes / edge

Aircraft part (Ring)	IMW8
	

Stelite	
Roughing turning	
Insert **RNGN 120700 T151 IMW4**	
V (m/min)	180
f (mm/rev)	0.07
ap (mm)	3.0
Coolant	Dry
Tool life	2 pcs / edge

Welded part	IMW4
	

Co-based high temperature alloy	
External	
Insert **LNJ 6688PO T754D IMW4**	
V (m/min)	130
f (mm/rev)	0.3
ap (mm)	5.0
Coolant	Dry
Tool life	2 pcs / corner

Roll	IMW8
	

Whisker Grade (IMW4 / IMW8)

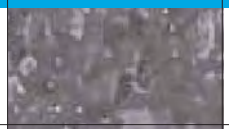
IMW4 and IMW8 developed by own technology of Importmetal Cutting Tools and is an advanced Silicon-Carbide (SiC) Whisker-reinforced ceramic grade.
Aluminium Oxide has been used successfully as a cutting tool material for many years in high speed machining, mainly due to it's excellent hardness and chemical stability at high temperature.
However the application of Aluminium Oxide was linited in interrupted cutting, high nickel based alloys at high cutting speed because of it's low resistance to fracture.
The important component of IMW4 and IMW8, ultra-strong whiskers makes possible increasing fracture toughness and notch wear resistance in the machining of super-alloys at high speed cutting.
IMW4 and IMW8 shows high productivity and extended reliability in the machining of Nickel- and Cobalt-based alloys, Inconel, Stelite, HSS etc.

Features

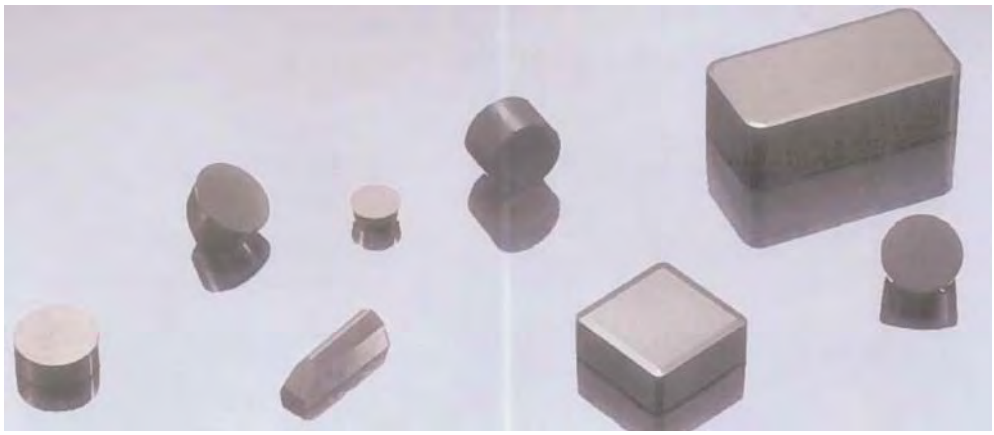
- Excelent wear and thermal shock resistance at high surface speed
- Superior notch wear resistance
- Outstanding fracture toughness

Grade Information

Application Range

Grade	Microstructure	Application Range
IMW4		High Speed Steel, High Crom Steel in medium or low speed cutting Roughing and Medium cutting with heavy interruption
IMW8		Nickel Base Alloys, Cobalt Base Alloys in High speed cutting Roughing and Finishing with continuous or light interruption

Grade	Composition	Color	Density (g/cm^3)	Hardness (Hv)	Toughnes ($MPa\ m^{1/2}$)	Thermal Conductivity ($X10^{-6}/K$)
IMW4	Al_2O_3 + SiC	Green	3.8	2,100	7.0	7.8
IMW8	Al_2O_3 + SiC	Green	3.7	2,100	7.0	7.6

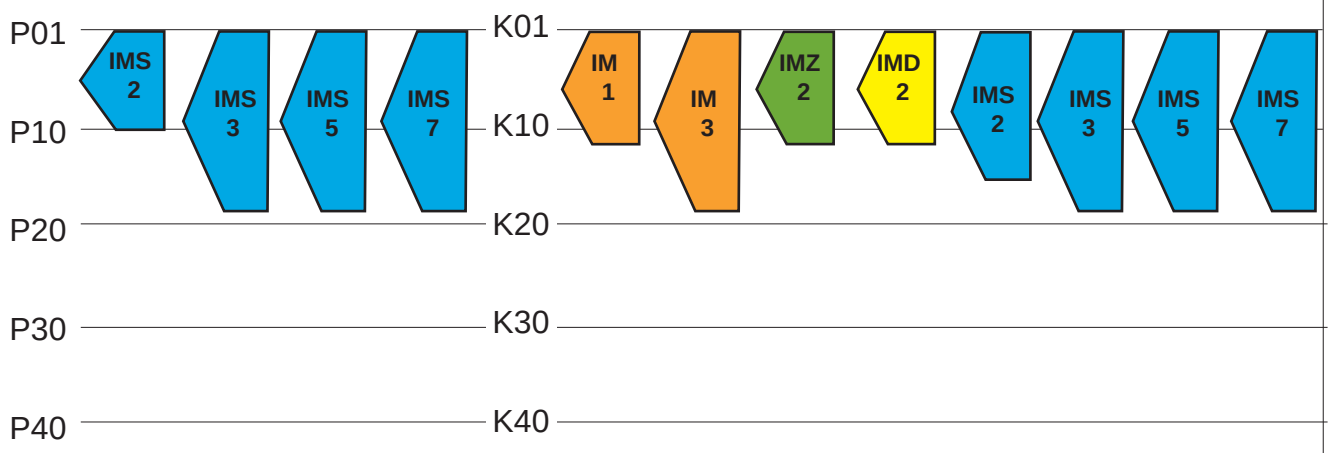


Grade Choice for Workpiece

Workpiece \ Grade		IMZ2	IM1 IM3	IMD2	IMS2, IMS3 IMS5	IMS7
Cast Iron	GRAY CAST IRON	●	●	❍	●	❍
	CHILLED CAST IRON	●	●		●	●
	DUCTILE CAST IRON		❍	●	❍	❍
Steel	MILD STEEL	❍				
	CARBON STEEL	❍				
	ALLOY STEEL	❍	●			●
	FORGED STEEL		●			
	HEAT TREATED STEEL		●			
	HIGH SPEED STEEL		●			
	HIGH MANGANESE STEEL		❍		❍	❍
	STAINLESS STEEL					
	HEAT RESISTANT STEEL		❍		❍	❍
	SUPER ALLOY STEEL		❍		❍	●

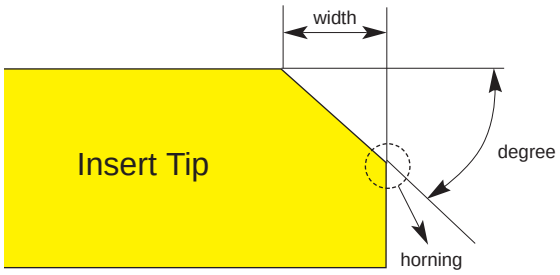
●: Excellent ❍: Good

Milling



10 Champfer specification

(1) Mono type



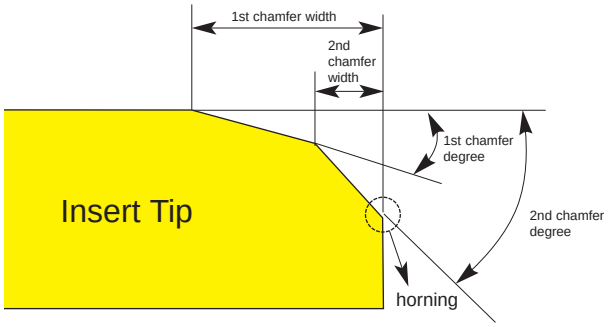
T1

Chamfer degree (°C)	Chamfer Width (mm)	Horning (µm)
20	0.10	0 No Horning

T2

Chamfer degree (°C)	Chamfer Width (mm)	Horning (µm)
20	0.20	0 No Horning

(2) Double type



T4D

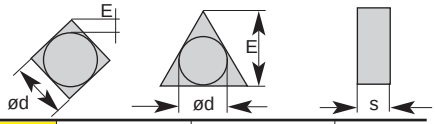
1st Chamfer degree (°C)	1st Chamfer Width (mm)	2nd Chamfer Width (mm) Xdegree (°C)	Horning (µm)
15	4.50	0.10 X 30	20

Ceramics

1 Shape

C	80°
D	75°
E	55°
H	
L	
R	
S	
T	
V	35°
W	

3 Tolerance



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	±0.13	±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

C S T — Class M

Inscribed circle (mm)	d (mm)	m (mm)
6.350	±0.05	±0.08
9.525	±0.05	±0.08
12.700	±0.08	±0.13
15.875	±0.10	±0.15
19.050	±0.10	±0.15
25.400	±0.13	±0.18

D K

	d (mm)	m (mm)
6.350	±0.05	±0.11
9.525	±0.05	±0.11
12.700	±0.08	±0.15
15.875	±0.10	±0.18
19.050	±0.10	±0.18

ISO
ASA

TURNING

S 1	N 2	G 3	N 4
S 1	N 2	G 3	N 4

MILLING

S 1	N 2	K 3	N 4

2 Relief angle

B	5°
C	7°
D	15°
E	20°
N	0°
P	11°
O	Other normal clearance

4 Type of insert

Type	Symbol: Inscribed circle over 6.35	Symbol: Inscribed circle (included 7.938) under 5.556
	N	E
	F	L
	R	S
	A	D
	G	K
	M	P
Special design	X	X

Type	Symbol: Inscribed circle over 6.35
70° - 90°	H
70° - 90°	B
40°-60°	T
40°-60°	W

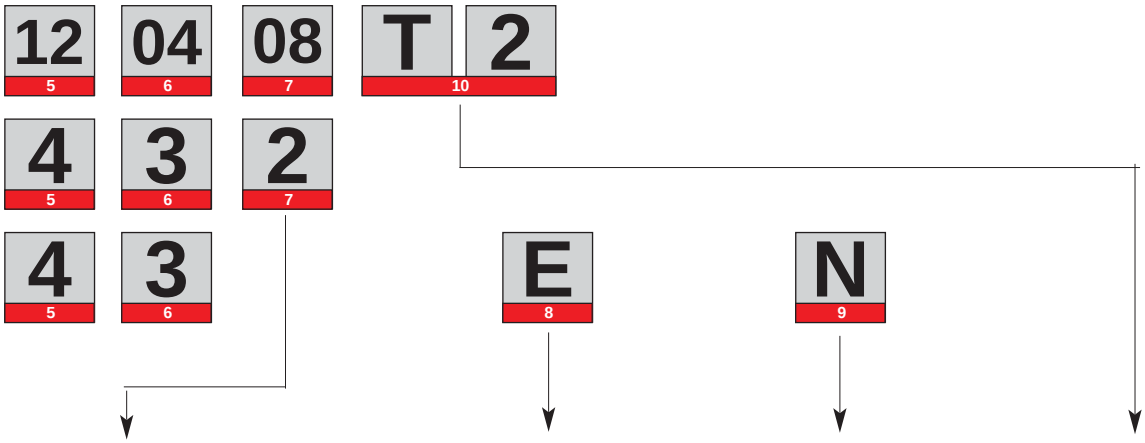
Ceramics

5 Cutting edge length

Diameter of inscribed circle	ASA (Inch)		Metric						
	6.35 over	5.56 under	R	W	V	D	C	S	T
3.969		5	03	02		04	03	03	06
4.762		6	04	03		05	04	04	08
5.556		7	05	03	09	06	05	05	09
6.350	2	(8)	06	04	11	07	06	06	11
7.938		0	07	05	13	09	08	07	13
9.525	3		09	06	16	11	09	09	16
12.700	4		12	08	22	15	12	12	22
15.875	5		15	10	27	19	16	15	27
19.050	6		19	13	33	23	19	19	33
22.225	7		22		38	27	22	22	38
25.400	8		25		44	31	25	25	44
31.750	0		31		54	38	32	31	55

6 Thickness

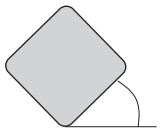
Thickness (mm)	ISO	ASA	
		6.35 over	5.65 under
1.59	01	-	2
2.38	02	-	3
3.18	03	2	4
3.97	T3	-	5
4.76	04	3	6
5.56	05	-	-
6.35	06	4	-
7.94	07	5	-
9.52	09	6	-
12.70	12	8	-



7 Nose-radius

Corner roundness (mm)	ISO	ASA
Sharp nose	00	O
0.2	02	Y
0.4	04	1
0.8	08	2
1.2	12	3
1.6	16	4
2.0	20	5
2.4	24	6
2.8	28	7
3.2	32	8

8 Land angle



A - 45°

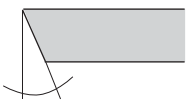
D - 60°

E - 75°

F - 85°

P - 90°

9 Relif angle

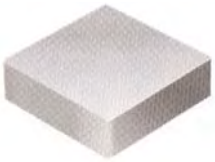


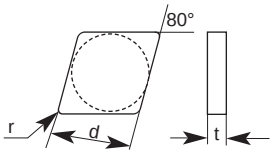
A - 3°
B - 5°
C - 7°
D - 15°
E - 20°
F - 25°
G - 30°
N - 0°
P - 11°

10 Chamfer spec

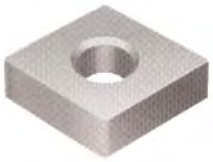
Detailed edge preparation is refer to page 9

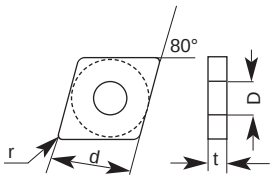
Ceramics TURNING





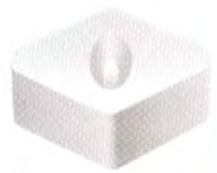
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
CNGN 090304	**CNGN 321**	9.525	3.18	0.4								
CNGN 090308	**CNGN 322**			0.8								
CNGN 090312	**CNGN 323**			1.2								
CNGN 090404	**CNGN 331**	9.525	4.76	0.4								
CNGN 090408	**CNGN 332**			0.8								
CNGN 090412	**CNGN 333**			1.2								
CNGN 120304	**CNGN 421**	12.70	3.18	0.4								
CNGN 120308	**CNGN 422**			0.8	●							
CNGN 120312	**CNGN 423**			1.2								
CNGN 120404	**CNGN 431**	12.70	4.76	0.4	●	●	●					
CNGN 120408	**CNGN 432**			0.8	●	●	●	●	●	●		
CNGN 120408	**CNGN 433**			1.2	●	●		●	●	●	●	●
CNGN 120416	**CNGN 434**			1.6	●				●	●	●	●
CNGN 120420	**CNGN 435**			2.0								
CNGN 120424	**CNGN 436**			2.4					●	●		
CNGN 120432	**CNGN 438**			3.2								
CNGN 120604	**CNGN 441**	12.70	6.35	0.4								
CNGN 120608	**CNGN 442**			0.8	●							
CNGN 120612	**CNGN 443**			1.2	●							
CNGN 120616	**CNGN 444**			1.6								
CNGN 120704	**CNGN 451**	12.70	7.94	0.4								
CNGN 120708	**CNGN 452**			0.8					●	●		●
CNGN 120712	**CNGN 453**			1.2	●	●	●	●	●	●	●	●
CNGN 120716	**CNGN 454**			1.6	●	●	●	●	●	●	●	●
CNGN 120720	**CNGN 455**			2.0	●							
CNGN 160608	**CNGN 542**	15.875	6.35	0.8								
CNGN 160612	**CNGN 543**			1.2	●							
CNGN 160616	**CNGN 544**			1.6	●							
CNGN 160620	**CNGN 545**			2.0								
CNGN 160708	**CNGN 552**	15.875	7.94	0.8	●			●				
CNGN 160712	**CNGN 553**			1.2	●	●			●			
CNGN 160716	**CNGN 554**			1.6	●	●	●		●	●	●	
CNGN 160720	**CNGN 555**			2.0	●				●	●		
CNGN 190612	**CNGN 643**	19.05	6.35	1.2	●				●			
CNGN 190616	**CNGN 644**			1.6	●					●		
CNGN 190632	**CNGN 648**			3.2	●							
CNGN 190712	**CNGN 653**	19.05	7.94	1.2								
CNGN 190716	**CNGN 654**			1.6	●	●						
CNGN 190720	**CNGN 655**			2.0	●							
CNGN 190724	**CNGN 656**			2.4								
CNGN 250724	**CNGN 856**	25.40	7.94	2.4	●							
CNGN 250924	**CNGN 866**	25.40	9.52	2.4	●				●			

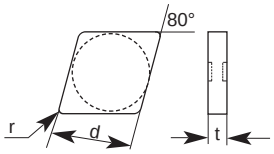




Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
CNGA 090304	**CNGA 321**	9.525	3.18	0.4	3.81								
CNGA 090308	**CNGA 322**			0.8									
CNGA 090312	**CNGA 323**			1.2									
CNGA 090404	**CNGA 331**	9.525	4.76	0.4	3.81								
CNGA 090408	**CNGA 332**			0.8									
CNGA 090412	**CNGA 333**			1.2									
CNGA 120304	**CNGA 421**	12.70	3.18	0.4	5.16	●	●	●		●			●
CNGA 120308	**CNGA 422**			0.8		●	●	●	●	●	●	●	●
CNGA 120312	**CNGA 423**			1.2		●	●	●	●	●	●	●	●
CNGA 120404	**CNGA 431**	12.70	4.76	0.4	5.16	●	●	●		●	●		●
CNGA 120408	**CNGA 432**			0.8									
CNGA 120412	**CNGA 433**			1.2									
CNGA 120416	**CNGA 434**			1.6									
CNGA 120420	**CNGA 435**			2.0									
CNGA 120424	**CNGA 436**			2.4									
CNGA 120432	**CNGA 438**			3.2									
CNGA 120604	**CNGA 441**	12.70	6.35	0.4	5.16								
CNGA 120608	**CNGA 442**			0.8									
CNGA 120612	**CNGA 443**			1.2									
CNGA 120616	**CNGA 444**			1.6									
CNGA 120704	**CNGA 451**	12.70	7.94	0.4	5.16								
CNGA 120708	**CNGA 452**			0.8		●	●		●	●	●		
CNGA 120712	**CNGA 453**			1.2		●	●		●	●	●		●
CNGA 120716	**CNGA 454**			1.6		●			●	●	●		●
CNGA 120720	**CNGA 455**			2.0									
CNGA 160608	**CNGA 542**	15.875	6.35	0.8	6.35					●			
CNGA 160612	**CNGA 543**			1.2						●	●		
CNGA 160616	**CNGA 544**			1.6		●							
CNGA 160620	**CNGA 545**			2.0									
CNGA 160708	**CNGA 552**	15.875	7.94	0.8	6.35	●	●						
CNGA 160712	**CNGA 553**			1.2		●	●				●		
CNGA 160716	**CNGA 554**			1.6							●		
CNGA 160720	**CNGA 555**			2.0									
CNGA 190608	**CNGA 642**	19.05	6.35	0.8	7.93	●				●	●		●
CNGA 190612	**CNGA 643**			1.2						●			
CNGA 190616	**CNGA 644**			1.6		●							
CNGA 190712	**CNGA 653**	19.05	7.94	1.2	7.93								
CNGA 190716	**CNGA 654**			1.6		●							
CNGA 190720	**CNGA 655**			2.0									
CNGA 190724	**CNGA 656**			2.4									

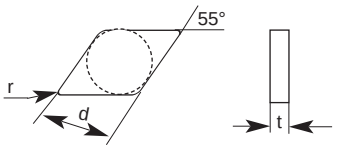
CNGX





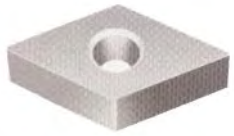
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
CNGX 120708	**CNGX 452**	12.70	7.94	0.8						●		
CNGX 120712	**CNGX 453**			1.2						●	●	●
CNGX 120716	**CNGX 454**			1.6						●	●	●

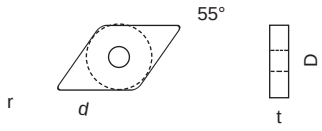
DNGN



Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
DNGN 150404	**DNGN 431**	12.70	4.76	0.4								
DNGN 150408	**DNGN 432**			0.8	●							
DNGN 150412	**DNGN 433**			1.2	●		●		●			
DNGN 150416	**DNGN 434**			1.6								
DNGN 150604	**DNGN 441**	12.70	6.35	0.4								
DNGN 150608	**DNGN 442**			0.8	●							
DNGN 150612	**DNGN 443**			1.2	●	●						
DNGN 150616	**DNGN 444**			1.6								
DNGN 150704	**DNGN 451**	12.70	7.94	0.4	●	●						
DNGN 150708	**DNGN 452**			0.8	●	●		●	●	●		●
DNGN 150712	**DNGN 453**			1.2	●	●		●	●	●		●
DNGN 150716	**DNGN 454**			1.6	●	●		●	●	●		●
DNGN 150720	**DNGN 455**			2.0	●							
DNGN 190608	**DNGN 542**	15.875	6.35	0.8								
DNGN 190608	**DNGN 543**			1.2								
DNGN 190608	**DNGN 544**			1.6								
DNGN 190708	**DNGN 552**	15.875	7.94	0.8								
DNGN 190712	**DNGN 553**			0.8								
DNGN 190716	**DNGN 554**			0.8								

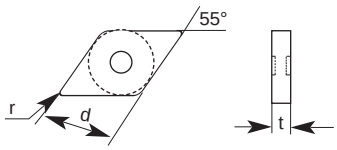
DNGA





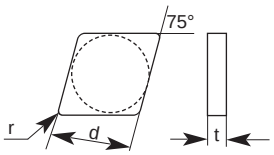
Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
DNGA 150404	**DNGA 431**	12.70	4.76	0.4	5.16	●	●						
DNGA 150408	**DNGA 432**			0.8		●	●			●	●		
DNGA 150412	**DNGA 433**			1.2		●					●		●
DNGA 150416	**DNGA 434**			1.6		●				●			
DNGA 150602	**DNGA 4402**	12.70	6.35	0.2	5.16	●							
DNGA 150604	**DNGA 441**			0.4		●	●	●					
DNGA 150606	**DNGA 4406**			0.6		●							
DNGA 150608	**DNGA 442**			0.8		●	●	●		●			
DNGA 150612	**DNGA 443**			1.2		●	●			●			
DNGA 150616	**DNGA 444**			1.6		●	●						
DNGA 150704	**DNGA 451**	12.70	7.94	0.4	5.16	●							
DNGA 150708	**DNGA 452**			0.8		●			●	●	●		
DNGA 150712	**DNGA 453**			1.2		●			●		●		
DNGA 150716	**DNGA 454**			1.6									
DNGA 150720	**DNGA 455**			2.0									
DNGA 190608	**DNGA 542**	15.875	6.35	0.8	5.16	●							
DNGA 190612	**DNGA 543**			1.2		●			●	●			●
DNGA 190616	**DNGA 544**			1.6		●							
DNGA 190708	**DNGA 552**	15.875	6.35	0.8	5.16								
DNGA 190712	**DNGA 553**			1.2									
DNGA 190716	**DNGA 554**			1.6									

DNGX



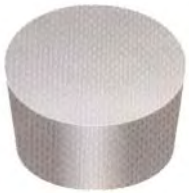
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
DNGX 120708		10.00	7.94	0.8								
DNGX 120712				1.2						●	●	●
DNGX 120716				1.6						●		
DNGX 150708	**DNGX 452**	12.70	7.94	0.8								
DNGX 150712	**DNGX 453**			1.2						●	●	
DNGX 150716	**DNGX 454**			1.6						●	●	●

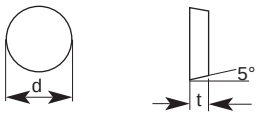
ENGN



Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
ENGN 130404	**ENGN 431**	12.70	4.76	0.4								
ENGN 130408	**ENGN 432**			0.8	●				●			
ENGN 130412	**ENGN 433**			1.2	●				●			
ENGN 130416	**ENGN 434**			1.6								
ENGN 130420	**ENGN 435**			2.0								
ENGN 130704	**ENGN 451**	12.70	7.94	0.4	●	●						
ENGN 130708	**ENGN 452**			0.8	●	●		●	●	●		
ENGN 130712	**ENGN 453**			1.2	●	●			●	●		
ENGN 130716	**ENGN 454**			1.6	●	●	●		●	●		
ENGN 130720	**ENGN 455**			2.0	●							

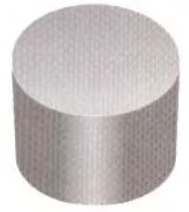
RBGN

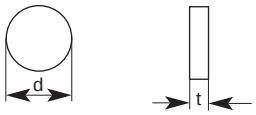




Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RBGN 090300	**RBGN 320**	9.525	3.18		●							
RBGN 100700		10.00	7.94		●						●	
RBGN 120400	**RBGN 430**	12.70	4.76		●	●						
RBGN 120600	**RBGN 440**	12.70	6.35		●							
RBGN 120700	**RBGN 450**	12.70	7.94		●	●				●		●

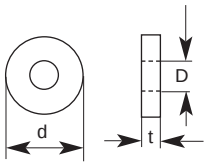
RNGN





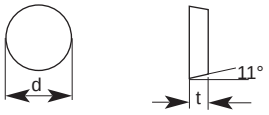
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RNGN 060200	**RNGN 210**	6.35	2.38									
RNGN 060300	**RNGN 220**		3.18						●			
RNGN 060400	**RNGN 230**		3.18		●							
RNGN 080700		8.00	7.94		●							
RNGN 090300	**RNGN 320**	9.525	3.18		●				●	●		
RNGN 090400	**RNGN 330**		4.76		●	●	●		●			●
RNGN 100700		10.00	7.94		●							
RNGN 120300	**RNGN 420**	12.70	3.18						●			●
RNGN 120400	**RNGN 430**		4.76		●	●	●	●	●	●	●	●
RNGN 120600	**RNGN 440**		6.35									
RNGN 120700	**RNGN 450**		7.94		●	●		●	●	●		●
RNGN 12J700		12.00	7.94		●							
RNGN 150700	**RNGN 550**	15.875	7.94		●				●	●		
RNGN 190600	**RNGN 640**	19.05	6.35		●	●			●			●
RNGN 190700	**RNGN 650**		7.94		●	●		●		●		●
RNGN 250700	**RNGN 850**	25.40	7.94		●			●	●	●		
RNGN 250900	**RNGN 860**		9.52									

RNGA



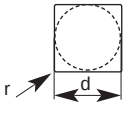
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RNGA 120300	**RNGA 420**	12.70	3.18	5.16								
RNGA 120400	**RNGA 430**		4.76		●							
RNGA 120600	**RNGA 440**		6.35									
RNGA 120700	**RNGA 450**		7.94		●	●						

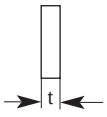
RPGN



Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RPGN 090300	**RPGN 320**	9.525	3.18		●							
RPGN 090400	**RPGN 330**		4.76		●							
RPGN 120300	**RPGN 420**	12.70	3.18									
RPGN 120400	**RPGN 430**		4.76		●				●			
RPGN 120600	**RPGN 440**		6.35									
RPGN 120700	**RPGN 450**		7.94		●							
RPGN 150700	**RPGN 550**	15.875	7.94									
RPGN 190700	**RPGN 650**	19.05	7.94									
RPGN 250900	**RPGN 850**	25.40	9.52									

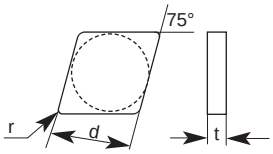
SNGN





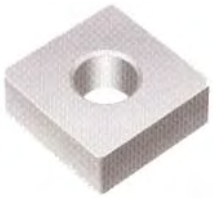
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNGN 060304	**SNGN 221**	6.35	3.18	0.4								
SNGN 060308	**SNGN 222**			0.8								
SNGN 090304	**SNGN 321**	9.525	3.18	0.4	●							
SNGN 090308	**SNGN 322**			0.8	●		●		●			
SNGN 090312	**SNGN 323**			1.2	●							
SNGN 090404	**SNGN 331**	9.525	4.76	0.4								
SNGN 090408	**SNGN 332**			0.8	●							
SNGN 090412	**SNGN 333**			1.2				●				
SNGN 090416	**SNGN 334**			1.6								
SNGN 090420	**SNGN 335**			2.0	●		●					
SNGN 120304	**SNGN 421**	12.70	3.18	0.4								
SNGN 120308	**SNGN 422**			0.8	●							
SNGN 120312	**SNGN 423**			1.2								
SNGN 120404	**SNGN 431**	12.70	4.76	0.4	●				●			
SNGN 120408	**SNGN 432**			0.8	●		●	●	●	●		
SNGN 120412	**SNGN 433**			1.2	●	●	●	●	●	●		
SNGN 120416	**SNGN 434**			1.6	●		●	●	●	●	●	●
SNGN 120420	**SNGN 435**			2.0	●				●	●	●	
SNGN 120424	**SNGN 436**			2.4	●			●	●			●
SNGN 120432	**SNGN 438**			3.2	●		●					
SNGN 120604	**SNGN 441**	12.70	6.35	0.4								
SNGN 120608	**SNGN 442**			0.8								
SNGN 120612	**SNGN 443**			1.2	●							
SNGN 120616	**SNGN 444**			1.6	●							
SNGN 120708	**SNGN 452**	12.70	7.94	0.8	●	●		●	●	●		●
SNGN 120712	**SNGN 453**			1.2	●	●	●	●	●	●	●	●
SNGN 120716	**SNGN 454**			1.6	●	●	●	●	●	●	●	●
SNGN 120720	**SNGN 455**			2.0	●	●	●	●	●	●		
SNGN 120724	**SNGN 456**			2.4	●							
SNGN 120732	**SNGN 458**			3.2	●							
SNGN 150408	**SNGN 532**	15.875	4.76	0.8								
SNGN 150412	**SNGN 533**			1.2	●			●		●		
SNGN 150416	**SNGN 534**			1.6	●					●		
SNGN 150420	**SNGN 535**			2.0								
SNGN 150424	**SNGN 536**			2.4						●	●	
SNGN 150708	**SNGN 552**	15.875	7.94	0.8	●							
SNGN 150712	**SNGN 553**			1.2	●	●	●	●	●	●		
SNGN 150716	**SNGN 554**			1.6	●			●	●	●	●	
SNGN 150720	**SNGN 555**			2.0	●							

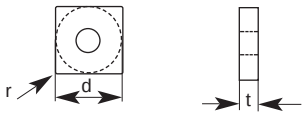
SNGN



Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNGN 190608	**SNGN 642**	19.05	4.76	0.8								
SNGN 190612	**SNGN 643**			1.2	●				●			●
SNGN 190616	**SNGN 644**			1.6	●				●			●
SNGN 190620	**SNGN 645**			2.0								
SNGN 190624	**SNGN 646**			2.4								
SNGN 190712	**SNGN 653**	19.05	7.94	1.2	●							
SNGN 190716	**SNGN 654**			1.6	●	●	●	●	●			●
SNGN 190720	**SNGN 655**			2.0	●			●	●			
SNGN 190724	**SNGN 656**			2.4	●				●			
SNGN 190732	**SNGN 658**			3.2								
SNGN 250720	**SNGN 854**	25.40	7.94	2.0	●				●			
SNGN 250724	**SNGN 856**			2.4	●	●			●	●		
SNGN 250732	**SNGN 858**			3.2								
SNGN 250924	**SNGN 866**	25.40	9.52	2.4	●			●	●	●		●
SNGN 250932	**SNGN 868**			3.2								
SNGN 3812R		38.10	12.70	0.4	●				●			

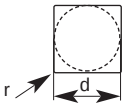
SNGN

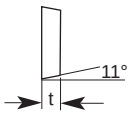




Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNGA 090304	**SNGA 321**	9.525	3.18	0.4	3.81								
SNGA 090308	**SNGA 322**			0.8									
SNGA 090312	**SNGA 323**			1.2									
SNGA 090404	**SNGA 331**	9.525	4.76	0.4	3.81								
SNGA 090408	**SNGA 332**			0.8									
SNGA 090412	**SNGA 333**			1.2									
SNGA 090416	**SNGA 334**			1.6									
SNGA 090420	**SNGA 335**			2.0									
SNGA 120304	**SNGA 421**	12.70	3.18	0.4	5.16								
SNGA 120308	**SNGA 422**			0.8									
SNGA 120312	**SNGA 423**			1.2									
SNGA 120404	**SNGA 431**	12.70	4.76	0.4	5.16	●		●		●			
SNGA 120408	**SNGA 432**			0.8		●		●		●	●	●	●
SNGA 120412	**SNGA 433**			1.2		●	●	●	●	●	●		●
SNGA 120416	**SNGA 434**			1.6		●		●		●			●
SNGA 120420	**SNGA 435**			2.0									
SNGA 120424	**SNGA 436**			2.4									
SNGA 120432	**SNGA 438**			3.2									
SNGA 120604	**SNGA 441**	12.70	6.35	0.4	5.16								
SNGA 120608	**SNGA 442**			0.8									
SNGA 120612	**SNGA 443**			1.2									
SNGA 120616	**SNGA 444**			1.6									
SNGA 120708	**SNGA 452**	12.70	7.94	0.8	5.16	●							
SNGA 120712	**SNGA 453**			1.2		●				●	●		
SNGA 120716	**SNGA 454**			1.6		●			●	●	●		●
SNGA 120720	**SNGA 455**			2.0									
SNGA 150408	**SNGA 532**	15.875	4.76	0.8	6.35								
SNGA 150412	**SNGA 533**			1.2		●							
SNGA 150416	**SNGA 534**			1.6									
SNGA 150420	**SNGA 535**			2.0									
SNGA 150424	**SNGA 536**			2.4		●							
SNGA 150708	**SNGA 552**	15.875	7.94	0.8	6.35								
SNGA 150712	**SNGA 553**			1.2						●	●		
SNGA 150716	**SNGA 554**			1.6							●		●
SNGA 150720	**SNGA 555**			2.0									
SNGA 190608	**SNGA 642**	19.05	6.35	0.8	7.94	●				●			
SNGA 190712	**SNGA 643**			1.2		●				●	●		
SNGA 190716	**SNGA 644**			1.6									
SNGA 190720	**SNGA 645**			2.0									
SNGA 190724	**SNGA 646**			2.4									

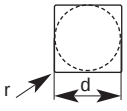
SPGN

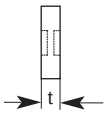




Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SPGN 060304	**SPGN 221**	6.35	3.18	0.4								
SPGN 060308	**SPGN 222**			0.8								
SPGN 090304	**SPGN 321**	9.525	3.18	0.4	●				●			
SPGN 090308	**SPGN 322**			0.8	●	●	●			●		
SPGN 090312	**SPGN 323**			1.2	●							
SPGN 090404	**SPGN 331**	9.525	4.76	0.4								
SPGN 090408	**SPGN 332**			0.8								
SPGN 090412	**SPGN 333**			1.2								
SPGN 090416	**SPGN 334**			1.6								
SPGN 090420	**SPGN 335**			2.0								
SPGN 120304	**SPGN 421**	12.70	3.18	0.4	●							
SPGN 120308	**SPGN 422**			0.8	●			●	●			
SPGN 120312	**SPGN 423**			1.2	●		●		●			
SPGN 120404	**SPGN 431**	12.70	4.76	0.4								
SPGN 120408	**SPGN 432**			0.8	●				●			
SPGN 120412	**SPGN 433**			1.2	●		●		●	●		
SPGN 120416	**SPGN 434**			1.6	●		●			●		
SPGN 120420	**SPGN 435**			2.0								
SPGN 120424	**SPGN 436**			2.4								
SPGN 120432	**SPGN 438**			3.2								
SPGN 120604	**SPGN 441**	12.70	6.35	0.4								
SPGN 120608	**SPGN 442**			0.8								
SPGN 120612	**SPGN 443**			1.2								
SPGN 120616	**SPGN 444**			1.6								
SPGN 120708	**SPGN 452**	12.70	7.94	0.8								
SPGN 120712	**SPGN 453**			1.2								
SPGN 120716	**SPGN 454**			1.6								
SPGN 120720	**SPGN 455**			2.0								
SPGN 150408	**SPGN 532**	15.875	4.76	0.8								
SPGN 150412	**SPGN 533**			1.2						●		
SPGN 150416	**SPGN 534**			1.6								
SPGN 150420	**SPGN 535**			2.0								
SPGN 150424	**SPGN 536**			2.4								
SPGN 150708	**SPGN 552**	15.875	4.76	0.8								
SPGN 150712	**SPGN 553**			1.2								
SPGN 150716	**SPGN 554**			1.6								
SPGN 150720	**SPGN 555**			2.0								

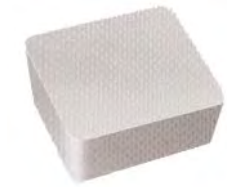
SNGX

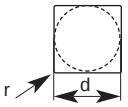


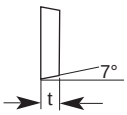


Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNGX 120708	**SNGX 452**	12.70	7.94	0.8						●	●	●
SNGX 120712	**SNGX 453**			1.2						●	●	●
SNGX 120716	**SNGX 454**			1.6						●	●	●

SCGN

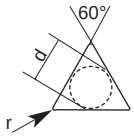


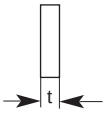




Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SCGN 120404	**SCGN 431**	12.70	4.76	0.4								
SCGN 120408	**SCGN 432**			0.8	●							
SCGN 120412	**SCGN 433**			1.2						●		
SCGN 120416	**SCGN 434**			1.6	●	●						

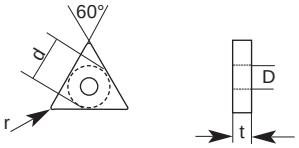
TNGN





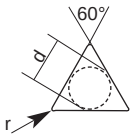
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TNGN 110304	**TNGN 221**	6.35	3.18	0.4								
TNGN 110308	**TNGN 222**			0.8	●	●		●	●	●		
TNGN 160304	**TNGN 321**	9.525	3.18	0.4	●							
TNGN 160308	**TNGN 322**			0.8								
TNGN 160312	**TNGN 323**			1.2								
TNGN 160404	**TNGN 331**	9.525	4.76	0.4	●		●	●				
TNGN 160408	**TNGN 332**			0.8	●	●	●	●	●	●		
TNGN 160412	**TNGN 333**			1.2	●				●	●		
TNGN 160416	**TNGN 334**			1.6	●		●			●		
TNGN 160704	**TNGN 351**	9.525	6.35	0.4	●							
TNGN 160708	**TNGN 352**			0.8	●		●			●		
TNGN 160712	**TNGN 353**			1.2	●			●	●	●		
TNGN 160716	**TNGN 354**			1.6	●							
TNGN 160720	**TNGN 355**			2.0								
TNGN 160724	**TNGN 356**			2.4								
TNGN 220404	**TNGN 431**	12.70	4.76	0.4	●							
TNGN 220408	**TNGN 432**			0.8	●				●			●
TNGN 220412	**TNGN 433**			1.2	●				●			
TNGN 220416	**TNGN 434**			1.6								
TNGN 220420	**TNGN 435**			2.0								
TNGN 220432	**TNGN 438**			3.2					●	●		
TNGN 220608	**TNGN 442**	12.70	6.35	0.8								
TNGN 220612	**TNGN 443**			1.2								
TNGN 220616	**TNGN 444**			1.6								
TNGN 220708	**TNGN 452**	12.70	7.94	0.8								
TNGN 220712	**TNGN 453**			1.2								
TNGN 220716	**TNGN 454**			1.6								
TNGN 270608	**TNGN 542**	15.875	6.35	0.8								
TNGN 270612	**TNGN 543**			1.2								
TNGN 270616	**TNGN 544**			1.6								
TNGN 440924	**TNGN 866**	25.40	9.52	2.4								
TNGN 440932	**TNGN 868**			3.2								
TNGN 440948	**TNGN 8612**			4.8								

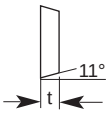
TNGA



Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TNGA 090304	**TNGA 221**	6.35	3.18	0.4	2.26								
TNGA 090308	**TNGA 222**			0.8									
TNGA 160304	**TNGA 321**	9.525	3.18	0.4	3.81	●							
TNGA 160308	**TNGA 322**			0.8		●			●	●			
TNGA 160312	**TNGA 323**			1.2		●							
TNGA 160404	**TNGA 331**	9.525	4.76	0.4	3.81	●	●	●		●	●	●	●
TNGA 160408	**TNGA 332**			0.8		●	●	●		●	●	●	●
TNGA 160412	**TNGA 333**			1.2		●	●	●		●	●		
TNGA 160416	**TNGA 334**			1.6		●			●	●	●		
TNGA 160704	**TNGA 351**	9.525	7.94	0.4	3.81								
TNGA 160708	**TNGA 352**			0.8									
TNGA 160712	**TNGA 353**			1.2									
TNGA 160716	**TNGA 354**			1.6									
TNGA 160720	**TNGA 355**			2.0									
TNGA 160724	**TNGA 356**			2.4									
TNGA 220404	**TNGA 431**	12.70	4.76	0.4	5.16	●				●			
TNGA 220408	**TNGA 432**			0.8		●				●			
TNGA 220412	**TNGA 433**			1.2		●							
TNGA 220416	**TNGA 434**			1.6		●			●	●			
TNGA 220420	**TNGA 435**			2.0									
TNGA 220432	**TNGA 438**			3.2									
TNGA 220404	**TNGA 442**	12.70	6.35	0.8	5.16								
TNGA 220408	**TNGA 443**			1.2									
TNGA 220408	**TNGA 444**			1.6									

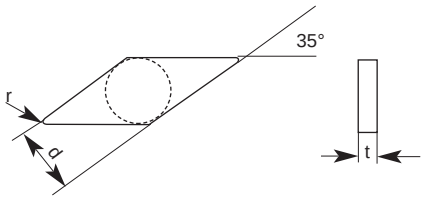
TPGN





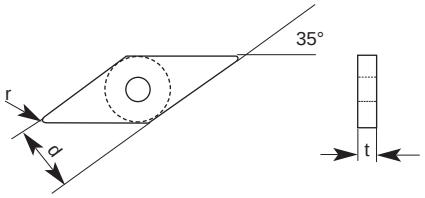
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TPGN 110304	**TPGN 221**	6.35	3.18	0.4	●	●	●		●			
TPGN 110308	**TPGN 222**			0.8	●	●	●		●	●		
TPGN 160304	**TPGN 321**	9.525	3.18	0.4	●	●	●	●	●			
TPGN 160308	**TPGN 322**			0.8	●	●	●	●	●	●		
TPGN 160312	**TPGN 323**			1.2	●	●						
TPGN 160404	**TPGN 331**	9.525	4.76	0.4	●							
TPGN 160408	**TPGN 332**			0.8	●							
TPGN 160412	**TPGN 333**			1.2	●							
TPGN 160416	**TPGN 334**			1.6	●							
TPGN 160704	**TPGN 351**	9.525	7.94	0.4								
TPGN 160708	**TPGN 352**			0.8								
TPGN 160712	**TPGN 353**			1.2								
TPGN 160716	**TPGN 354**			1.6								
TPGN 160720	**TPGN 355**			2.0								
TPGN 160724	**TPGN 356**			2.4								
TPGN 220404	**TPGN 431**	12.70	4.76	0.4	●							
TPGN 220408	**TPGN 432**			0.8	●	●			●			
TPGN 220412	**TPGN 433**			1.2	●	●				●		
TPGN 220416	**TPGN 434**			1.6	●							
TPGN 220420	**TPGN 435**			2.0								
TPGN 220432	**TPGN 438**			3.2								
TPGN 220608	**TPGN 442**	12.70	6.35	0.8								
TPGN 220612	**TPGN 443**			1.2								
TPGN 220616	**TPGN 444**			1.6								
TPGN 220708	**TPGN 452**	12.70	7.94	0.8								
TPGN 220712	**TPGN 453**			1.2								
TPGN 220716	**TPGN 454**			1.6								
TPGN 270608	**TPGN 542**	15.875	6.35	0.8								
TPGN 270612	**TPGN 543**			1.2								
TPGN 270616	**TPGN 544**			1.6	●							

VNGN



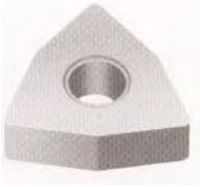
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
VNGN 160404	**VNGN 331**	9.525	4.76	0.4	●							
VNGN 160408	**VNGN 332**			0.8	●							
VNGN 160412	**VNGN 333**			1.2								
VNGN 220404	**VNGN 431**	9.525	4.76	0.4								
VNGN 220408	**VNGN 432**			0.8	●							
VNGN 220412	**VNGN 433**			1.2								

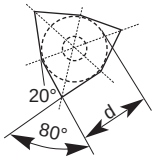
VNGA

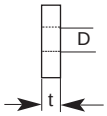


Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
VNGA 160404	**VNGA 331**	9.525	4.76	0.4	3.81	●	●			●			
VNGA 160408	**VNGA 332**			0.8		●	●			●	●		
VNGA 160412	**VNGA 333**			1.2		●					●		
VNGA 220404	**VNGA 431**	12.70	4.76	0.4	5.16								
VNGA 220408	**VNGA 432**			0.8		●	●						
VNGA 220412	**VNGA 433**			1.2		●							

WNGA

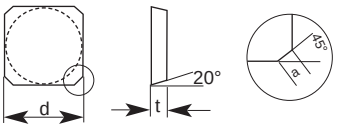






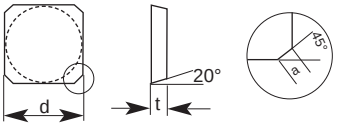
Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	r	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
WNGA 080404	**WNGA 431**	12.70	4.76	0.4	5.16	●	●						
WNGA 080408	**WNGA 432**			0.8		●	●			●	●		●
WNGA 080412	**WNGA 433**			1.2		●				●	●	●	

SEAN



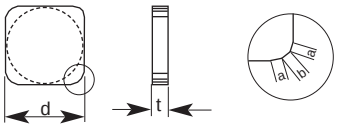
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SEAN 1203 AFTN	**SEAN 42 AFTN**	12.70	3.18	2.0					●	●		

SEKN



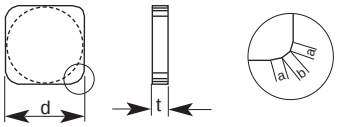
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SEKN 1203 AFTN	**SEKN 42 AFTN**	12.70	3.18	2.0					●	●		
SEKN 1504 AFTN	**SEKN 53 AFTN**	15.875	4.76	2.0					●	●		●

SNCN



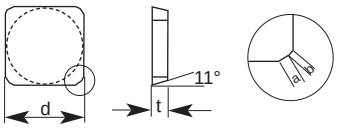
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNCN 1204 ENTN	**SNCN 43 ENTN**	12.70	4.76	1.0					●	●		

SNKN



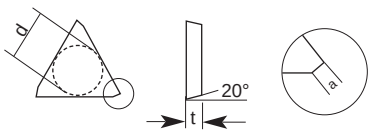
Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	a	b	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNKN 1204 ENTN	**SNKN 43 ENTN**	12.70	4.76	1.4	1.0					●	●		
SNKN 1504 ENTN	**SNKN 53 ENTN**	15.875	4.76	1.4	1.0					●	●		

SPKN



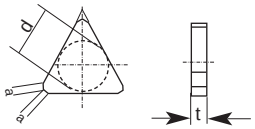
Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	a	b	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SPKN 1204 ENTN	**SPKN 43 ENTN**	12.70	3.18	1.4	1.0					●	●		●
SPKN 1504 ENTN	**SPKN 53 ENTN**	15.875	4.76	1.4	1.0					●	●		●

TEKN



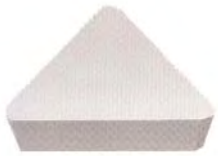
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TEKN 1603 PDTR	**TEKN 32 PDTR**	9.525	3.18	1.75					●	●		
TEKN 2204 PDTR	**TEKN 43 PDTR**	12.70	4.76	1.75					●	●		

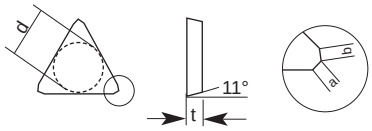
TNCN



Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TNCN 1204 ANT	**TNCN 43 ANT**	12.70	4.76	2.6					●	●		

TPKN

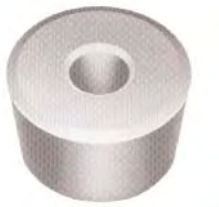


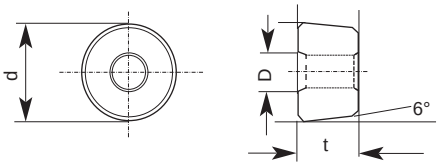


Specification		Dimension (mm)				Ceramic Stock							
ISO	ASA	d	t	a	b	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
TPKN 1603 PDTR	**TPKN 32 PDTR**	9.525	3.18	0.7	1.3					●	●		
TPKN 2204 PDTR	**TPKN 43 PDTR**	12.70	4.76	0.7	1.3					●	●		

ROLL TURNING

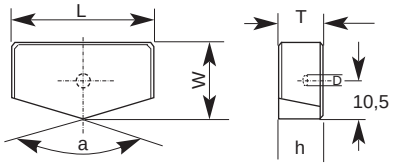
CDH





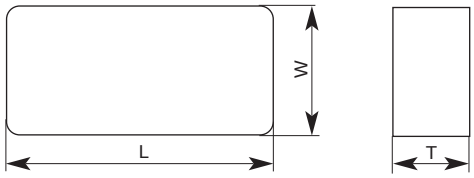
Specification		Dimension (mm)			Ceramic Stock							
ISO	ASA	d	t	D	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
CDH 120600	**CDH 22**	12.70	6.35	3.18	●	●						
CDH 120900	**CDH 23**	12.70	9.525	3.18	●							
CDH 191200	**CDH 32**	19.05	12.70	6.35	●							
CDH 191900	**CDH 33**	19.05	9.525	6.35	●							
CDH 251200	**CDH 42**	25.40	12.70	6.75	●	●						
CDH 251900	**CDH 43**	25.40	19.05	6.75	●							
CDH 320900	**CDH 515**	31.75	9.525	9.92	●			●	●			
CDH 321900	**CDH 53**	31.75	19.05	9.92	●	●		●	●	●		

F - Series



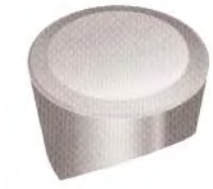
Specification	Dimension (mm)						Ceramic Stock							
ISO	L	W	T	D	h	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
F 13941	32.0	19.05	12.0	6.5	6.0	120°	●			●	●			
F 10537	44.5	25.4	14.2	6.5	7.0	140°	●			●	●	●		

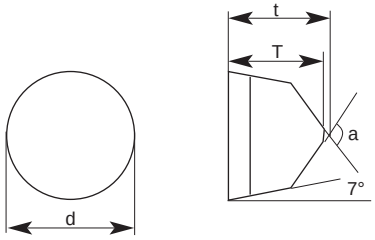
LNJ



Specification	Dimension (mm)				Ceramic Stock							
	L	W	T	r	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
LNJ 5464	25.40	15.88	9.52	1.6	●				●			
LNJ 5568	31.75	15.88	9.52	3.2					●			
LNJ 6588	31.75	19.05	12.70	3.2	●	●		●	●	●		
LNJ 6688	38.10	19.05	12.70	3.2	●	●		●	●	●		

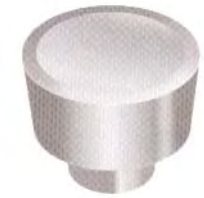
RCGX

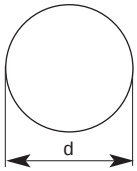


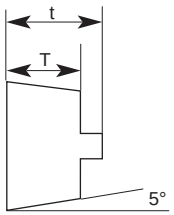


Specification	Dimension (mm)				Ceramic Stock							
	d	t	T	a	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RCGX 060400	6.35	4.76	4.57	120°	●							
RCGX 060600		6.35	6.20			●						
RCGX 060700		7.94	7.70		●				●			
RCGX 090700	9.52	7.94	7.70	120°	●	●			●			
RCGX 120700	12.70	7.94	7.70	120°	●	●			●			
RCGX 151000	15.88	10.0	9.77	120°	●	●			●			
RCGX 191000	19.05	10.0	9.77	120°	●	●						
RCGX 251200	25.4	12.0	11.85	140°	●	●						

RBGX

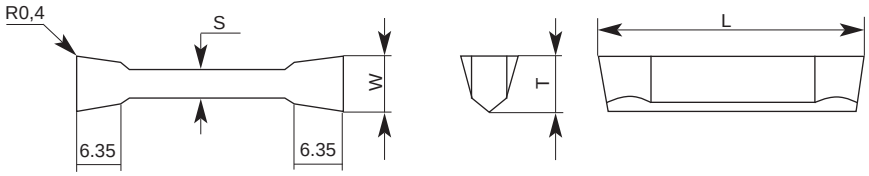






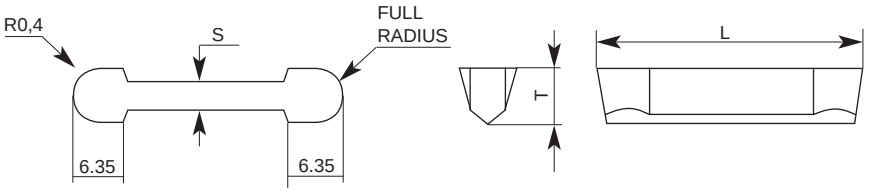
Specification	Dimension (mm)				Ceramic Stock							
	d	D	t	T	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
RBGX 06T	6.0	3.0	5.0	3.0	●							
RBGX 12T	12.0	6.0	9.0	6.0	●							
RBGX 16T	16.0	8.0	13.0	8.0	●							
RBGX 20T	20.0	10.0	15.0	10.0	●	●						
RBGX 26T	26.0	14.0	15.0	1.0	●	●						

SYBF



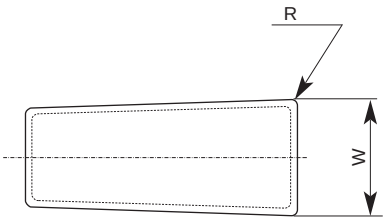
Specification	Dimension (mm)				Ceramic Stock							
	L	W	T	S	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SYBF 3228	28.58	3.175	6.350	2.692	●							
SYBF 4028		3.962	6.350	2.692	●							
SYBF 4828		4.775	6.350	3.657	●							
SYBF 5528		5.537	6.350	3.657	●							
SYBF 6428		6.350	8.559	5.130	●							
SYBF 7128		7.137	8.559	5.130	●							
SYBF 7928		7.924	8.559	5.130	●							
SYBF 8728		8.737	8.559	6.985	●							
SYBF 9528		9.525	8.559	6.985	●							

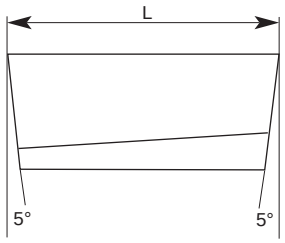
SYBR

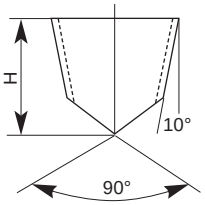


Specification	Dimension (mm)				Ceramic Stock							
	L	W	T	S	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SYBR 3228	28.58	3.175	6.350	2.692	●							
SYBR 4028		3.962	6.350	2.692	●							
SYBR 4828		4.775	6.350	3.657	●							
SYBR 5528		5.537	6.350	3.657	●							
SYBR 6428		6.350	8.559	5.130	●							
SYBR 7128		7.137	8.559	5.130	●							
SYBR 7928		7.924	8.559	5.130	●							
SYBR 8728		8.737	8.559	6.985	●							
SYBR 9528		9.525	8.559	6.985	●							

SGF

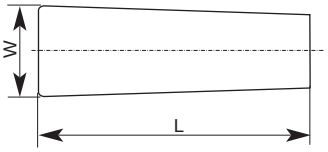


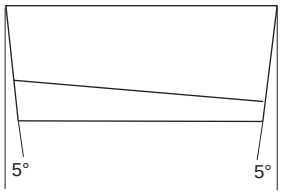


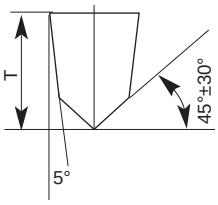


Specification	Dimension (mm)				Ceramic Stock							
	L	W	H	R	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SGF 0525	25.4	5.0	7.5	0.8	●							
SGF 0625	25.4	6.0	7.5	0.8	●							
SGF 6325	25.4	6.35	7.5	0.8	●							
SGF 1425	25.4	14.0	7.5	0.8	●				●			
SGF 0515	15.0	5.0	7.5	0.8								
SGF 6315	15.0	6.35	7.5	0.8	●							

SGR

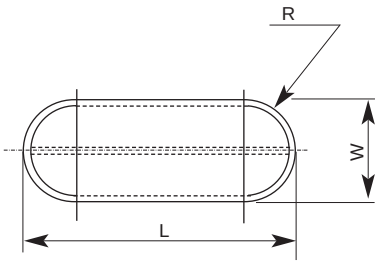


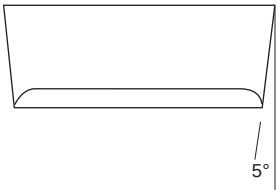


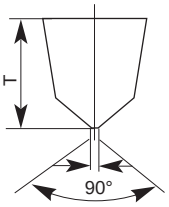


Specification	Dimension (mm)			Ceramic Stock							
	L	W	T	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SGR 4712	12.70	4.762	4.749	●							
SGR 5519	19.05	5.557	6.35	●							
SGR 6319		6.350		●							
SGR 7119		7.142		●							
SGR 7925	25.40	7.937	8.559	●							
SGR 8725		8.732		●							
SGR 9525		9.525		●							
SGR 6325	25.40	6.350	7.96	●							
SGR 0625		6.00		●							
SGR 0525		5.00		●							

SSR



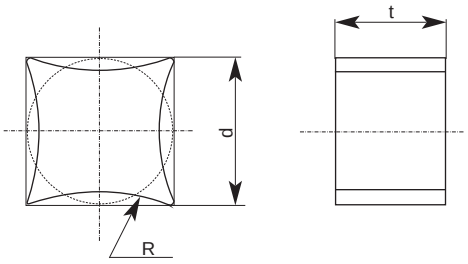




Specification	Dimension (mm)				Ceramic Stock							
	L	W	T	R	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SSR 4713	13.462	4.762	4.724	2.387	●							
SSR 3515	15.875	3.571	4.749	1.778	●							
SSR 6319	19.05	6.350	4.775	3.175	●							
SSR 9519	19.05	9.525	6.350	4.749	●							
SSR 1225	25.40	12.70	7.772	6.35	●							

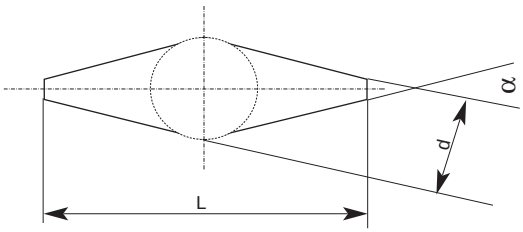
Special inserts

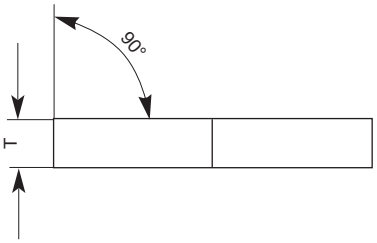
SNMX



Specification	Dimension (mm)			Ceramic Stock							
	d	t	R	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
SNMX 121006R	12.70	10.0	6				●				
SNMX 121009R			9				●				
SNMX 121012R			12				●				
SNMX 121015R			15				●				
SNMX 121020R			20				●				
SNMX 121025R			25				●				
SNMX 121030R			30				●				
SNMX 121040R			40				●				
SNMX 121050R			50				●				

GVGN





Specification	Dimension (mm)				Ceramic Stock							
	L	α	d	T	IM1	IM8	IMD2	IMZ2	IMS2	IMS3	IMS5	IMS7
GVGN 38320	32	38°	14.238	7.94				●				
GVGN 38335	33.5	38°	13.28									
GVGN 36340	34	36°	13.59									