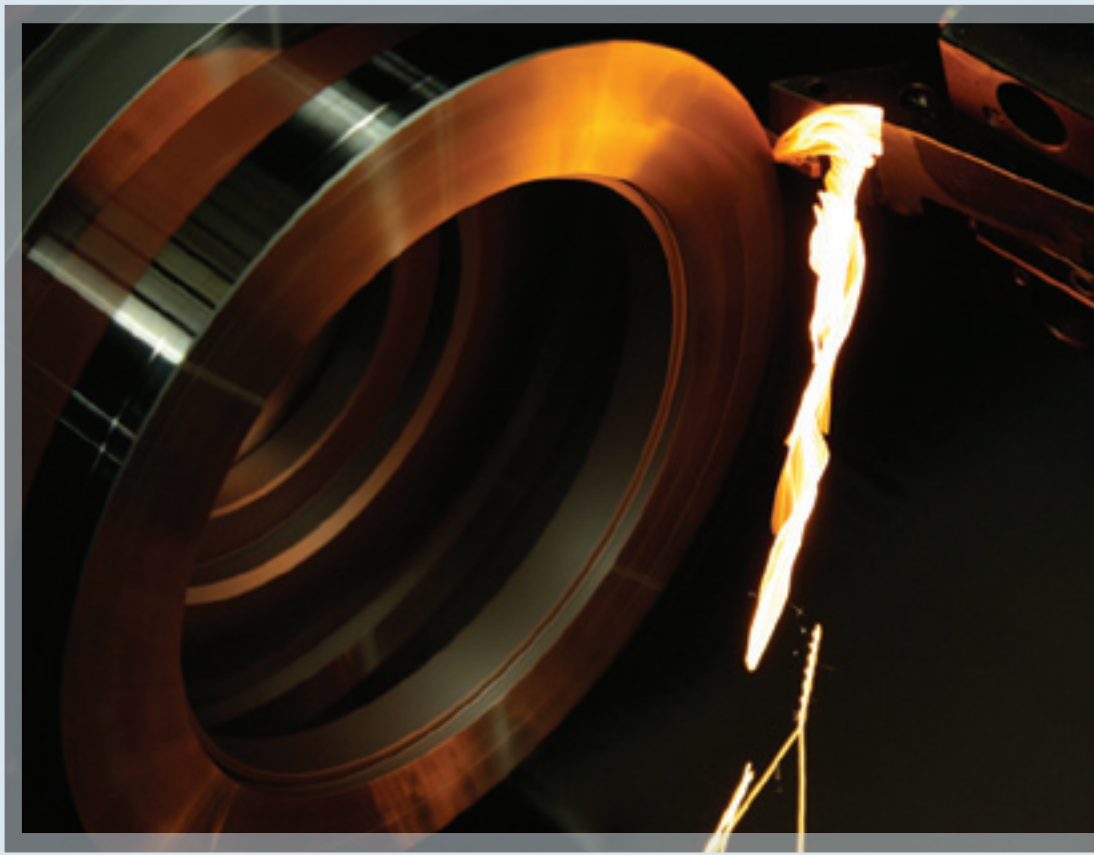


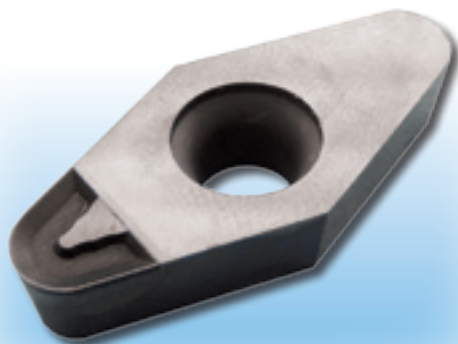
Superhard

CATALOG 2012



Superhard

As the name „Superhard“ indicates, we specialize in super-hard cutting materials. In particular, PCD (polycrystalline diamond) and PCBN (polycrystalline cubic boron nitride), which are materials with high hardness used for machining hard, difficult to machine materials, or for increase productivity in machining of ferrous materials, etc.



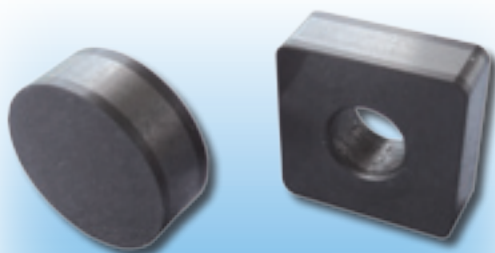
From past times to the present there is a constant requirement to increase productivity and to overcome the already established habits. This logically comes up from the competitive environment that exists in all industries segments.

No matter if a small batch production of molds from hardened steel or serial production in the automotive industry where aluminum or cast iron is machined with use of high cutting speeds and feeds.

Therefore, the use of these super-hard cutting materials is one of many solutions how to be always one step ahead.

Due to the complexity of the machining process there is always necessary to select proper cutting material for the given application. Like any other cutting material also PCD or PCBN have their specific properties that make them to be used under given cutting conditions on the machine.

This material by itself makes sense to use on the machines which meets the conditions for optimal use, of this high performance material especially rigidity, sufficient cutting power and speed.



We are aware that customers need to verify the quality and suitability of offered products directly in his given conditions, therefore we provide technical support directly to given machining process. Based on the particular requirements of the process, machined material, etc., we recommend the most suitable process of machining with given tool.

When there are special tools used, we offer to hold a necessary stock of those tools and supply when there is a need from customer.

There is also possibility to use the consignment stock of goods which can be used based on current production needs of the customer. Dispatch of goods is then arranged immediately after confirmation from the customer. By this process customer can reduce the amount of money spent in stock reserves, also this ensures higher efficiency and continuity of production, in case of sudden tool breakage or increased needs.

In case of any question regarding our product range please do not hesitate to contact us, we appreciate your interest about our services.



PCD (polycrystalline diamond)

Diamond is the hardest known material. PCD (polycrystalline diamond) is synthetic diamond, created under high pressure and temperature (approx. 1700 °C), where grains of randomly oriented synthetic diamond with added binder are sintered to the supporting carbide layer.

Synthetic PCD powder for diamond production, consist of one element called carbon.

The arrangement of atoms takes place in the crystalline lattice and crystallizes in the cubic system.

By this process there is made so called PCD disc which is afterwards by using EDM method or laser cut to small segments required for the production of cutting inserts.

This PCD segment is subsequently brazed in to the carbide blank and ground to desired shape. We are able to offer standard ISO insert shapes, but also special inserts according to customer needs.

PCD material can be classified according to the grain size:

coarse grain

– is suitable for applications with request for longer tool life, or machining of very abrasive materials (fiberglass composites, aluminum alloy with higher silicon content, etc.)

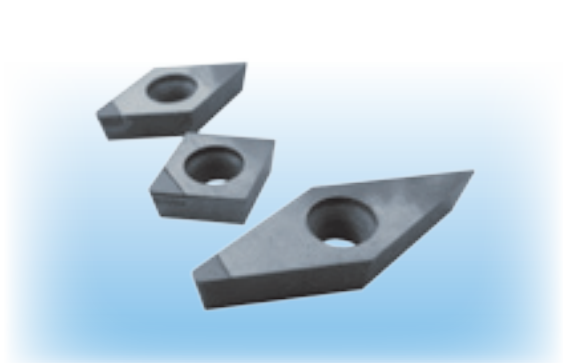
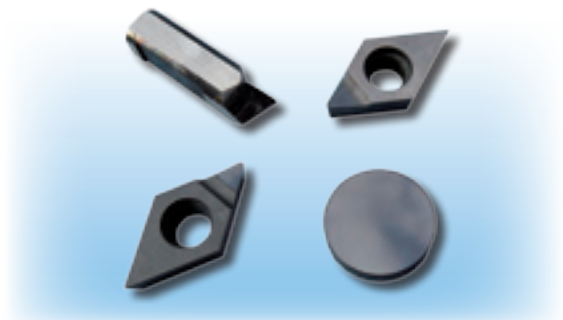
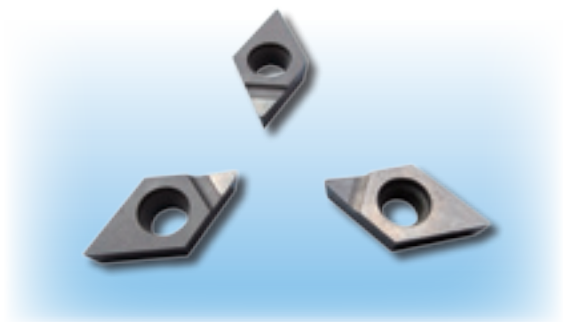
fine grain

– this can be used for applications requiring high surface quality or where edge toughness and resistance against cracking is required

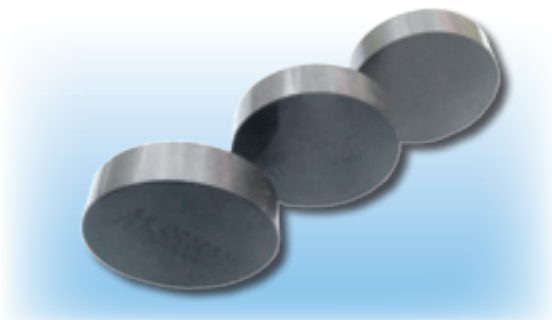
The main advantages of PCD inserts in comparison with other cutting materials:

- increased lifetime
- reduction of production time
- variability in use machining non-ferrous materials
- reducing the build-up edge when machining soft sticky materials (low silicon aluminium)
- High thermal conductivity of PCD

Less productive machining methods and tools, can be replaced with PCD, with target to reduce production cost and increase productivity. The disadvantage might be relatively low thermal resistance of PCD, at temperatures exceeding 650°C there is already degradation, from diamond structure back to the graphite (carbon).

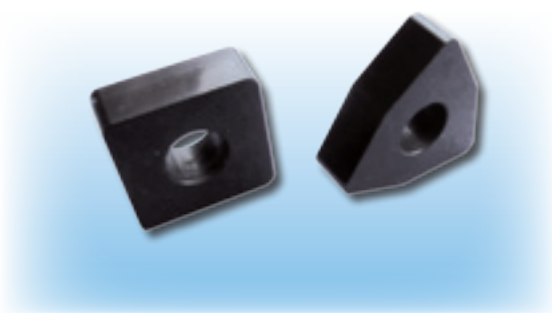


PCBN (polycrystalline cubic boron nitride)

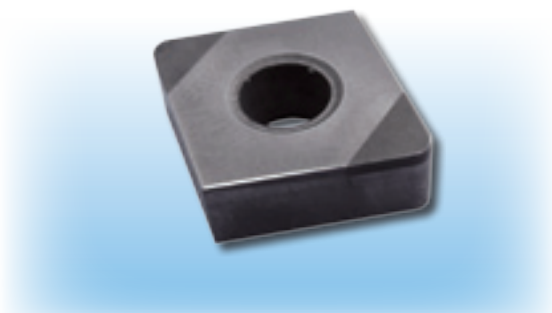


PCBN is the second hardest material after diamond. Method of PCBN production is similar to the production of PCD, it means sintering at high temperature and pressure.

The advantage of PCBN compared to PCD, is a possibility to use for machining of materials containing iron (hardened steel, cast iron, PM materials, etc.)

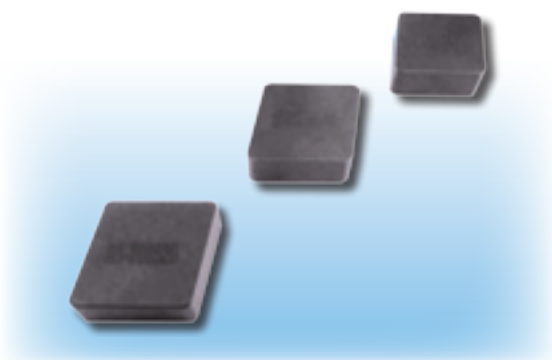


In compliance with proper use and appropriate cutting parameters is PCBN cutting material suitable for many applications. PCBN inserts have significant use especially in mass production, where is important productivity and machined surface quality, there is also possible to replace grinding. Depending on the application whether roughing or finishing operation, there is usually small chamfer on the edge of PCBN insert to protect relatively brittle edge against possible chipping, especially during interrupted machining. Sharp edge is used in special cases such as finishing with a small depth of cut, or when there is weak clamping of the work-piece, to reduce the cutting forces during machining, etc.



We are able to offer and deliver both PCBN inserts in ISO standards, or in special shapes.

There is possibility to have PCBN "solid" or "full face". Solid PCBN inserts are made of solid PCBN material, which allows the use of all insert edges and for big depths of cut. There is also possibility to regrind this solid PCBN insert to smaller size and reuse it again.



PCBN sintered directly to the carbide layer is used especially for smaller depth of cut. From the PCBN primary disk, is cut-out a small segment which is brazed in a desired shape of carbide insert and is re-grinded. Another type is when the PCBN is sintered to the carbide support layer from both sides, this is called "double layer" insert. This insert has almost identical use as solid PCBN insert. The advantage is a relatively tough carbide middle layer, therefore is suitable for interrupted cutting or to produce inserts with through hole, where in case of solid PCBN might be possibility of insert breakage.

Basic characteristics of the PCBN material according to % of binder in PCBN:

PCBN with low content of CBN grains in the substrate

This type of PCBN material suits finishing applications, when machining hardened steel with small depth of cut. Due to the lower thermal conductivity than high content PCBN grades, even when small depth of cut, the heat generated during machining remains in the cutting zone, which is one of the essential conditions for machining of hardened steel.

PCBN with medium content of CBN grains in the substrate

This is generally speaking cutting material used in applications where high content PCBN is too brittle, for example in interrupted machining. Or alternatively, in applications where during machining of hardened steel coolant has to be used, and there is no sufficient heat generated in cutting zone for successful machining, etc.

High content PCBN grade

The use of this material is typical for machining of grey cast iron, PM materials, centrifugally casted material, etc. This type of PCBN has the highest abrasion resistance of all PCBN substrates.

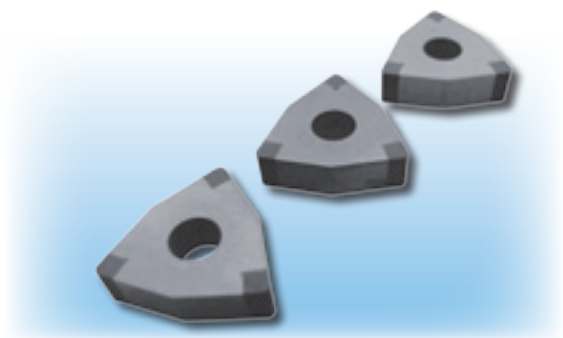
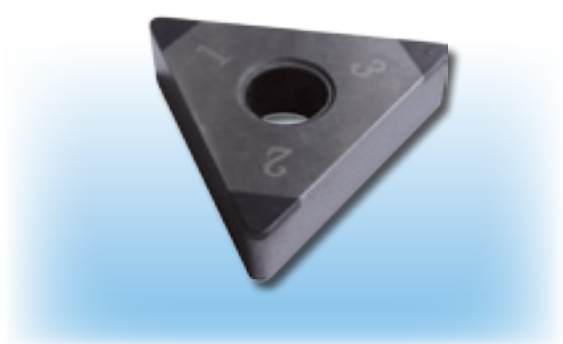
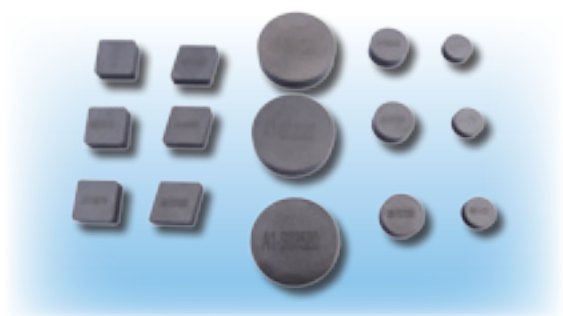
In addition to the basic sorting according to PCBN content in the substrate, there is in closer look to the substrate, possibility to sort according to size of individual CBN grains in the substrate this way:

- Very fine grain size (suitable for finishing applications)
- Medium grain size (general applications)
- Coarse grain CBN (roughing)
- Or mix of grain sizes grits

Another division of PCBN can be made based on the type of used binder. In general there can be used either ceramic binder, Ti, TiN, or mix of the above, etc. Type of binder used is important in applications where chemical reaction with the machined material occurs.

The main advantages of PCBN in comparison with other cutting materials:

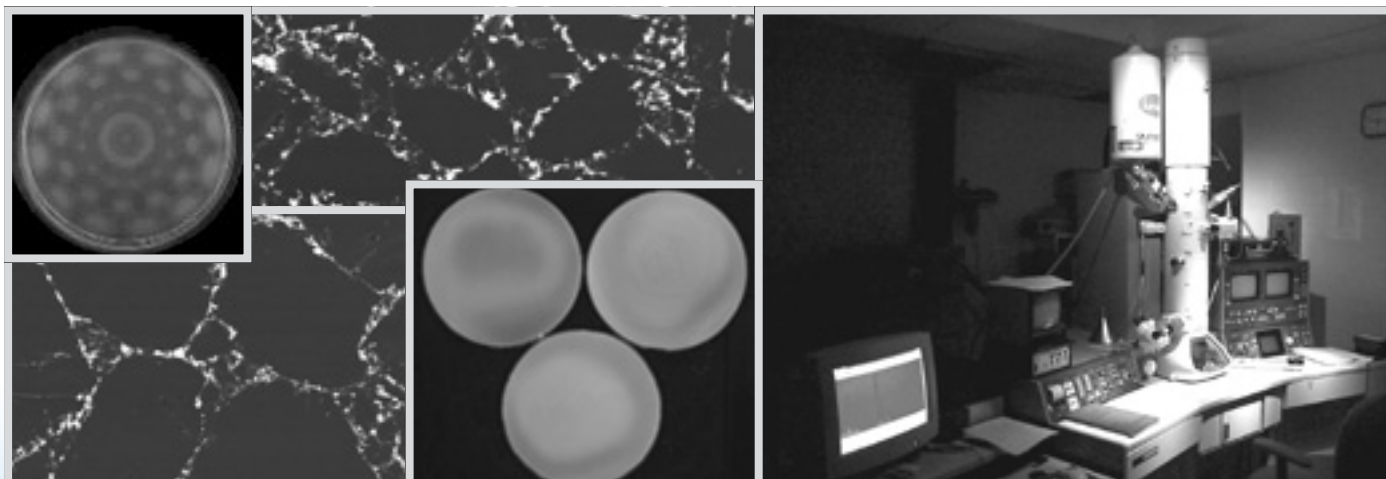
- possibility to use higher cutting speeds
- reduction of production time
- machining of hardened materials , replacement of grinding
- also possible to use for heavy interrupted machining (gear wheels)
- solution for machining of materials, which can't be machined by use of standard methods



CUTTING MATERIAL GRADES

PCD (polycrystalline diamond)	
PKD 5	Fine grain PCD. The average grain size is about 5 μm , cobalt binder. Use for finishing applications with high demand on surface quality. This is also relatively tough grade suitable for interrupted cut.
PKD 10	Medium grain sized PCD. The average grain size about 10 μm , cobalt binder. The most commonly used type for general machining applications, with balanced wear resistance and toughness.
PKD 25	Coarse grain PCD. The grain size of about 25 μm , cobalt binder. Used for applications requiring high abrasion resistance, machining abrasive materials (aluminum with high Silicone content, fiberglass, MMC, etc.)

PCBN (polycrystalline cubic boron nitride)	
PCBN layer sintered on carbide	
CBN 50	This PCBN material has content of approx. 50% CBN grains in the substrate (Ti – binder used). Suits for finishing applications of hardened steel with small depth of cut, also possibility of interrupted cut. Good resistance to chemical wear mechanism.
CBN 75	This PCBN material has content of approx. 75% of CBN grains in the substrate (TiC-binder). PCBN material, with balanced substrate wear resistance and toughness. Suitable for machining hardened steel materials, finishing, machining with higher depth of cut or interrupted machining is possible. Cast iron machining, with unstable
CBN 90	This PCBN material has content of approx. 90% of CBN grains in the substrate. Cast iron machining, with unstable conditions is also possible. Used for cast iron machining, PM materials, hard welded layers. Interrupted cut is possible on stable machines.
CBN 95	High content PCBN material, approx. 95% of the CBN grains in the substrate. Ideal for machining of PM materials, finishing cast iron, etc. High cutting speed can be used, this PCBN has great resistance against abrasive wear.
SOLID PCBN	
CBN 60S	Solid PCBN material, with lower CBN content in the substrate. Suitable for finishing of hardened steel. Possibility to use for interrupted cutting or unstable conditions with higher depth of cut.
CBN 85S	Material with medium content of CBN. Balanced toughness of the substrate with a wear resistance. Universal grade for general machining applications with high material removal rates. Machining of rolls (stationary or centrifugally casted), crushing rolls, machining of hard welded layers. Can be used also for machining of grey cast iron.
CBN 92S	PCBN with high CBN grains content in the substrate. Material has high resistance against abrasive wear and is suitable for machining of grey cast iron and PM materials.



RECOMMENDED CUTTING CONDITIONS

MACHINED MATERIAL	CUTTING MATERIAL/ APPLICATION TYPE	CUTTING SPEED Vc (m/min)	PCD			PCBN LAYER ON CARBIDE				SOLID PCBN			CUTTING EDGE TYPE -CHAMFER SIZE	NOTE
			PKD 5	PKD 10	PKD 25	CBN 50	CBN 75	CBN 90	CBN 95	CBN 605	CBN 855	CBN 925		
POWDER METAL ALLOYS	PCBN / Roughing	100-200						●	○		○	●	T, S (0,15-0,25 x 20°)	Cutting speed must be adjusted according application type, machine rigidity, etc. The use of chamfered edge is recommended.
	PCBN / finishing	150-300						●	○		○	●	T, F, E (0,05-0,15 x 20°)	For finishing applications of thin-walled parts, or if there is necessary to minimize any burrs it is possible to use sharp cutting edge.
GREY CAST IRON	PCBN / Roughing	600-1500						●	○		●	○	T, S (0,15-0,25 x 20°)	Grey cast iron (types GG according DIN 1691). It is necessary to use chamfered edge, especially for interrupted cut, or cut through the crust of the workpiece. When using higher cutting speeds (greater centrifugal forces) there is necessary to ensure a sufficient clamping of the workpiece.
	PCBN finishing	800-2000						○	●		○	●	T, F, E (0,05-0,25 x 20°)	There is possible to use sharp cutting edge for finishing with request for low roughness of the machined surface, or even positive insert geometry.
DUCTILE IRON	PCBN	100-250						●	○		●	○	T, S (0,1-0,25 x 20°)	Ductile cast iron (types GGG according DIN 1691). There is important to determine content of free ferrite in the machined material. Free ferrite chemically attacks the PCBN, resulting in low tool live and machining by the PCBN is not usually economical.
WHITE-CHILLED IRON	PCBN	40-130						●	○		●	○	T, S (0,2-0,4 x 20°-25°)	For rough machining applications and applications through the crust, it is recommended to use chamfered edge.
ALUMINUM ALLOYS	PCD	500-2500	●	○									F	For alloys with silicon content over 12% is recommended, to reduce cutting speed accordingly. Also suitable to use sharp cutting edge, or chip-breaker in the PCD.
COPPER AND BRASS ALLOYS	PCD	300-1200	●	○									F	Appropriate to use sharp cutting edge. It is also possible to use laser created chip-breaker in PCD material.
CERAMIC POWDER MATERIALS, GRAPHITE, etc.	PCD	150-600	○	●									F	If machining such abrasive materials, there occurs mainly flank wear of the cutting edge. Therefore choose appropriate cutting speed, to avoid exceeding the thermal resistance of PCD, or possibly use cooling.
FIBRE GLASS, MMC MATERIALS, etc.	PCD	200-1000	○	●									F	For these materials it is recommended to use a coarse grain PCD grade. No cooling is usually necessary.
WOOD, MDF BOARD	PCD	1000-3000	●	○									F	When machining big MDF boards, etc. is necessary to ensure, there will be no big vibration during machining, or when parts of the MDF boards are separated each from other.
HARD FACING ALLOYS, HEATRESISTANT ALLOYS, SUPERALLOYS	PCBN	80-200					○	●			●	○	T, S (0,1-0,3 x 20°-25°)	Check the suitability, of cooling for given specific machined material with our representative.
HARDENED STEEL	PCBN / Roughing (interrupted)	80-150				○	●			○	●		T, S (0,15-0,25 x 20°)	It is recommended to use negative protection chamfer on the edge, the application should be without cooling.
	PCBN finishing	120-220				●	○			●	○		T, F, E (0,05-0,15 x 20°)	Generally it is recommended to have small protection chamfer on the edge, in some cases it is possible to use sharp cutting edge (weak clamping or requirement to minimize burrs, etc.).
CARBIDE	PCD	10-25	○	●									T, S, E (0,1-0,2 x 20°)	Machined material carbide (usually rolls), with cobalt content approx. (8-25%). Choose suitable cutting speed, do not to exceed thermal resistance of PCD (above 650 °C), if possible use cooling.
CARBIDE	PCBN	10-40						●	○		●	○	T, S, E (0,1-0,2 x 20°)	Machined carbide, with cobalt binder content of about 20% or more. It is recommended to use slightly chamfered cutting edge, or for stable applications can be used a sharp edge.

GENERAL RECOMMENDATIONS FOR MACHINING

PCBN CUTTING MATERIAL

When selecting the appropriate type (shape) of cutting insert, it is necessary to keep in mind that the PCBN material is hard, but also relatively brittle material, with low resistance to shock and vibrations during machining. Therefore it is recommended to use maximum corner radius allowable at application, of course considering the machine stability, clamping, etc. In cases with request for relatively small corner radius, there should be used insert with honed or chamfered cutting edge.

If there is application, where the PCBN cutting edge enters machined material that does not have chamfered edge, than is recommended to reduce the feed rate about 50%.

Coolant should not be used during machining when using PCBN, especially do not use if there is interrupted cutting. Constant heating and cooling during interrupted machining, would lead to creating of small cracks in the PCBN material and to a shortened tool life of the cutting edge. The use of coolant is only possible in specific cases, where the cut is continuous, but the coolant must be sufficient, without interruption during machining.

During machining is also necessary to take into consideration the whole system (i.e. the machine, workpiece clamping, insert type, machined material, etc.). Especially there should not be any big vibrations caused by poor system toughness. To a certain extent this can be compensated by use of tougher PCBN substrate, different chamfered edge, etc. But in general, the PCBN edge damage should have a balanced combination of flank wear and notch wear. When exceeding a certain degree of wear there might occur sudden edge breakage, or complete insert breakage with possible workpiece damage.

PCBN is used for machining of hardened steel with a minimum hardness about 45 HRC. At lower hardness is the machining with PCBN not economically attractive, these materials can be machined with standard cutting materials.

PCD CUTTING MATERIAL

Taking into consideration the known properties of PCD, the use of this advanced material is limited for machining of non-ferrous materials, plastics, wood, etc. Certain exception is machining of titanium alloys or carbide rolls where PCD can be successfully used. Generally, there is not necessary to use coolant, when machining with PCD, only in cases where the high temperature could lead to PCD degradation, is essential to use coolant. Cooling has to be continuous, without interruption and in sufficient volume.

Typical wear of PCD should be controlled flank wear of the cutting edge. In any case there should be no signs of cutting edge chipping. In this case it is necessary to adjust the cutting conditions, or use more suitable PCD grade with higher chipping resistance.

SPECIAL TOOLS

Generally increasing demands of the machined part producers, necessarily brings needed progress in the manufacturing of cutting tools.

The combination of these requirements, gives rise to a special tailor made tool, that combines several technologies of the machining process and thus enable speed up productivity and reduce time required for tool change, etc.

We also provide repair of these tools either only regrinding, or if the cutting segments are damage their exchange and regrind.

SEMI-STANDARD TOOLS

In a large mass production, there is in some cases necessary to modify standard insert to suit the given application. One possibility, is for example insert with a special size of corner radius for copy turning application, grooving, etc., or another modification of standard insert.

Other case might be end mill, with given diameter of PCD or PCBN segments for groove milling, etc.



LASER CREATED CHIPBREAKER TOOLS

During machining of non-ferrous materials, some of them create long chips which can subsequently result in twisting the chips around the workpiece, etc. This can cause problems (necessity to interrupt machining due to the chips removal, scratched machined surface, etc.). The solution for machining such a material, is the use of insert with laser-created chipbreaker.

Laser created chipbreaker can be used also on inserts with PCBN cutting material. Typical application for this use is machining of thin-walled workpieces, or if there is a weak component clamping, also for high quality machined surfaces. Furthermore, the laser is also used to create various clamping grooves, etc. into small inserts which allows clamping of inserts into special holder, with a simple exchange without necessity to solder insert in the holder.



CONVERSION TABLE OF HARDNESS AND TENSILE STRENGTH








TENSILE STRENGTH Rm (N/mm ²)	HARDNESS HB	HARDNESS HRC	HARDNESS Shore C	HARDNESS HV
740	210	–	29	210
810	230	19,2	31	230
880	250	23	34	250
950	270	26,1	36	270
1020	290	29	39	290
1090	310	31,5	41	310
1150	330	33,8	43	330
1230	350	36	45	350
1300	368	38	47	370
1370	385	39,8	49	390
1440	400	41,5	51	410
1510	416	43,2	53	430
1580	429	44,8	55	450
1650	441	46,3	57	470
1720	457	47,7	59	490
1790	474	49	61	510
1860	489	50,3	63	530
1930	503	51,5	65	550
2000	520	52,7	67	570
2070	533	53,8	69	590
2140	543	54,9	71	610
2210	555	55,9	73	630
2280	568	56,9	75	650
2350	581	57,9	76	670
2410	595	58,9	78	690
2480	609	59,8	80	710
2550	622	60,7	82	730
2630	633	61,5	84	750
2700	644	62,3	86	770
2770	655	63,1	87	790
2840	666	63,9	88	810
2910	677	64,6	89	830
2980	–	65,3	90	850
3050	–	66	92	870
















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Cutting edge type	
S	Solid insert
F	PCBN or PCD layer sintered on carbide
T	Brazed cutting edge

Number of cutting	
1	1x cutting edge
2	2x cutting edge
3	3 x cutting edge
4	4x cutting edge

Insert shape	
C	
D	
R	
S	
T	
V	
W	

Clearance angle	
B	
C	
D	
E	
N	
P	

Clamping type – chipbreaker type	
A	
B	
H	
M	
N	
T	
W	
X	special shape


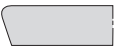


Tolerance		
	d (mm)	t (mm)
G	±0,025	±0,130
M	±0,05 – ±0,13	±0,13

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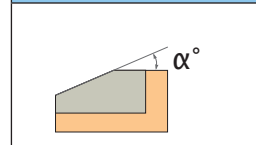
Insert thickness

ISO	Thickness (mm)
01	1.59
02	2.38
03	3.18
T3	3.97
04	4.76
05	5.56
06	6.35
07	7.94
09	9.52
12	12.70

Cutting edge type

F		Sharp
E		Honed
T		Chamfered
S		Chamfered + honed

Angle of chamfer - α



Cutting material type

PCD	PCBN
PKD5	CBN50
PKD10	CBN75
PKD25	CBN90
	CBN95
	CBN60S
	CBN85S
	CBN92S

Corner radius

ISO	(mm)
00	Sharp corner
02	0.2
04	0.4
08	0.8
12	1.2
16	1.6
20	2.0
24	2.4
28	2.8
32	3.2








Chamfer length (mm)

Kód	L (mm)
005	0,05
010	0,1
015	0,15
020	0,2
040	0,4

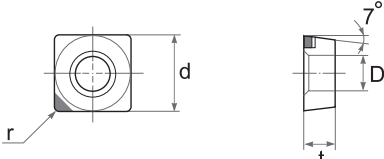
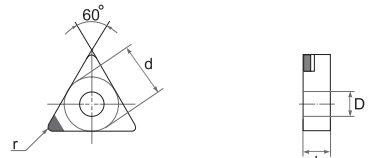
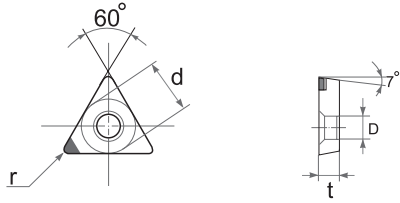
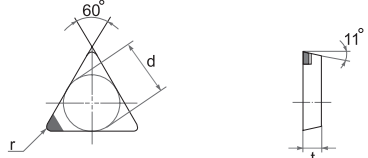
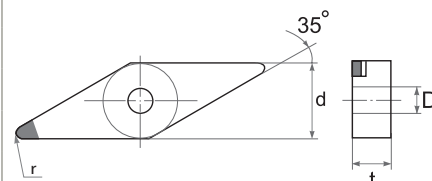
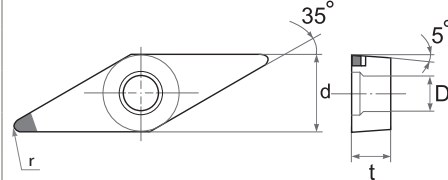
Additional marking

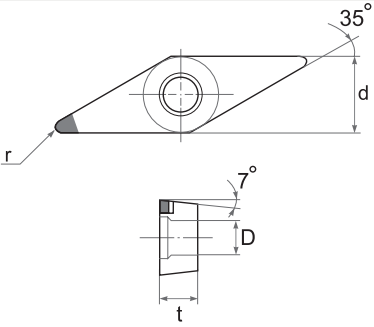
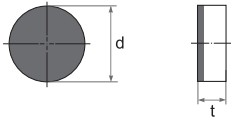
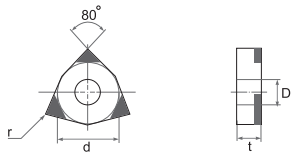
L	Chipbreaker
X	Special

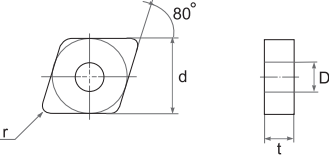
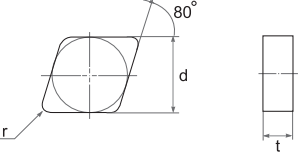
Insert size

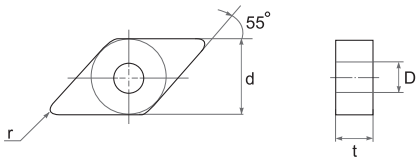
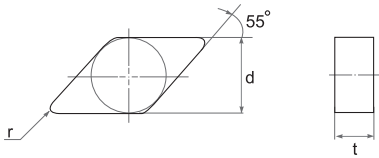
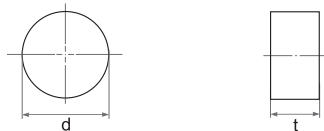
Inscribed circle diameter - d (mm)	ISO						
							
5.556	05	03	09	06	05	05	09
6.350	06	04	11	07	06	06	11
7.938	07	05	13	09	08	07	13
9.525	09	06	16	11	09	09	16
12.700	12	08	22	15	12	12	22
15.875	15	10	27	19	16	15	27
19.050	19	13	33	23	19	19	33
22.225	22	-	38	27	22	22	38
25.400	25	-	44	31	25	25	44
31.750	31	-	54	38	32	31	55

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCD			PCBN				
		d	t	r	D	PKD5	PKD10	PKD25	CBN50	CBN75	CBN90	CBN95	
	CNGA 120402	12,7	4,76	0,2	5,16								
	CNGA 120404	12,7	4,76	0,4	5,16		■			■	■	■	
	CNGA 120408	12,7	4,76	0,8	5,16		■		■	■	■	■	
	CNGA 120412	12,7	4,76	1,2	5,16								
	CNGA 120416	12,7	4,76	1,6	5,16								
	CCGW 060202	6,35	2,38	0,2	2,8								
	CCGW 060204	6,35	2,38	0,4	2,8						■		
	CCGW 060208	6,35	2,38	0,8	2,8								
	CCGW 09T302	9,52	3,97	0,2	4,4		■						
	CCGW 09T304	9,52	3,97	0,4	4,4		■			■	■	■	
	CCGW 09T308	9,52	3,97	0,8	4,4					■	■	■	
	CCGW 120404	12,7	4,76	0,2	5,5								
	CCGW 120408	12,7	4,76	0,4	5,5								
	CCGW 120412	12,7	4,76	0,8	5,5								
	DNGA 150402	12,7	4,76	0,2	5,16								
	DNGA 150404	12,7	4,76	0,4	5,16		■			■	■	■	
	DNGA 150408	12,7	4,76	0,8	5,16					■	■	■	
	DNGA 150412	12,7	4,76	1,2	5,16								
	DNGA 150602	12,7	6,35	0,2	5,16								
	DNGA 150604	12,7	6,35	0,4	5,16					■		■	
	DNGA 150608	12,7	6,35	0,8	5,16					■			
	DNGA 150612	12,7	6,35	1,2	5,16								
	DCGW 070202	6,35	2,38	0,2	2,8								
	DCGW 070204	6,35	2,38	0,4	2,8								
	DCGW 070208	6,35	2,38	0,8	2,8								
	DCGW 11T302	9,52	3,97	0,2	4,4								
	DCGW 11T304	9,52	3,97	0,4	4,4		■			■	■	■	
	DCGW 11T308	9,52	3,97	0,8	4,4		■			■			
	SNGA 120402	12,7	4,76	0,2	5,16								
	SNGA 120404	12,7	4,76	0,4	5,16		■				■		
	SNGA 120408	12,7	4,76	0,8	5,16					■	■		
	SNGA 120412	12,7	4,76	1,2	5,16								
	SNGA 120416	12,7	4,76	1,6	5,16								
	SNGN 120402	12,7	4,76	0,2	5,16								
	SNGN 120404	12,7	4,76	0,4	5,16		■						
	SNGN 120408	12,7	4,76	0,8	5,16						■		
	SNGN 120412	12,7	4,76	1,2	5,16								
	SNGN 120416	12,7	4,76	1,6	5,16								
Complete code for order: T2-CNGA120402-T015-20-CBN75 <i>For explanation see pages 11,12</i> ■ : Stock item ● : Recommended use ○ : Alternative		POWDER METAL ALLOYS				P							● ○
		CAST IRON				K							● ○
		ALLUMINIUM ALLOYS, PLASTICS, ETC.				N	○ ●						
		SUPERALLOYS				S				○ ●			
		HARDENED STEEL				H			○ ●				

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCD			PCBN						
		d	t	r	D	PKD5	PKD10	PKD25	CBN50	CBN75	CBN90	CBN95			
	SCGW 09T302	9,52	3,97	0,2	4,4										
	SCGW 09T304	9,52	3,97	0,4	4,4		■								
	SCGW 09T308	9,52	3,97	0,8	4,4		■			■	■				
	SCGW 120402	12,7	4,76	0,2	5,5										
	SCGW 120404	12,7	4,76	0,4	5,5										
	SCGW 120408	12,7	4,76	0,8	5,5										
	TNGA 160402	9,52	4,76	0,2	3,81										
	TNGA 160404	9,52	4,76	0,4	3,81		■			■					
	TNGA 160408	9,52	4,76	0,8	3,81		■		■	■	■	■			
	TNGA 160412	9,52	4,76	1,2	3,81										
	TNGA 220404	12,7	4,76	0,4	5,16										
	TNGA 220408	12,7	4,76	0,8	5,16										
	TNGA 220412	12,7	4,76	1,2	5,16										
	TCGW 090202	5,56	2,38	0,2	2,5										
	TCGW 090204	5,56	2,38	0,4	2,5		■			■	■	■			
	TCGW 090208	5,56	2,38	0,8	2,5										
	TCGW 110202	6,35	2,38	0,2	2,8					■					
	TCGW 110204	6,35	2,38	0,4	2,8										
	TCGW 110208	6,35	2,38	0,8	2,8										
	TCGW 16T302	9,52	3,97	0,2	4,4										
	TCGW 16T304	9,52	3,97	0,4	4,4		■			■	■				
TCGW 16T308	9,52	3,97	0,8	4,4											
	TPGN 110302	6,35	3,18	0,2											
	TPGN 110304	6,35	3,18	0,4			■			■	■				
	TPGN 110308	6,35	3,18	0,8											
	TPGN 160302	9,52	3,18	0,2											
	TPGN 160304	9,52	3,18	0,4											
	TPGN 160308	9,52	3,18	0,8											
	VNGA 160402	9,52	4,76	0,2	3,18										
	VNGA 160404	9,52	4,76	0,4	3,18		■			■	■				
	VNGA 160408	9,52	4,76	0,8	3,18					■	■	■			
	VNGA 160412	9,52	4,76	1,2	3,18										
	VNGA 160416	9,52	4,76	1,6	3,18										
	VBGW 160402	9,52	4,76	0,2	4,4										
	VBGW 160404	9,52	4,76	0,4	4,4		■				■	■			
	VBGW 160408	9,52	4,76	0,8	4,4					■	■				
	VBGW 160412	9,52	4,76	1,2	4,4										
	VBGW 160416	9,52	4,76	1,6	4,4										
Complete code for order: T3-TNGA160402-T020-20-CBN75 <i>For explanation see pages 11,12</i> ■ : Stock item ● : Recommended use ○ : Alternative		POWDER METAL ALLOYS				P						●	○		
		CAST IRON				K							●	○	
		ALUMINIUM ALLOYS, PLASTICS, ETC.				N	○	●							
		SUPERALLOYS				S						○	●		
		HARDENED STEEL				H				○	●				

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCD			PCBN				
		d	t	r	D	PKD5	PKD10	PKD25	CBN50	CBN75	CBN90	CBN95	
	VCGW 160402	9,52	4,76	0,2	4,4								
	VCGW 160404	9,52	4,76	0,4	4,4		■			■	■	■	
	VCGW 160408	9,52	4,76	0,8	4,4		■				■		
	VCGW 160412	9,52	4,76	1,2	4,4								
	VCGW 160416	9,52	4,76	1,6	4,4								
	VCGW 220516	12,7	5,56	1,6	5,5								
	VCGW 220524	12,7	5,56	2,4	5,5								
	VCGW 220530	12,7	5,56	3,2	5,5								
	RNGN 060300	6,35	3,18								■		
	RNGN 060400	6,35	4,76										
	RNGN 090300	9,52	3,18								■		
	RNGN 090400	9,52	4,76										
	RNGN 120400	12,7	4,76								■		
	WNGA 060402	9,52	4,76	0,2	3,81								
	WNGA 060404	9,52	4,76	0,4	3,81								
	WNGA 060408	9,52	4,76	0,8	3,81								
	WNGA 080402	12,7	4,76	0,2	5,16								
	WNGA 080404	12,7	4,76	0,4	5,16					■	■		
	WNGA 080408	12,7	4,76	0,8	5,16				■	■	■	■	
	WNGA 080412	12,7	4,76	1,2	5,16								
Complete code for order: T3-W NGA080402-T015-20 -CBN75 <i>For explanation see pages 11,12</i> ■ : Stock item ● : Recommended use ○ : Alternative		POWDER METAL ALLOYS				P						●	○
		CAST IRON				K						●	○
		ALLUMINIUM ALLOYS, PLASTICS, ETC.				N	○	●					
		SUPERALLOYS				S				○	●		
		HARDENED STEEL				H			○	●			

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN			
		d	t	r	D	CBN60S	CBN85S	CBN92S	
	CNGA 120404	12,7	4,76	0,4	5,16				
	CNGA 120408	12,7	4,76	0,8	5,16	■	■	■	
	CNGA 120412	12,7	4,76	1,2	5,16	■	■	■	
	CNGA 120416	12,7	4,76	1,6	5,16				
	CNGA 120704	12,7	7,94	0,4	5,16				
	CNGA 120708	12,7	7,94	0,8	5,16				
	CNGA 120712	12,7	7,94	1,2	5,16				
	CNGA 120716	12,7	7,94	1,6	5,16				
	CNGA 160608	15,87	6,35	0,8	6,35		■		
	CNGA 160612	15,87	6,35	1,2	6,35		■		
	CNGA 160708	15,87	7,94	0,8	7,93				
	CNGA 160712	15,87	7,94	1,2	7,93				
	CNGA 160716	15,87	7,94	1,6	7,93				
	CNGA 190612	19,05	6,35	1,2	6,35				
	CNGA 190616	19,05	6,35	1,6	6,35				
	CNGA 190712	19,05	7,94	1,2	7,93				
	CNGA 190716	19,05	7,94	1,6	7,93				
	CNGN 120404	12,7	4,76	0,4					
	CNGN 120408	12,7	4,76	0,8		■	■	■	
	CNGN 120412	12,7	4,76	1,2		■	■	■	
	CNGN 120416	12,7	4,76	1,6					
	CNGN 120704	12,7	7,94	0,4					
	CNGN 120708	12,7	7,94	0,8					
	CNGN 120712	12,7	7,94	1,2					
	CNGN 120716	12,7	7,94	1,6					
	CNGN 160608	15,87	6,35	0,8			■	■	
	CNGN 160612	15,87	6,35	1,2					
	CNGN 160708	15,87	7,94	0,8					
	CNGN 160712	15,87	7,94	1,2					
	CNGN 160716	15,87	7,94	1,6					
	CNGN 160720	15,87	7,94	2					
	CNGN 190612	19,05	6,35	1,2					
	CNGN 190616	19,05	6,35	1,6					
	CNGN 190712	19,05	7,94	1,2					
	CNGN 190716	19,05	7,94	1,6					
	CNGN 250716	25,4	7,94	1,6					
	CNGN 250724	25,4	7,94	2,4					
	CNGN 250732	25,4	7,94	3,2					
Complete code for order: S-CNGN120404-T015-20-CBN85S <i>For explanation see pages 11,12</i> ■ : Stock item ● : Recommended use ○ : Alternative		POWDER METAL ALLOYS		P		○	●		
		CAST IRON		K		○	●		
		ALUMINIUM ALLOYS, PLASTICS, ETC.		N					
		SUPERALLOYS		S		○	●		
		HARDENED STEEL		H		○	●		

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN			
		d	t	r	D	CBN60S	CBN85S	CBN92S	
	DNGA 150404	12,7	4,76	0,4	5,16				
	DNGA 150408	12,7	4,76	0,8	5,16	■	■	■	
	DNGA 150412	12,7	4,76	1,2	5,16		■		
	DNGA 150416	12,7	4,76	1,6	5,16				
	DNGA 150604	12,7	6,35	0,4	5,16				
	DNGA 150608	12,7	6,35	0,8	5,16		■		
	DNGA 150612	12,7	6,35	1,2	5,16				
	DNGA 150708	12,7	7,94	0,8	5,16				
	DNGA 150712	12,7	7,94	1,2	5,16				
	DNGA 150716	12,7	7,94	1,6	5,16				
	DNGA 190712	15,87	7,94	1,2	6,35				
	DNGA 190716	15,87	7,94	1,6	6,35				
	DNGN 150404	12,7	4,76	0,4					
	DNGN 150408	12,7	4,76	0,8		■	■	■	
	DNGN 150412	12,7	4,76	1,2		■	■	■	
	DNGN 150416	12,7	4,76	1,6					
	DNGN 150604	12,7	6,35	0,4					
	DNGN 150608	12,7	6,35	0,8					
	DNGN 150612	12,7	6,35	1,2					
	DNGN 150708	12,7	7,94	0,8					
	DNGN 150712	12,7	7,94	1,2					
	DNGN 150716	12,7	7,94	1,6					
	DNGN 190712	15,87	7,94	1,2					
	DNGN 190716	15,87	7,94	1,6					
	RNGN 060300	6,35	3,18				■	■	
	RNGN 060400	6,35	4,76				■		
	RNGN 090300	9,52	3,18			■	■	■	
	RNGN 090400	9,52	4,76				■		
	RNGN 120300	12,7	3,18						
	RNGN 120400	12,7	4,76			■	■	■	
	RNGN 120600	12,7	6,35						
	RNGN 120700	12,7	7,94						
	RNGN 150700	15,87	7,94						
	RNGN 190600	19,05	6,35				■		
	RNGN 190700	19,05	7,94						
	RNGN 250600	25,4	6,35				■	■	
	RNGN 250700	25,4	7,94						
	RNGN 250900	25,4	9,52						

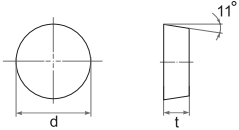
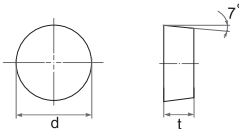
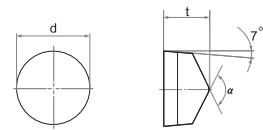
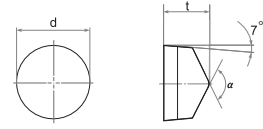
Complete code for order:
S-DNGA150404-T020-20-CBN85S
For explanation see pages 11,12

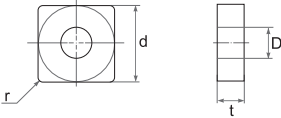
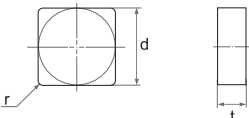
■ : Stock item

● : Recommended use

○ : Alternative

POWDER METAL ALLOYS	P		○	●	
CAST IRON	K		○	●	
ALLUMINIUM ALLOYS, PLASTICS, ETC.	N				
SUPERALLOYS	S		○	●	
HARDENED STEEL	H	○	●		

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN			
		d	t	r	α	CBN60S	CBN85S	CBN92S	
	RPGN 060300	6,35	3,18						
	RPGN 060400	6,35	4,76						
	RPGN 090300	9,52	3,18				■	■	
	RPGN 090400	9,52	4,76						
	RPGN 120400	12,7	4,76				■		
	RPGN 120600	12,7	6,35						
	RPGN 190700	19,05	7,94						
	RCGN 060300	6,35	3,18						
	RCGN 060400	6,35	4,76						
	RCGN 090300	9,52	3,18				■	■	
	RCGN 090400	9,52	4,76						
	RCGN 120400	12,7	4,76				■		
	RCGN 120600	12,7	6,35						
	RCGN 190700	19,05	7,94						
V shape seat 	RCGX 060400	6,35	4,57		120°		■	■	
	RCGX 090700	9,52	7,7		120°	■	■	■	
	RCGX 120700	12,7	7,7		120°		■	■	
	RCGX 151000	15,87	9,77		120°		■		
	RCGX 191000	19,05	9,77		120°		■		
Conical seat 	RCGX 060400	6,35	4,57		120°				
	RCGX 090700	9,52	7,7		120°		■		
	RCGX 120700	12,7	7,7		120°				
	RCGX 151000	15,87	9,77		120°				
	RCGX 191000	19,05	9,77		120°				
Complete code for order: S-RCGX060400-T015-20-CBN85S <i>For explanation see pages 11,12</i> ■ : Stock item ● : Recommended use ○ : Alternative		POWDER METAL ALLOYS		P		○	●		
		CAST IRON		K		○	●		
		ALLUMINIUM ALLOYS, PLASTICS, ETC.		N					
		SUPERALLOYS		S		○	○		
		HARDENED STEEL		H		○	●		

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN			
		d	t	r	α	CBN60S	CBN85S	CBN92S	
	SNGA 090304	9,52	3,18	0,4	3,81				
	SNGA 090308	9,52	3,18	0,8	3,81				
	SNGA 090404	9,52	4,76	0,4	3,81				
	SNGA 090408	9,52	4,76	0,8	3,81				
	SNGA 090412	9,52	4,76	1,2	3,81				
	SNGA 120404	12,7	4,76	0,4	5,16				
	SNGA 120408	12,7	4,76	0,8	5,16	■	■	■	
	SNGA 120412	12,7	4,76	1,2	5,16		■	■	
	SNGA 120416	12,7	4,76	1,6	5,16				
	SNGA 190608	19,05	6,35	0,8	6,35				
	SNGA 190612	19,05	6,35	1,2	6,35				
	SNGA 190616	19,05	6,35	1,6	6,35				
	SNGA 190620	19,05	6,35	2	6,35				
	SNGN 090304	9,52	3,18	0,4					
	SNGN 090308	9,52	3,18	0,8			■	■	
	SNGN 090312	9,52	3,18	1,2			■		
	SNGN 090404	9,52	4,76	0,4					
	SNGN 090408	9,52	4,76	0,8					
	SNGN 090412	9,52	4,76	1,2					
	SNGN 120404	12,7	4,76	0,4			■		
	SNGN 120408	12,7	4,76	0,8		■	■	■	
	SNGN 120412	12,7	4,76	1,2		■	■	■	
	SNGN 120416	12,7	4,76	1,6					
	SNGN 120608	12,7	6,35	0,8					
	SNGN 120612	12,7	6,35	1,2			■		
	SNGN 120708	12,7	7,94	0,8			■	■	
	SNGN 120712	12,7	7,94	1,2					
	SNGN 120716	12,7	7,94	1,6					
	SNGN 190608	19,05	6,35	0,8					
	SNGN 190612	19,05	6,35	1,2			■		
	SNGN 190616	19,05	6,35	1,6					
	SNGN 190712	19,05	7,94	1,2					
	SNGN 190716	19,05	7,94	1,6					
	SNGN 190720	19,05	7,94	2					
	SNGN 250616	25,4	6,35	1,6					
	SNGN 250624	25,4	6,35	2,4					
	SNGN 250716	25,4	7,94	1,6					
	SNGN 250724	25,4	7,94	2,4					

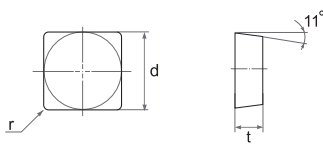
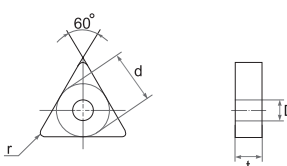
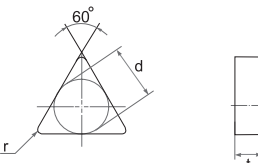
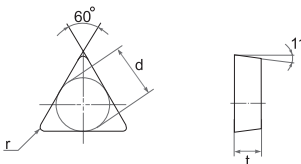
Complete code for order:
S-SNGA120404-T015-20-CBN85S
For explanation see pages 11,12

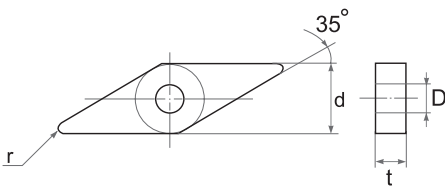
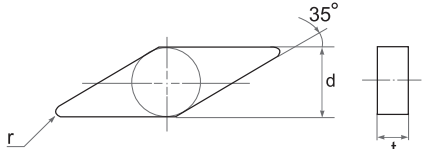
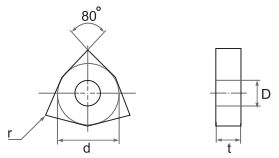
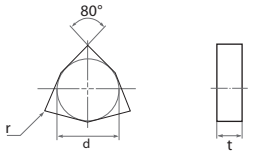
■ : Stock item

● : Recommended use

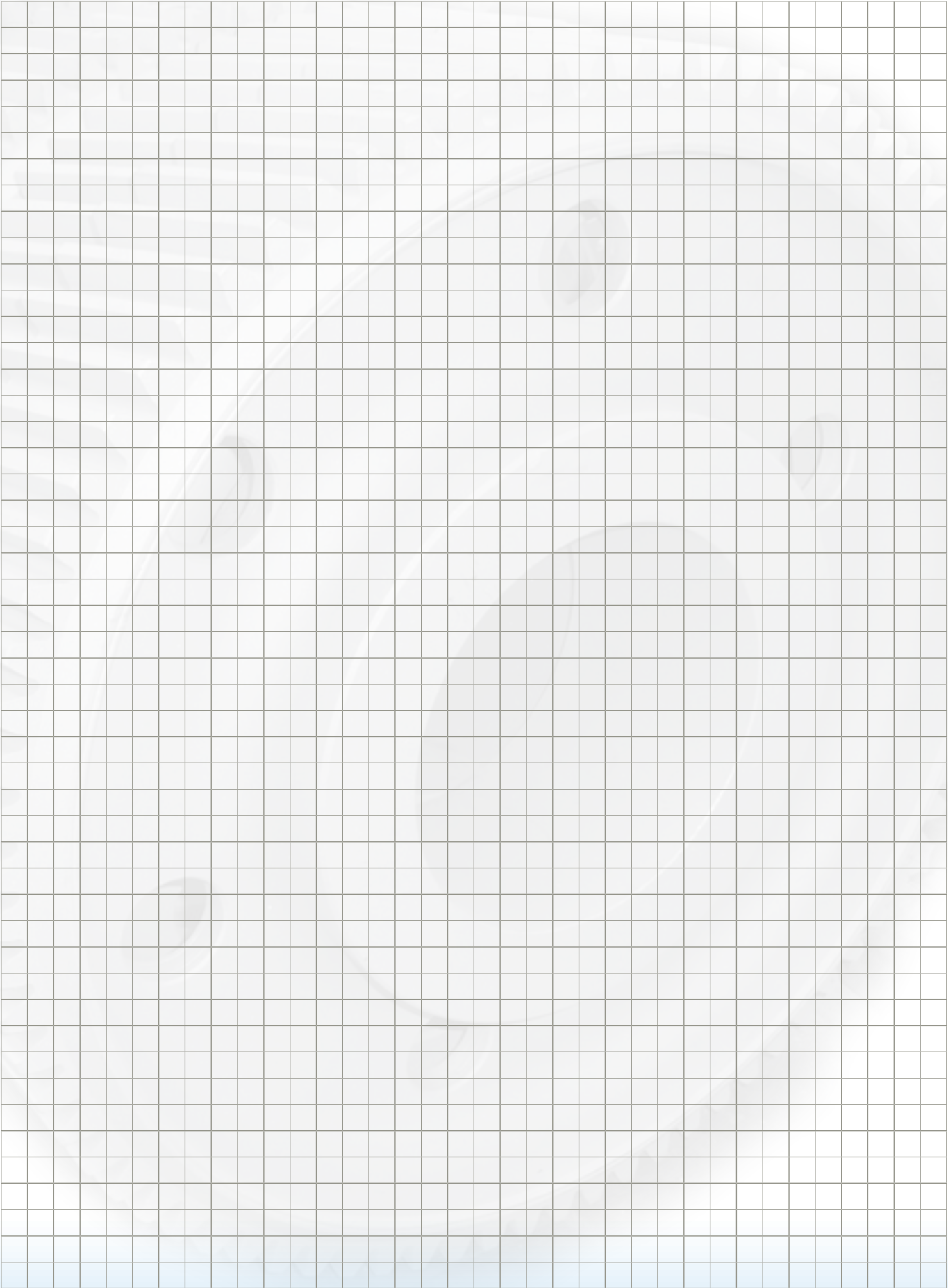
○ : Alternative

POWDER METAL ALLOYS	P		○	●	
CAST IRON	K		○	●	
ALLUMINIUM ALLOYS, PLASTICS, ETC.	N				
SUPERALLOYS	S		○	○	
HARDENED STEEL	H	○	●		

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN			
		d	t	r	α	CBN60S	CBN85S	CBN92S	
	SPGN 090304	9,52	3,18	0,4					
	SPGN 090308	9,52	3,18	0,8					
	SPGN 120404	12,7	4,76	0,4					
	SPGN 120408	12,7	4,76	0,8			■	■	
	SPGN 120412	12,7	4,76	1,2			■		
	SPGN 190608	19,05	6,35	0,8					
	SPGN 190612	19,05	6,35	1,2					
	TNGA 110304	6,35	3,18	0,4	2,26				
	TNGA 110308	6,35	3,18	0,8	2,26				
	TNGA 160404	9,52	4,76	0,4	3,81				
	TNGA 160408	9,52	4,76	0,8	3,81		■		
	TNGA 160412	9,52	4,76	1,2	3,81	■	■	■	
	TNGA 160416	9,52	4,76	1,6	3,81				
	TNGA 220408	12,7	4,76	0,8	5,16				
	TNGA 220412	12,7	4,76	1,2	5,16				
	TNGA 220416	12,7	4,76	1,6	5,16				
	TNGN 110304	6,35	3,18	0,4					
	TNGN 110308	6,35	3,18	0,8			■		
	TNGN 160404	9,52	4,76	0,4			■	■	
	TNGN 160408	9,52	4,76	0,8		■	■	■	
	TNGN 160412	9,52	4,76	1,2					
	TNGN 160416	9,52	4,76	1,6					
	TNGN 220408	12,7	4,76	0,8			■		
	TNGN 220412	12,7	4,76	1,2			■		
	TNGN 220416	12,7	4,76	1,6					
	TNGN 220712	12,7	7,94	1,2					
	TNGN 220716	12,7	7,94	1,6					
	TPGN 110304	6,35	3,18	0,4			■		
	TPGN 110308	6,35	3,18	0,8					
	TPGN 160304	9,52	3,18	0,4					
	TPGN 160308	9,52	3,18	0,8			■	■	
	TPGN 160404	9,52	4,76	0,4			■		
	TPGN 160408	9,52	4,76	0,8					
	TPGN 220408	12,7	4,76	0,8					
	TPGN 220412	12,7	4,76	1,2					
Complete code for order: S-TNGA160404-T020-20-CBN85S For explanation see pages 11,12		POWDER METAL ALLOYS		P		○	●		
		CAST IRON		K		○	●		
		ALLUMINIUM ALLOYS, PLASTICS, ETC.		N					
		SUPERALLOYS		S		○	○		
		HARDENED STEEL		H	○	●			
■ : Stock item ● : Recommended use ○ : Alternative									

INSERT SHAPE	ISO INSERT CODE	DIMENSIONS (mm)				PCBN				
		d	t	r	α	CBN60S	CBN85S	CBN92S		
	VNGA 160404	9,52	4,76	0,4	3,81		■			
	VNGA 160408	9,52	4,76	0,8	3,81	■	■	■		
	VNGA 160412	9,52	4,76	1,2	3,81					
	VNGA 160608	9,52	6,35	0,8	3,81					
	VNGA 160612	9,52	6,35	1,2	3,81					
	VNGA 220408	12,7	4,76	0,8	5,16					
	VNGA 220412	12,7	4,76	1,2	5,16					
	VNGN 160404	9,52	4,76	0,4						
	VNGN 160408	9,52	4,76	0,8		■	■	■		
	VNGN 160412	9,52	4,76	1,2			■			
	VNGN 160608	9,52	6,35	0,8						
	VNGN 160612	9,52	6,35	1,2						
	VNGN 220408	12,7	4,76	0,8						
	VNGN 220412	12,7	4,76	1,2			■			
	WNGA 060404	9,52	4,76	0,4	3,81					
	WNGA 060408	9,52	4,76	0,8	3,81					
	WNGA 080404	12,7	4,76	0,4	5,16		■			
	WNGA 080408	12,7	4,76	0,8	5,16	■	■	■		
	WNGA 080412	12,7	4,76	1,2	5,16		■			
	WNGA 080416	12,7	4,76	1,6	5,16					
	WNGN 060404	9,52	4,76	0,4						
	WNGN 060408	9,52	4,76	0,8						
	WNGN 080404	12,7	4,76	0,4			■			
	WNGN 080408	12,7	4,76	0,8		■	■	■		
	WNGN 080412	12,7	4,76	1,2			■	■		
	WNGN 080416	12,7	4,76	1,6						
Complete code for order: S-WNGA080412-T015-20-CBN85S For explanation see pages 11,12		POWDER METAL ALLOYS				P		○	●	
		CAST IRON				K		○	●	
		ALLUMINIUM ALLOYS, PLASTICS, ETC.				N				
		SUPERALLOYS				S		●	○	
		HARDENED STEEL				H	○	●		
■ : Stock item ● : Recommended use ○ : Alternative										

NOTES:



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