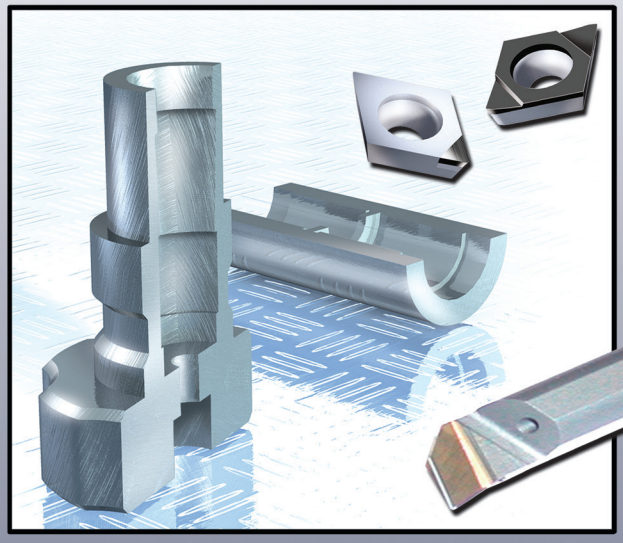
Technical Information

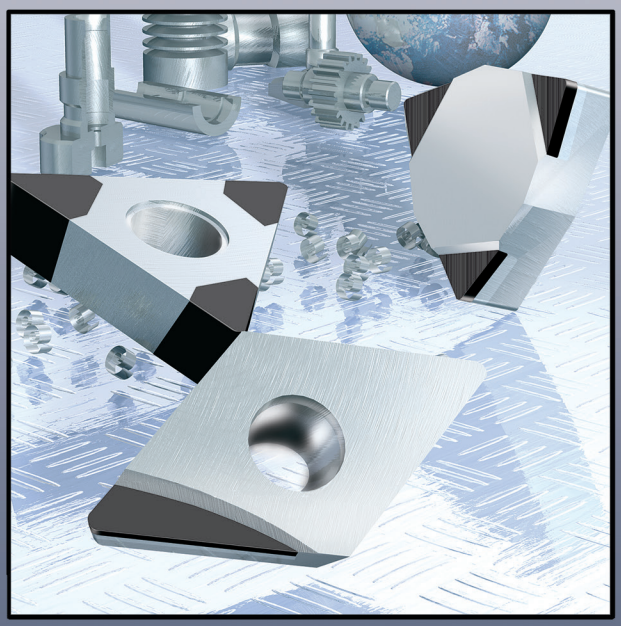
TyCarb

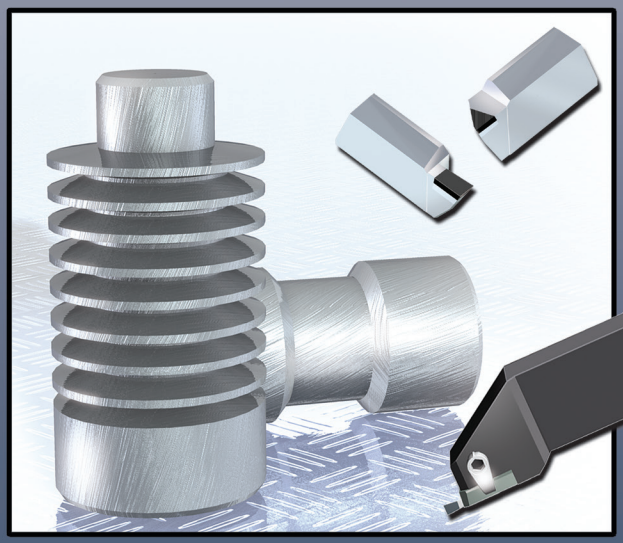
Superabrasives – PCD & CBN

Made in Germany

PCD / CBN Inserts & Tooling







Tyson Tool®

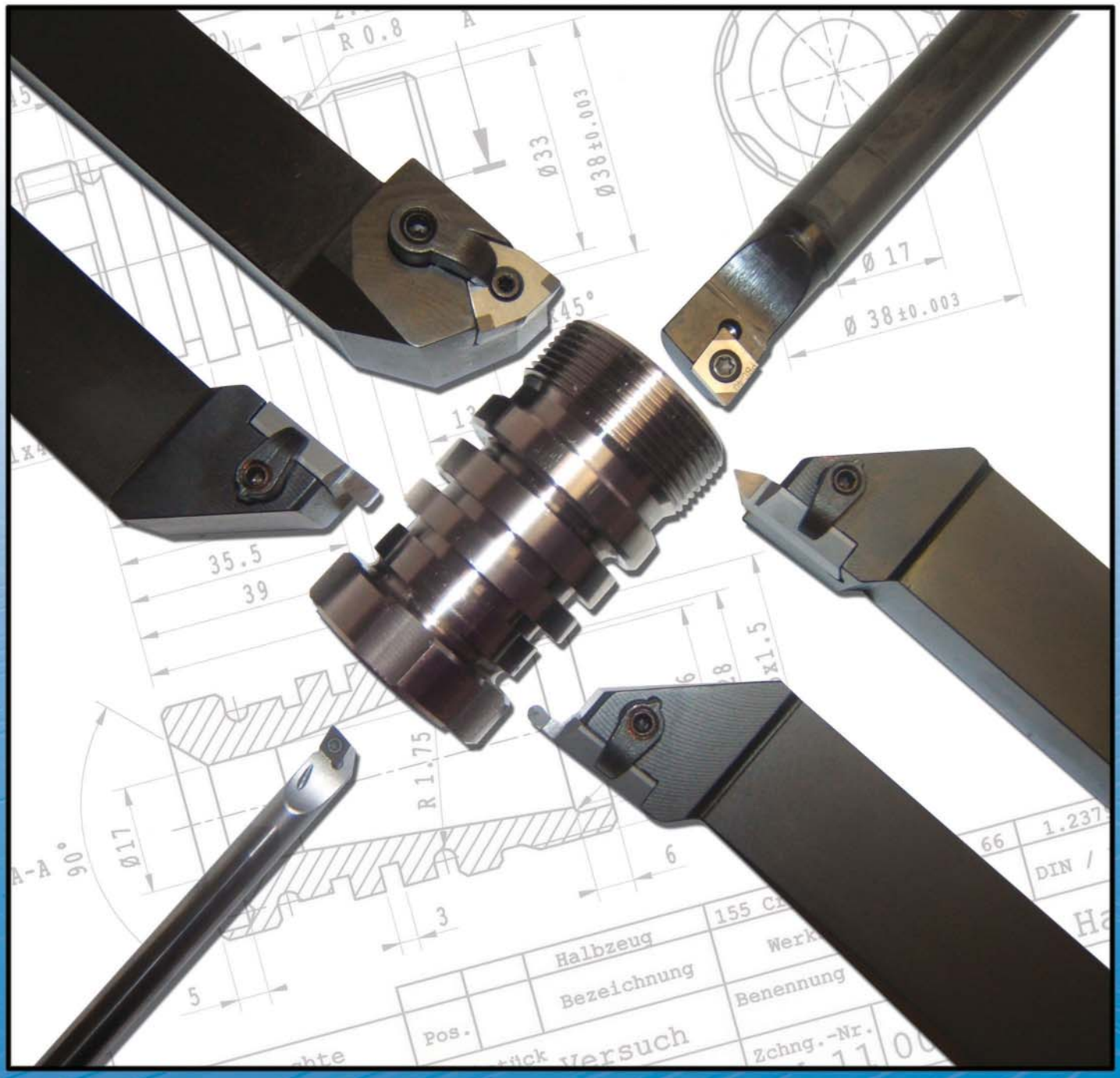
Test Sample

Workpiece Material: D2

Workpiece Hardness: 62 ± 2 HRc

Workpiece Tolerance: ± .0008"

Surface Finish Tolerance: Ra 16 µin



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To achieve optimum application success, closely follow the enclosed selection checklists. Maximum machining performance with TyCarb Superabrasive products is achieved through a calculated selection of required cutting materials, and proper macro-cutting edge geometries. Please be advised that machining with TyCarb Superabrasive tools will be significantly different from what you have become accustomed to with normal carbide tooling. Due to the physical properties of the TyCarb Superabrasive cutting materials, and the range of micro-cutting edge geometries, it is important that you completely rethink your machining approach when determining selection criteria.

When selecting the TyCarb Superabrasive grades from our comprehensive range, a complex performance profile of the machining result is required. Due to the different variations of tipped corner styles, macro and micro cutting edge geometries, careful pre-planning is required to ensure that the best tool is selected for the given application.

The overall machining system should also be reconsidered in order to achieve full performance from the TyCarb Superabrasive product. Use the most rigid and accurate tooling systems available. Machinery and equipment should be compatible with the machining tasks. Particular attention must be paid to the general rigidity, the slideways, spindles and work-holding systems. When all working parameters are optimized, you can achieve surface finishes in a nanometer range as a standard using Monocrystalline Diamond for non ferrous metals and with PCBN for hard cutting of hardened steel.

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Check List for Determining the Cutting Materials Grades (i.e. Hard- Cutting)

1.) Determine the material group as per DIN ISO 513 ..... page 4
2.) Determine the range of application for your material group as per DIN ISO 513 ..... page 6
3.) Then determine the cutting data for your area of application based on the surface quality required, and machining application ..... page 18-28
4.) Check your selection of cutting material based on the grade description ..... page 16-17
5.) Determine the correct insert type including tipped corner style ..... page 8-9
6.) Based on nose radius and finish requirements, determine feed rate ..... page 15

Example: Turning case-hardened steel HRc 62 ap=0.01", continuous cut in stable circumstances, a surface quality of Ra=24µ" must be achieved (At Ra=24µ" the overall machining environment must be checked for suitability)

1st Step

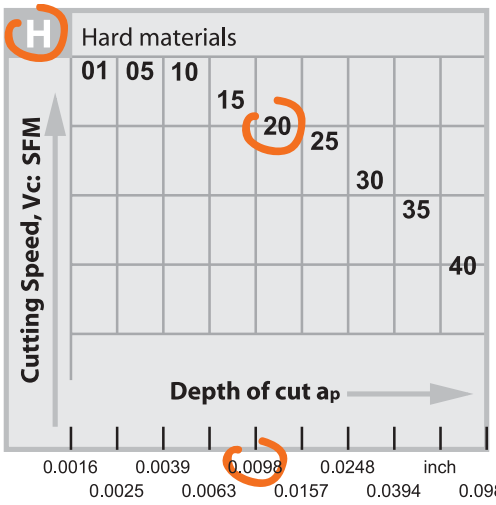
Material group **H**

Identification letter & colour	Main Materials	Range of applica
H	**Hard Materials:** Carburized or fully hardened steels from 48 to 65 HRc HSS, tool steel, cold and hot work steel, spring steel, ball-bearing steel, chilled cast iron, chilled cast iron rolls, chilled cast iron alloys, hardfacing alloys sintered carbide	H01 - H05 - H10 - H15 - H20 - H H35 - H40

Choose material spec. and hardness on page 4

2nd Step

Range of application **H-20**



Based on depth of cut, choose your range of application on page 6

3rd Step

Cutting material: SB40 (T) at Vc=358-520 SFM ap=.01"

Materials	Conditions of chip removal	Range of application H01 - H40					
		H01 - H15			H05 - H20		
		Ra µin			Ra µin		
		8-32	32-63	63-126	8-32	32-63	6
H Hard materials hardened steel HRc 48-54 hard turning	Turning						
	unstable (varied depth)			PBC-25 (F)			PB
				520-715			4
	continuous	SB40 (T)	PBC-17 (T)	PBC-25 (F)	SB40 (T)	PBC-17 (T)	PB
		390-520	423-585	520-715	358-520	423-553	4
	heavily + slightly interrupted	PBC-20 (T)	PBC-17 (T)	PBC-25 (T)	PBC-20 (T)	PBC-17 (T)	PB
		390-520	488-618	423-585	358-488	455-585	3

With application range and finish in mind, choose grade and specs. range on page 23

4th Step

Nose radius required

Theoretical Surface Roughness		Corner Radius				
		Feed Rate (f=inch/rev)				
Ra µin	Rt µin	r = .008	r = .016	r = .031	r = .047	r = .063
24	100	.002	.003	.004	.005	.006
63	250	.003	.004	.006	.007	.009
125	500	.005	.007	.009	.011	.014
250	1000	.006	.009	.012	.015	.018

With corner radius in mind, choose feed rate required on page 15

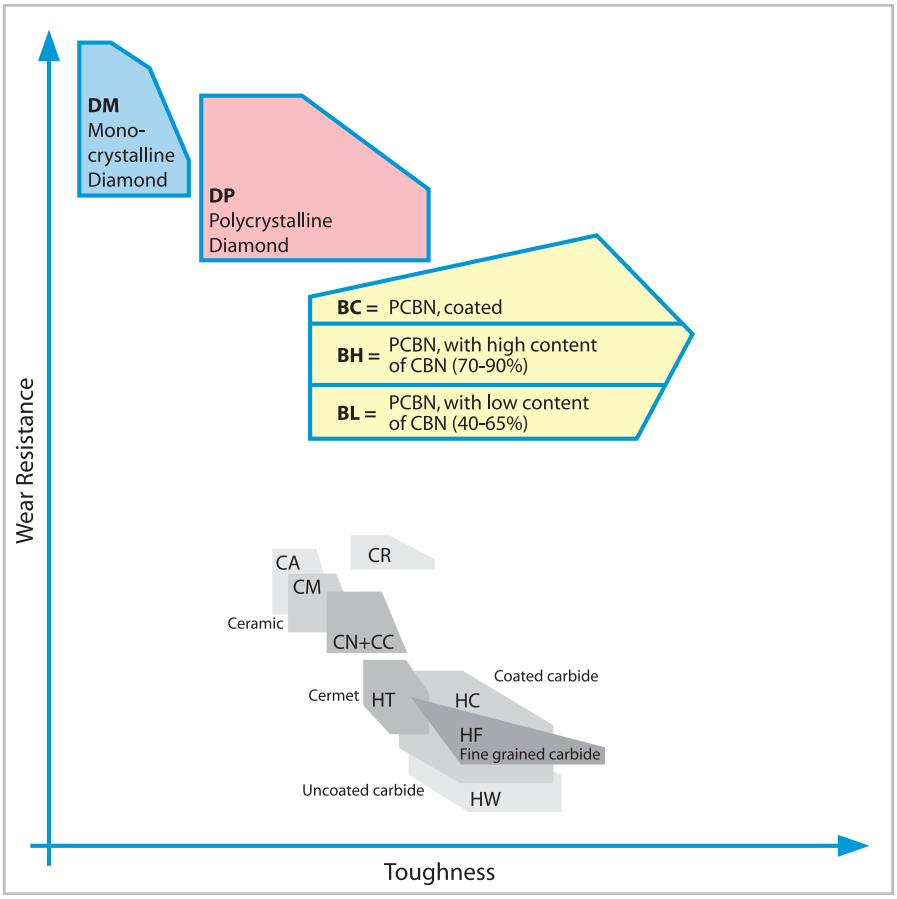
* Please note that these recommendations are guidelines based on rigid part set-up, good machine rigidity, and general machining practices.

Workpiece Material Groups (DIN ISO 513)

Identification letter & colour	Main Materials	Range of applications	ISO	BECKER Grade
P	**Steel** Sintered powdered alloys	P01 - P10	BH	PBC-17
		P05 - P15	BH	PBC-15
		P15 - P25	BH	SB10
		P20 - P40	BH	SBC1
M	**Stainless Steel**	**	CBN or PCD not suitable for this application range. For stainless steels above 48 HRc, refer to application range H	
K	**Cast Iron** **Grey Cast Iron** GG 10 - GG 35 **Nodular Cast Iron** GGG 40 - GGG 40.3 - GGG 50 GGG 60 - GGG 70	K01 - K25	BH	PBC-10
		K01 - K25	BH	PBC-15
		K05 - K20	BH	PBC-17
		K05 - K20	BL	PBC-25
		K05 - K40	BH	SB10
		K10 - K35	BL	SB25
		K15 - K40	BH	SBC1
N	**Nonferrous Metals** **Nonmetallics** Aluminum alloys, Low + High-Silicon Aluminum alloys, MMC's, Magnesium alloys, Copper-Copper alloys, Brass, Bronze, Precious metals, Plastics, GRP, CRP, Carbon and Graphite composits, Ceramics and other high-abrasive Nonmetallics	N01 - N35	DM	MDC
		N05 - N35	DP	PDC-L
		N05 - N40	DP	PDC
		N10 - N40	DP	PDC-S
S	**Super-alloys and Titanium:** Heat resistant special alloys based on Nickel or Cobalt, Titanium and Titanium alloys	S01 - S15	BH	PBC-10
		S01 - S15	BH	PBC-15
		S01 - S20	DM	MDC
		S01 - S30	BH	SB10
		S05 - S25	BL	PBC-25
		S15 - S40	BH	SBC1
H	**Hard Materials:** Carburized or fully hardened steels from 48 to 65 HRc HSS, tool steel, 300 & 400 series stainless cold and hot work steel, spring steel, ball-bearing steel, chilled cast iron, chilled cast iron rolls, chilled cast iron alloys, hardfacing alloys sintered carbide	H01 - H20	BL	PBC-40
		H01 - H25	BL	PBC-25
		H01 - H35	BL	SB40
		H01 - H40	BL	SB25
		H05 - H15	BH	PBC-17
		H05 - H25	BL	PBC-30
		H05 - H30	BL	PBC-20
		H20 - H40	BH	SBC1

As per DIN ISO 513 (2001) there are now additional identification letters for carbide (also cermet) and ceramic.

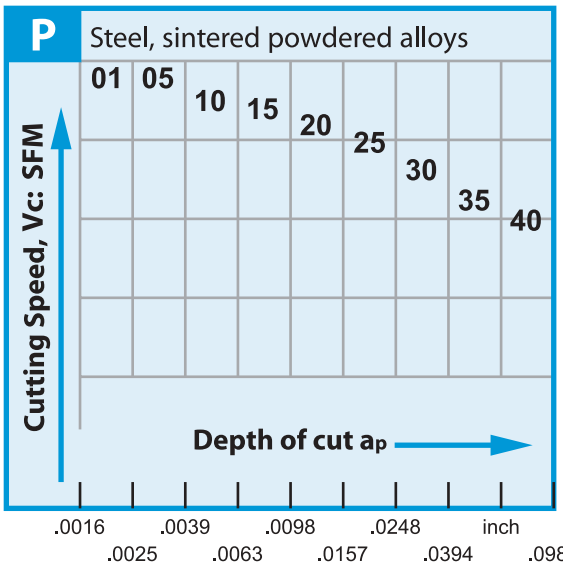
Furthermore new identification letters for the ultrahard cutting materials Polycrystalline Cubic Boron Nitride, Monocrystalline and Polycrystalline Diamond have been introduced.

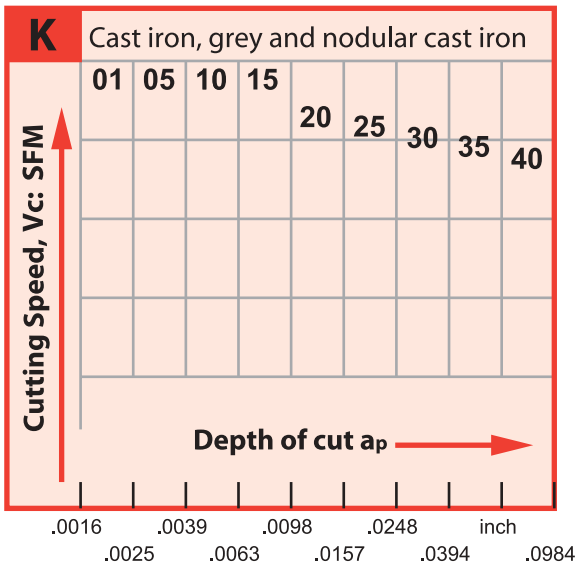


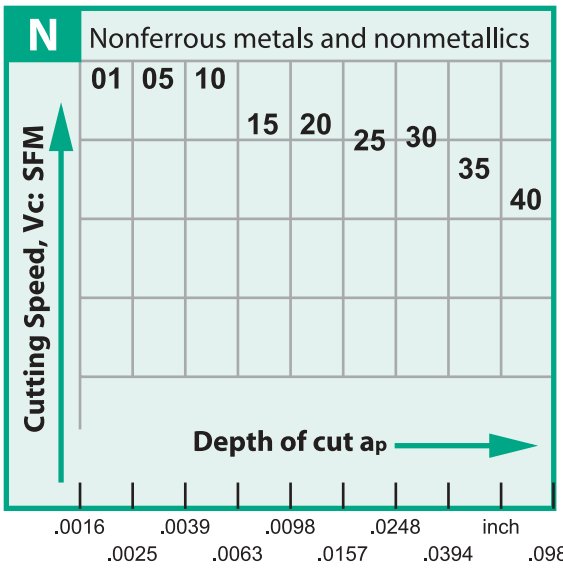
Groups of cutting materials (DIN ISO 513)

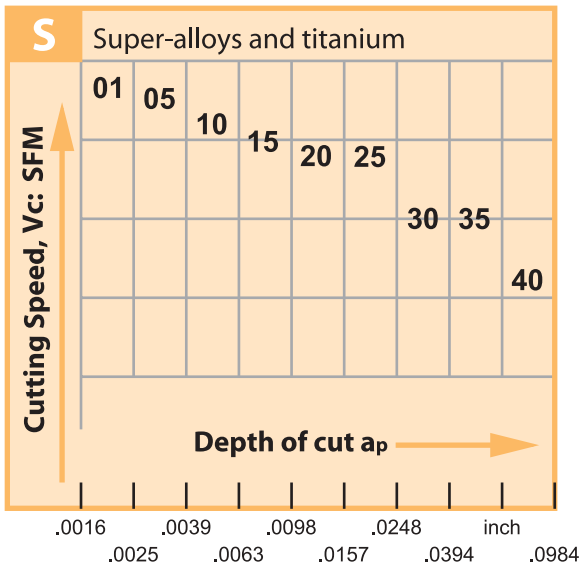
HW=	Uncoated carbide
HF=	Fine grained carbide
HT=	Cermet, TiC, or TiN
HC=	As above, but coated
CA=	Ceramic, main content Al_2O_3
CM=	Mixed ceramic, main content Al_2O_3, plus components other than oxides
CN=	Siliconnitride ceramic, main content Si_3N_4
CR=	Ceramic, main content Al_2O_3, reinforced
CC=	Ceramics as above, but coated
DM=	Monocrystalline Diamond
DP=	Polycrystalline Diamond
BL=	Polycrystalline Cubic Boron Nitride with low content CBN
BH=	Polycrystalline Cubic Boron Nitride with high content of CBN
BC=	Polycrystalline Cubic Boron Nitride as above, but coated

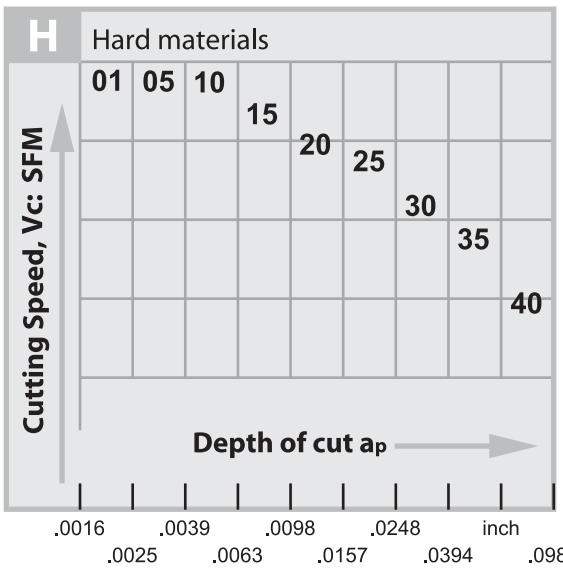
Range of Application (DIN ISO 513) for Material Groups P, K, N, S, H

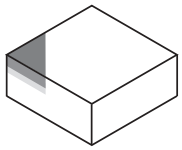
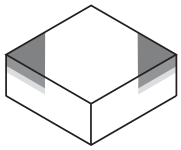
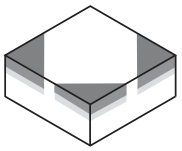
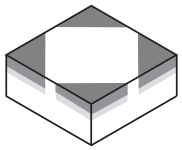
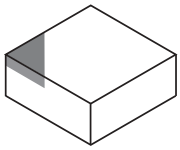
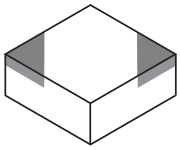
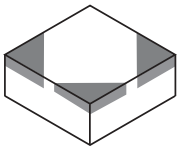
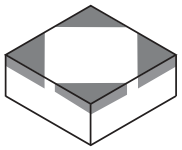
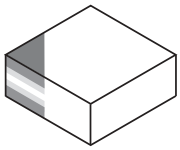
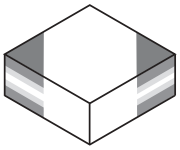
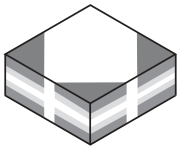
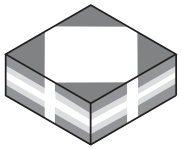
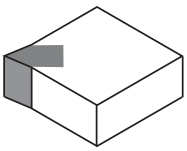
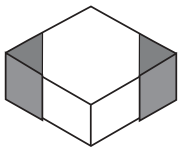
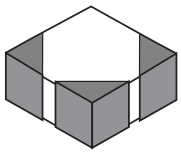
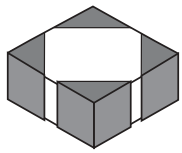
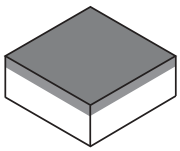
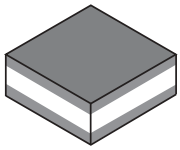
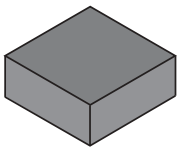




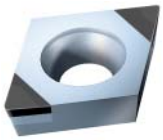
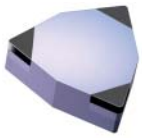
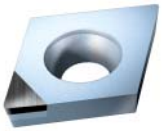
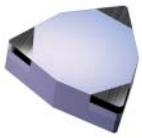
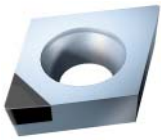
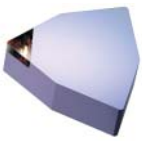


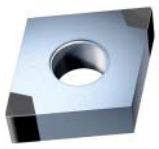
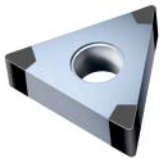
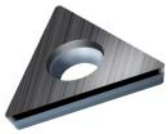
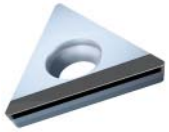
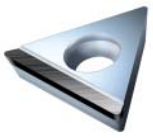




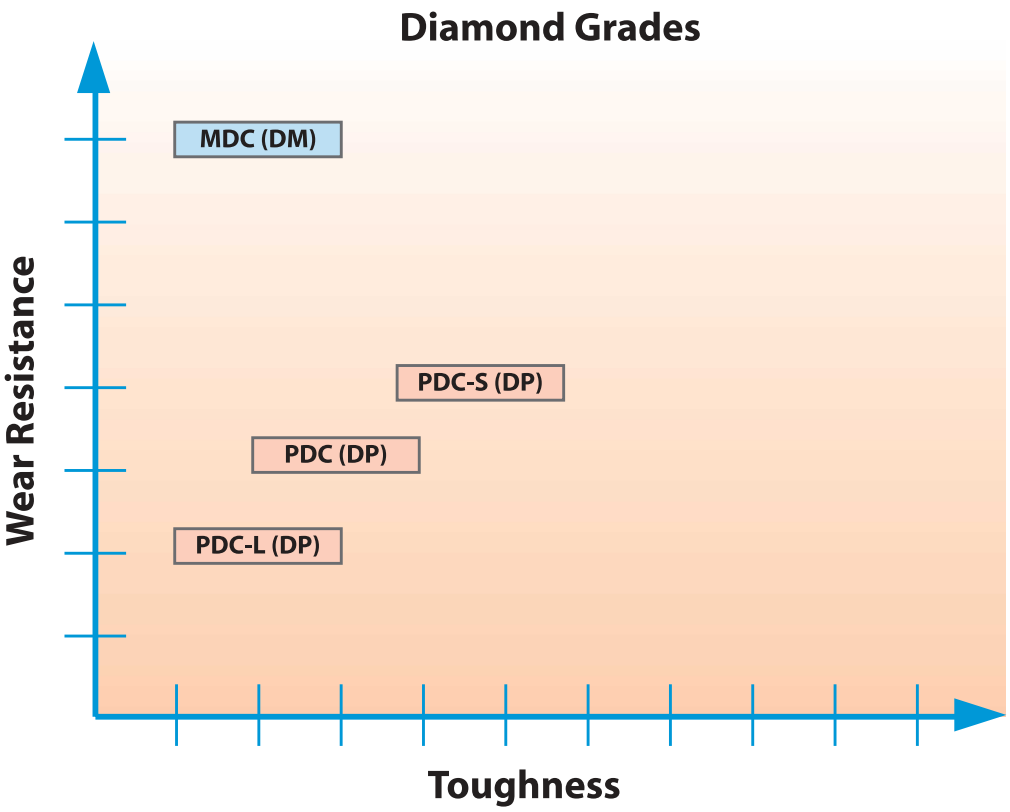
ISO	TyCarb Designation	Design	Amount of tipped corners		
			2	3	4
A	EW MW MC PDC	 1 tipped corner, carbide reinforced			
A-S	EWS MC-S MDC	 1 tipped corner, solid grades			
C	***	 2 tipped corner, carbide reinforced			
D	PC-S PC-M	 1 tipped edge, solid grades			
F	VM	 Full face			
E	***	 Double sided full face			
S	SBC SB	 Solid			

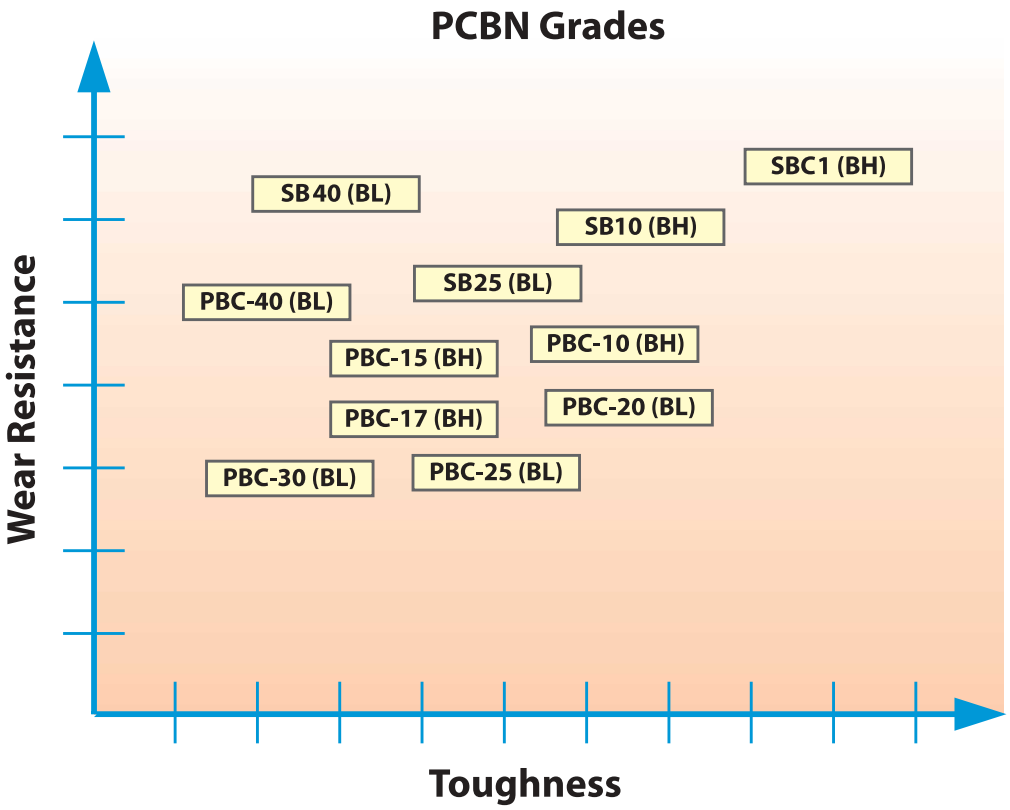
Variations of Tipped Corners for all Ultrahard Cutting Materials

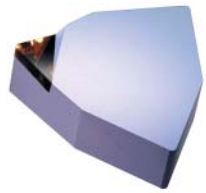
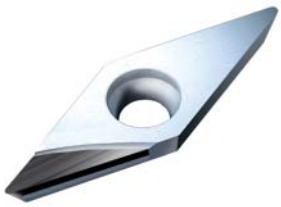
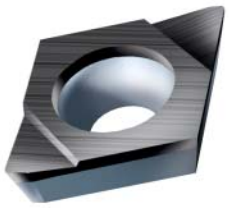
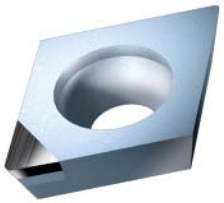
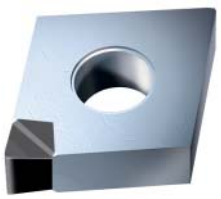
ISO	TyCarb Designation	Design	Tip description	Grade	ISO
A	EW MW		Carbide reinforced PCBN - grades, thickness of PCBN layer = .024 - .039"	PBC-10, PBC-15, PBC-17 PBC-20, PBC-25 PBC-30, PBC-40	BH BH BL BL
A-2	MC		Carbide reinforced PCBN - grades, thickness of PCBN layer = .024 - .039"	PBC-10, PBC-15, PBC-17 PBC-20, PBC-25 PBC-30, PBC-40	BH BH BL BL
A-3	MC		Carbide reinforced PCBN - grades, thickness of PCBN layer = .024 - .039"	PBC-10, PBC-15, PBC-17 PBC-20, PBC-25 PBC-30, PBC-40	BH BH BL BL
A	PDC-L PDC PDC-S		Carbide reinforced PCD - grades	PDC-L, PDC PDC-S	DP DP
A-3	MC		Carbide reinforced PCD - grades	PDC-L, PDC PDC-S	DP DP
A-S	EWS		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
A-S2	MC-S		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
A-S	MDC		Solid Monocrystalline Diamond - grade without reinforcement	MDC	DM
D	PC-S		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL

ISO	TyCarb Designation	Design	Tip description	Grade	ISO
D-2	PC-M		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
D-3	PC-M		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
D-4	PC-M		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
F	VM		Carbide reinforced PCBN - grades, Fullface	PBC-10, PBC-15, PBC-17 PBC-20, PBC-25 PBC-30, PBC-40	BH BH BL BL
F	VM		Carbide reinforced PDC - grades Fullface	PDC, PDC-S	DP
S	SBC SB		Solid PCBN - grades without reinforcement	SBC1, SB10 SB25, SB40	BH BL
**	SBC-GS SB-GS		Solid PCBN - grades whole cutting edge without reinforcement	SBC1, SB10 SB25, SB40	BH BL
**	PBC-GS		Carbide reinforced PCBN - grades whole cutting edge	PBC-10, PBC-15, PBC-17 PBC-20, PBC-25 PBC-30, PBC-40	BH BH BL BL
**	PDC-GS PDC-S-GS		Carbide reinforced PDC - grades whole cutting edge	PDC, PDC-S	DP

Wear Resistance and Toughness, Comparison of all our Ultrahard Cutting Materials

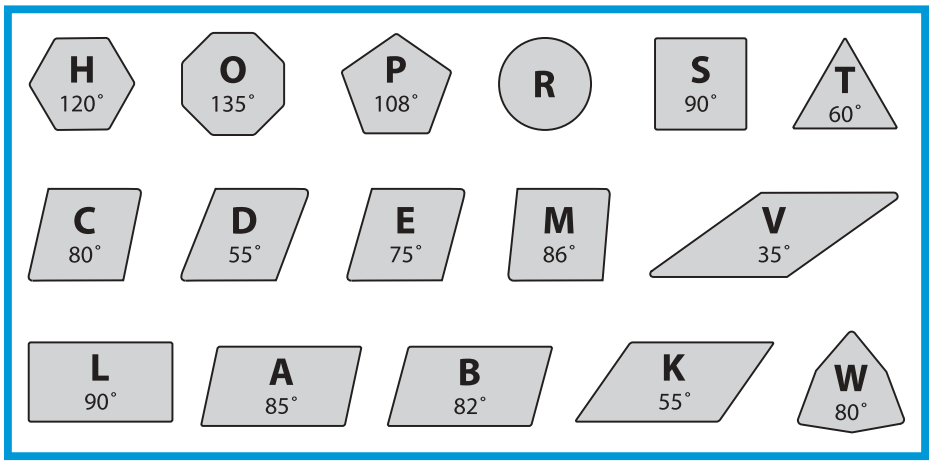




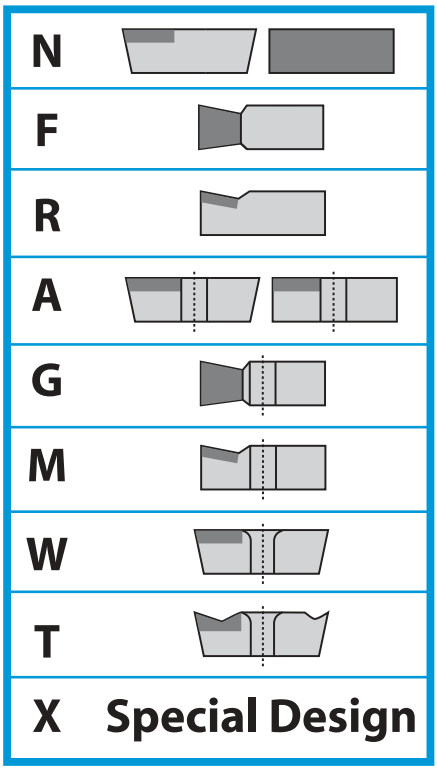
Top Rake		Advantages	Disadvantage
	1) negative insert 2) positive rake angle (R/L) 3) sharp cutting edge	**Cutting Materials:** **MDC** 1) very high cutting speed 2) large depth of cut 3) no cutting pressure 4) absolutely burr-free 5) very small tolerance limits 6) very high tool life	1) little reduction of surface finish caused by positive rake angle
	1) positive insert 2) positive rake angle (R/L) 3) sharp cutting edge	**Cutting Materials:** **PDC and PDC-S** 1) extremely large depth of cut 2) low cutting pressure 3) burr-free 4) small tolerance limits	1) little reduction of surface finish caused by positive rake angle
	1) positive insert 2) positive rake angle (N) 3) sharp cutting edge	**Cutting Materials:** **PBC and PDC for boring** 1) low cutting pressure 2) burr-free 3) small tolerance limits 4) high overhang 5) high cutting speed	1) little reduction of surface finish caused by positive rake angle
	1) positive insert 2) positive rake angle (N) 3) sharp cutting edge	**Cutting Materials:** **PDC, PDC-S, and PBC** 1) low cutting pressure 2) burr-free 3) small tolerance limits 4) high cutting speed	1) little reduction of surface finish caused by positive rake angle
	1) negative insert 2) positive rake angle (N) 3) sharp cutting edge	**Cutting Materials:** **SBC, SB** 1) great depth of cut 2) low cutting pressure 3) small tolerance limits 4) high cutting speed	1) little reduction of surface finish caused by positive rake angle

ISO Insert Nomenclature

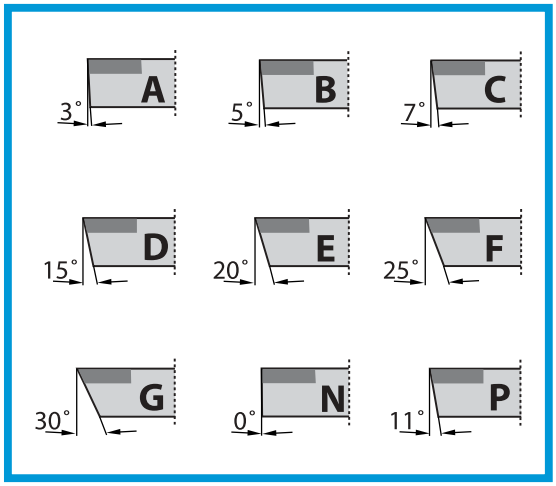
1. Shape



4. Insert type



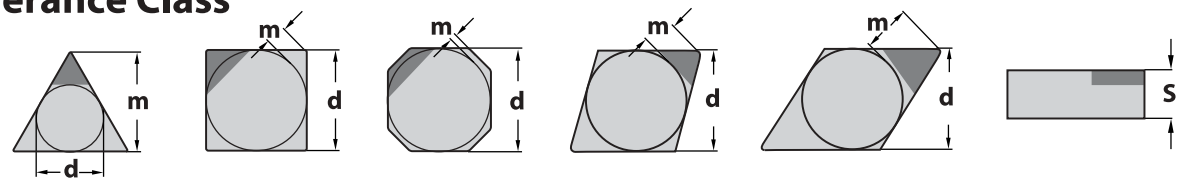
2. Clearance



ISO Designation Code Position 1 - 9

1	2	3	4
T	N	M	A

3. Tolerance Class



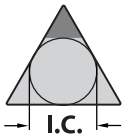
	m	s	d		m	s	d¹)
A	± 0.0002	± 0.0010	± 0.0010	J	± 0.0002	± 0.0010	± 0.0020 - 0.0059
F	± 0.0002	± 0.0010	± 0.0005	K	± 0.0005	± 0.0010	± 0.0020 - 0.0059
C	± 0.0005	± 0.0010	± 0.0010	L	± 0.0010	± 0.0010	± 0.0020 - 0.0059
H	± 0.0005	± 0.0010	± 0.0005	M¹)	± 0.0031 - 0.0079	± 0.0051	± 0.0020 - 0.0059
E	± 0.0002	± 0.0010	± 0.0010	N¹)	± 0.0031 - 0.0079	± 0.0098	± 0.0020 - 0.0059
G	± 0.0010	± 0.0051	± 0.0010	U¹)	± 0.0051 - 0.0150	± 0.0051	± 0.0031 - 0.0059

1) Exact tolerance is determined by size of insert

5. Insert I.C. Size

I.C. shown in 1/8 inch increments on inserts

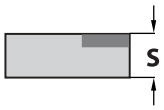
1.2 = 3/32"
1.5 = 3/16"
1.8 = 7/32"
2 = 1/4"
2.5 = 5/16"
3 = 3/8"
4 = 1/2"
5 = 5/8"
6 = 3/4"
8 = 1.0"



6. Thickness

(T) shown in 1/16 inch increments on inserts

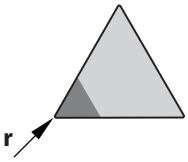
1 = 1/16"
1.2 = 5/64"
1.5 = 3/32"
2 = 1/8"
2.5 = 5/32"
3 = 3/16"
3.5 = 7/32"
4 = 1/4"
5 = 5/16"



7. Corner Configuration

1.) (R) shown in 1/64 inch increments

0 = .004"
0.5 = .008"
1 = 1/64"
2 = 1/32"
3 = 3/64"
4 = 1/16"
5 =5/64"
6 =3/32"
8 = 1/8"



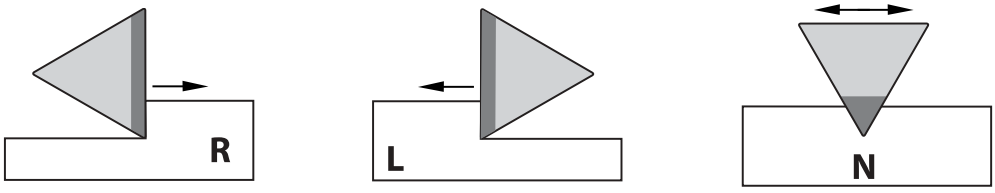
2.) For milling inserts
Major cutting edge angle:
A = 45˚
D = 60˚
E = 75˚
F = 85˚
P = 90˚

ZZ = detailed explanations are necessary

Wiper edge clearance
A = 3˚
B = 5˚
C = 7˚
D = 15˚
E = 20˚
F = 25˚
G = 30˚
N = 0˚
P = 11˚

8. Cutting Edge Condition

9. Cutting Direction



5 6 7 8 9

3 3 2 T R

Flank Wear Characteristics of our Ultrahard Cutting Materials

1) MDC - Monocrystalline Diamond (DM)

Monocrystalline diamond is the hardest known mineral. It's outstanding abrasive hardness and highest homogeneity enable the manufacture of ultra sharp and notch free micro-cutting edge qualities, (as it is ground from a single crystal) - not achievable using other cutting materials. The sharpness of the cutting edge produces a slight cutting pressure without any heat generated during machining. The unsurpassable wear resistance retains the perfect micro-cutting edge quality over an extremely long tool life. MDC cannot be used on aluminium with fillers.

2) PCD - Polycrystalline Diamond (DP)

The core structure (ultra-fine to coarse grain) of the Polycrystalline Diamond provides a higher toughness, yet lower wear resistance and reduced micro-cutting edge quality than with Monocrystalline Diamond. The reaction behaviour is identical, yet the higher toughness extends the application range considerably. Materials with a low to very high content (from 2% to 70%) of abrasives fillers can be machined with excellent tool life.

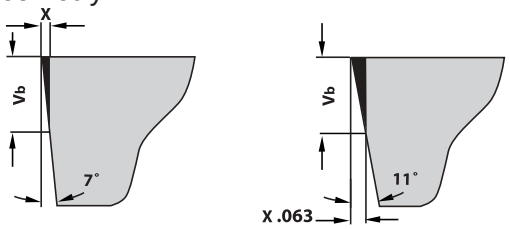
3) CBN - Polycrystalline Cubic Boron Nitride (BH and BL)

Polycrystalline Cubic Boron Nitride is the second hardest cutting material next to Diamond, however, it has far less in common with Diamond. Reaction resistance reaches 1,250°C which makes this cutting material have a very high wear resistance, toughness, compression strength and thermal hardness ideal for self-induced hot cutting mode of hardened steels.

Flank Wear of Ultrahard Cutting Materials

Flank wear has a significant influence on the life of all cutting tools. Due to the excellent flank wear resistance of all TyCarb Superabrasive cutting materials, they are clearly superior to conventional cutting materials in many fields. Typically, the TyCarb Superabrasive product will exhibit negligible flank wear - if any at all, thereby resulting in extremely long tool life.

The following drawing shows the difference of tool life under the same machining conditions for inserts with a clearance angle of 7° respectively 11°. Tool life of the insert with 11° angle will be 1.6 times longer than that of 7° before they reach the same width of flank wear. The following aspects should be taken into account in order to choose the adequate cutting edge geometry.



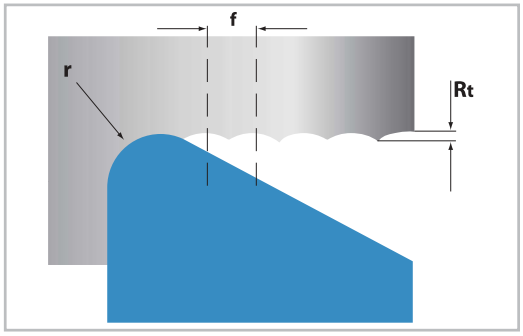
Under normal working conditions, abrasion will usually cause a certain degree of flank wear. Mono- and polycrystalline diamonds, however, are susceptible to abrasion caused by oxidation at a heat exceeding 650°C. The cause of flank wear is due to the extremely high thermal conductivity of diamonds. It is therefore recommended to select the smallest possible clearance angle for all diamond tools (if formation of burrs is of no importance). This selection will increase passive cutting pressure, leading to a better surface finish.

In contrast, CBN's low thermal conductivity flank wear is usually not only caused by abrasion, but also oxidation, diffusion, or adhesion, when applied for high speed cutting (HSC) and also self-induced hot cutting mode of hardened steel. With this point in mind, the correct clearance angle for external and internal turning is pivotal with regards to the friction between flank and the work piece. The passive cutting pressure and the temperature it is reaching can be controlled not only by the clearance angle, but also by the micro cutting edge geometry. In order to obtain maximum tool life, interaction of those facts must be considered.

One can simply calculate the theoretical surface roughness Rt- also known as R max and Rz. (In practice it usually runs up to four times the Ra value). The theoretical value, however, is again based on a perfect cutting edge geometry with a wide minor cutting edge angle. Using TyCarb MDC and PCD when machining nonferrous metals and non-metallics or CBN for grey cast iron results in hardly any flank wear or deformation of the cutting edge - due to the excellent flank wear resistance of our tools. It is therefore possible to complete the precise data for the required surface roughness, provided the cutting environment in itself will not hamper the machining as such.

In practice, the values of roughness will typically be less than the theoretical calculation when hard-cutting with CBN. This is due to a simple reason: the cutting process itself is influenced by self induced hot-cutting mode which can cause an extremely high passive cutting pressure.

Theoretical Surface Roughness		Corner Radius				
		Feed Rate (f=inch/rev)				
Ra µin	Rt µin	r = .008	r = .016	r = .031	r = .047	r = .063
24	100	.002	.003	.004	.005	.006
63	250	.003	.004	.006	.007	.009
125	500	.005	.007	.009	.011	.014
250	1000	.006	.009	.012	.015	.018

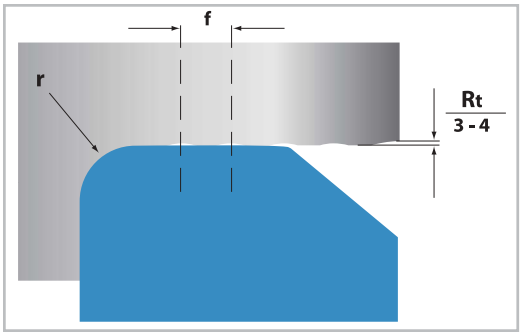


The practical application proves that the theoretically calculated value can hardly be achieved, since the environmental conditions tend to be imperfect. Unstable machining conditions, incorrect workholding, chucking, faulty or wrong tool system, wrong cutting speed and depth of cut etc. will impair the results. Conversely, working towards near perfect working conditions can result in an improved surface finish due to improved and optimized cutting edge geometries. In particular, the general reduction of the minor cutting edge angle, as well as the micro-geometries, with PCBN (for more cutting pressure) should be mentioned. In order to obtain the various stages of excellent surface finishes while hard-cutting, the T-land styles are of great influence. For a mirror-finish surface of nonferrous metals and nonmetallics, TyCarb is able to supply even MDC-inserts with a T-Land, if necessary.

With regards to high-performance cutting of all types, the manufacturer has developed a variety of inserts with WIPER geometry for internal, external and milling processes. The WIPER edge replaces the above-mentioned minor cutting edge, reducing its angle to a minimum, thereby reducing the theoretically computed surface roughness by 2 to 4 times.

In practice this is the alternative for high-performance and high-tech cutting:

1) 2-4x higher feed rate = same surface finish 2) same feed rate = 2-4x improved surface finish



Wiper inserts are available for:

- FormCut
- MonoCut
- MiniCut
- ISO-HardCut

In addition to the improvements gained in productivity by decreased flank wear, TyCarb products will result in significant gains in product quality.

Grades	ISO	Composition - Performance	Application
Mono - and Polycrystalline Diamond - PCD & MDC			
MDC	DM	Solid monocrystalline diamond with no structure. Cutting edge is extremely sharp and without microdamages, generating no cutting pressure, allowing burr-free results with tolerances close to zero. Extremely flank wear resistant and maximum thermal conductivity, low toughness.	Superfinishing of all pure nonferrous metals and non-metallics with no abrasive reinforcement or silicon. (HSC - High Tech)
PDC-L	DP	Polycrystalline, carbide reinforced diamond of ultrafine grit size, high cutting edge sharpness, minimal cutting pressure allowing close tolerances. Good flank wear resistance and toughness.	Finishing of all pure nonferrous materials and nonmetallics with verylow content of abrasive reinforcement or silicon.
PDC	DP	Polycrystalline, carbide reinforced diamond of fine grit size, good cutting edge sharpness and low cutting pressure allowing close tolerances. Increased flank wear resistance and toughness.	Finishing and general purpose of all nonferrous metals and nonmetallics with low content of abrasive reinforcement or silicon.
PDC-S	DP	Polycrystalline carbide reinforced diamond of coarse grit size, good edge sharpness and low cutting pressure allowing close tolerances. Best performances for milling. High flank wear resistance and toughness.	Finishing, general purpose and milling of all nonmetallics with medium to high content of abrasive reinforcement or silicon.
Polycrystalline Cubic Boron Nitride - High Content CBN			
SBC1	BH	Solid polycrystalline Cubic Boron Nitride grade with high content of CBN and medium grit size. Designed with exceptional flank wear resistance, thermal stability, compression strength and toughness for roughing and finishing of grey cast iron. HSC and HPC.	Grey cast iron Chilled cast iron Ni-hard Super alloys Sintered powdered alloys
SB10	BH	Solid polycrystalline Cubic Boron Nitride grade with high content of CBN and fine grit size. HSC, HPC and superfinishing of grey cast iron (GG 25) causing excellent flankwear resistance and toughness.	Grey cast iron GG25 Super alloys Sintered powdered alloys
PBC-10	BH	Polycrystalline carbide reinforced Cubic Boron Nitride grade with high content of CBN and fine grit size, perfect flank wear resistance and toughness. HSC and superfinishing of grey cast iron (GG25) and finishing of super alloys.	Grey cast iron GG25 Super alloys Sintered powdered alloys
PBC-15	BH	Polycrystalline carbide reinforced Cubic Boron Nitride grade with high content of CBN and fine grit size. The favourable grade for sintered powdered alloys, very good flank wear resistance and toughness.	Grey cast iron Super alloys Sintered powdered alloys
PBC-17	BH	Polycrystalline carbide reinforced Cubic Boron Nitride grade with high content of CBN and fine grit size. This grade excels in two main fields of application: general purpose and finishing of nodular cast iron, and hard-cutting of hardened steel (HRc 48-54) using flood coolant.	Nodular cast iron (GGG40 - GGG70) Hard-cutting (HRc 48 - 54) Sintered powdered alloys

Grades	ISO	Composition - Performance	Application
Polycrystalline Cubic Boron Nitride - Low Content CBN			
PBC-20	BL	Polycrystalline carbide reinforced Cubic Boron Nitride grade with low content of CBN and fine grit size. Engineered for hard-cutting of hardened steel (HRc 56 - 65) when highest surface finish is crucial (Ra 8µin - 32µin. Good performance in heavy interruptions as well as continuous cutting.	Hardened steels (HRc 56 - 65) dry cutting for Ra 8µin - 32µin ap= .006" - .020"
SB25	BL	Solid Polycrystalline Cubic Boron Nitride with low content of CBN and fine grit size. Highest compression strength, toughness and flank wear resistance when hard-cutting (HRc 56-65) with high depth of cut. (ap = .012" - .079"). Thermal conductivity is reduced and a soft cut attained. Suitable for continuous as well as heavy interrupted cutting. Also finishing of grey cast iron at a very low cutting speed.	Hardened steels (HRc 56 - 65) dry cutting for Ra 32µin - 125µin ap= .012" - .079" Grey cast iron (Vc 800 - 1140 sfm)
PBC-25	BL	Polycrystalline carbide reinforced Cubic Boron Nitride with low content of CBN and fine grit size. Excellent wear resistance, compression strength and toughness for hard-cutting. (HRc 54-62) General purpose for continuous and slightly interrupted cutting at surface finish Ra 32µin - 125µin. Also, finishing of grey cast iron at a very low cutting speed.	Hardened steels (HRc 56 - 65) dry cutting for Ra 32µin - 125µin ap= .003" - .016" Grey cast iron (Vc 975 - 1300 sfm)
PBC-30	BL	Polycrystalline carbide reinforced Cubic Boron Nitride with low content of CBN and fine grit size. Excellent wear resistance, compression strength and toughness for hard-cutting. (HRc 56 - 65 applying flood coolant) Suitable for continuous and heavily interrupted cutting at surface finish Ra 32µin - 63µin.	Hardened steels (HRc 56 - 65) with flood coolant for Ra 32µin - 63µin ap= .003" - .016"
SB40	BL	Solid Polycrystalline Cubic Boron Nitride with low content of CBN and ultrafine grit size. Extreme wear resistance, compression strength and toughness for dry hard-cutting (HRc 56 - 65) at higher feed rates with lower depth of cut. Very soft cut at continuous and slightly interrupted cutting.	Hardened steels (HRc 56 - 65) dry cutting for Ra 8µin - 32µin ap= .012" - .060"
PBC-40	BL	Solid Polycrystalline Cubic Boron Nitride with low content of CBN and ultrafine grit size. Perfect wear resistance for dry hard-cutting at higher feed rates with low depth of cut. Continuous and slightly interrupted cutting.	Hardened steels (HRc 56 - 62) dry cutting for Ra 32µin - 63µin ap= .002" - .012"

Turning

Materials	Conditions of chip removal	Range of application P01 - P40 — Vc								
P Steel sintered powdered alloys	Turning	**P01 - P15** see page 6			**P10 - P25** see page 6			**P20 - P40 (HPC)** see page 6		
		Vc: SFM			**Vc: SFM**			**Vc: SFM**		
		1300-2275	**813-1300**	**488-975**	**1300-2275**	**813-1300**	**488-975**	**1300-2275**	**813-1300**	**488-975**
	unstable (varied depth)	PBC-15 (T)	PBC-15 (T)	PBC-15 (T)	PBC-15 (T)	SBC-10 (T)		SBC1 (T)	SB10 (T)	SBC1 (T)
	continuous	PBC-15 (F)	PBC-15 (F)	PBC-15 (T)	SBC1 (T)	PBC-15 (T)	PBC-17 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)
		PBC-17 (F)	PBC-17 (T)	PBC-10 (F)	PBC-15 (T)	PBC-17 (T)			SB10 (T)	
	heavily + slightly interrupted	PBC-15 (T)	PBC-15 (T)	PBC-15 (T)	SBC-1 (T)	SBC1 (T)	PBC-17 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)
		PBC-10 (T)	PBC-10 (T)	PBC-17 (T)		SB10 (T)			SB10 (T)	

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

Go Back

Turning

Materials	Conditions of chip removal	Range of application K01 - K40 — Vc								
		K01 - K15 see page 6			**K10 - K25** see page 6			**K20 - K40 (HSC+HPC)** see page 6		
	Turning	**Vc: SFM**			**Vc: SFM**			**Vc: SFM**		
		2925-6500	**1625-2925**	**1138-1625**	**2925-6500**	**1625-2925**	**1138-1625**	**2925-6500**	**1625-2925**	**1138-1625**
K Cast irons (grey cast iron) GG10 GG15 GG20	unstable (varied depth)	PBC-15 (T)	PBC-15 (T)	PBC-25 (T)	PBC-15 (T)	PBC-15 (T)	PBC-25 (T)	SBC1 (T)	SB10 (T)	SB25 (T)
		PBC-10 (F)	PBC-10 (F)		PBC-10 (F)			SB10 (T)	SBC1 (T)	
	continuous	PBC-15 (F)	PBC-15 (T)	PBC-25 (F)	PBC-10 (T)	PBC-10 (F)	PBC-25 (F)	SBC1 (T)	SB10 (T)	SB25 (T)
		PBC-10 (F)	PBC-10 (F)		SB10 (T)			SB10 (T)	SBC1 (T)	
	heavily + slightly interrupted	PBC-15 (T)	PBC-15 (T)	PBC-25 (T)	PBC-10 (T)	PBC-10 (T)	PBC-25 (T)	SBC1 (T)	SBC1 (T)	SB25 (T)
		PBC-10 (T)	PBC-10 (T)		SB10 (T)			SB10 (T)	SB10 (T)	
K Cast irons (grey cast iron) GG25 GG30 GG35	unstable (varied depth)	PBC-15 (T)	PBC-15 (T)	PBC-25 (T)	PBC-15 (T)	PBC-15 (T)	PBC-25 (T)	SB10 (T)	SB10 (T)	SB25 (T)
		PBC-10 (F)	PBC-10 (F)		PBC-10 (T)			SBC1 (T)	SBC1 (T)	
	continuous	PBC-10 (F)	PBC-10 (F)	PBC-25 (F)	PBC-10 (T)	PBC-15 (T)	PBC-25 (F)	SB10 (T)	SBC1 (T)	SB25 (T)
		PBC-10 (F)			PBC-10 (F)		PBC-25 (T)	SBC1 (T)	SB10 (T)	
	heavily + slightly interrupted	PBC-10 (T)	PBC-10 (T)	PBC-25 (T)	PBC-10 (T)	PBC-10 (T)	PBC-25 (T)	SBC1 (T)	SBC1 (T)	SB25 (T)
		SB10 (T)						SB10 (T)	SB10 (T)	
K Cast irons (nodular cast iron) GGG40 GGG50 GGG60 GGG70	unstable (varied depth)			PBC-17 (T)			PBC-17 (T)		SBC1 (T)	PBC-17 (T)
										SBC1 (T)
	continuous		SBC1 (T)	PBC-17 (F)		SBC1 (T)	PBC-17 (F)		SBC1 (T)	PBC-17 (T)
				PBC-17 (T)			PBC-17 (T)			SBC1 (T)
	heavily + slightly interrupted		SBC1 (T)	PBC-17 (T)		SBC1 (T)	PBC-17 (T)		SBC1 (T)	PBC-17 (T)
				PBC-15 (T)			PBC-15 (T)			SBC1 (T)

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

Turning

Materials	Conditions of chip removal	Range of application N01 - N40 — Rt + Vc								
		N01 - N20 (HSC) see page 6			**N20 - N30 (HSC)** see page 6			**N25 - N40 (HSC+HPC)** see page 6		
		Rt (Rz) µ			**Rt (Rz) µ**			**Rt (Rz) µ**		
		3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin
N Nonferrous metals Aluminum alloys without silicon	Turning (high-speed)									
	unstable (varied depth)	MDC	PDC	PDC	MDC	PDC	PDC	MDC	PDC	PDC
		2925-9750	1300-8125	1300-8125	1950-8125	1300-6500	1300-6500	1625-6500	1300-5200	1300-5200
	continuous	MDC	PDC-L	PDC	MDC	PDC-L	PDC	MDC	PDC-L	PDC
		2925-13000	1300-8125	1300-8125	1950-9750	1300-6500	1300-6500	1625-8125	1300-5200	1300-5200
	heavily + slightly interrupted	MDC	PDC	PDC	MDC	PDC	PDC	MDC	PDC	PDC
		2925-9750	1300-8125	1300-8125	1950-8125	1300-6500	1300-6500	1625-6500	1300-6500	1300-5200
N Nonferrous metals Aluminum alloys with less than 12% silicon	unstable (varied depth)		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	PDC-S
			1950-6500	1950-7150		1950-5850	1950-6500		1950-4875	1950-5850
	continuous	MDC	PDC	PDC-S		PDC	PDC-S		PDC	PDC-S
		3900-4875	1300-6500	1300-7150		1300-5850	1950-6500		1300-4875	1300-5850
	heavily + slightly interrupted		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	
			1950-6500	1950-7150		1950-5850	1950-6500		1950-4875	
N Nonferrous metals Aluminum alloys with more than 12% silicon	unstable (varied depth)			PDC-S			PDC-S			PDC-S
				1950-5850			1950-4875			1950-3900
	continuous		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	PDC-S
			2600-3900	1300-5850		2275-3250	1300-4875		1950-2925	1300-3900
	heavily + slightly interrupted			PDC-S			PDC-S			
				1950-5850			1950-4875			

Coolant: Air (plastics) or flood coolant (metals), it is tool life only that is reduced when cutting without cooling, the surface finish, however, is not affected.

Turning

Materials	Conditions of chip removal	Range of application N01 - N40 — Rt + Vc								
		N01 - N20 (HSC) see page 6			**N20 - N30 (HSC)** see page 6			**N25 - N40 (HSC+HPC)** see page 6		
		Rt (Rz) µ			**Rt (Rz) µ**			**Rt (Rz) µ**		
		3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin
N Nonferrous metals Copper and copper alloys brass, bronze, precious metals	Turning (high-speed)									
	unstable (varied depth)	MDC	PDC-L	PDC	MDC	PDC	PDC-S	MDC	PDC	PDC-S
		1950-8125	1300-5850	975-4875	1950-6500	1300-5200	975-4875	1625-5850	1300-4875	975-4550
	continuous	MDC	PDC-L	PDC	MDC	PDC-L	PDC-S	MDC	PDC	PDC-S
		1950-9750	1300-7150	975-5850	1950-8125	1300-5850	975-5525	1625-6500	1300-5200	975-4225
	heavily + slightly interrupted	MDC	PDC	PDC	MDC	PDC	PDC-S	MDC	PDC	PDC-S
		1950-9750	1300-5850	975-5200	1950-6500	1300-5200	975-5200	1625-5850	1300-4550	1300-4875
N Non-metallics pure plactics without re-inforcement	unstable (varied depth)	MDC	PDC-L	PDC	MDC	PDC-L	PDC	MDC	PDC-L	PDC
		1950-9750	1625-5850	1300-3900	1950-5850	1300-3900	975-3250	1950-5850	975-2925	650-3250
	continuous	MDC	PDC-L	PDC	MDC	PDC-L	PDC	MDC	PDC-L	PDC
		1300-11375	975-5850	975-3900	1300-5850	975-3250	650-3250	1300-5850	650-2600	650-2925
	heavily + slightly interrupted	MDC	PDC-L	PDC	MDC	PDC-L	PDC	MDC	PDC-L	PDC
		1950-9750	1625-5850	1300-3900	1950-5850	1300-3900	975-3250	1950-5850	975-2925	650-3250
N Non-metallics plastics with re-inforcement (ie/ GRP, CRP)	unstable (varied depth)	MDC	PDC-S		MDC	PDC-S	PDC-S		PDC-S	PDC-S
		2600-3900	1625-3250		2275-2925	1300-2925	975-2925		975-2600	650-3900
	continuous	MDC	PDC-S		MDC	PDC-S	PDC-S		PDC-S	PDC-S
		1300-4550	1300-2925		1950-3250	975-2600	650-2925		650-2600	650-4550
	heavily + slightly interrupted	MDC	PDC-S		MDC	PDC-S	PDC-S		PDC-S	
		2925-3900	1625-3250		2275-2925	1300-2600	975-3250		975-2600	

Coolant: Air (plastics) or flood coolant (metals), it is tool life only that is reduced when cutting without cooling, the surface finish, however, is not affected.

Turning

Materials	Conditions of chip removal	Range of application S01 - S40 — Vc								
S Super-alloys heat resistant alloys nickel base alloys Inconel 718, Nimonic, Hastelloy, Waspaloy	Turning	**S01 - S15** see page 6			**S15 - S25** see page 6			**S25 - S40** see page 6		
		Vc: SFM			**Vc: SFM**			**Vc: SFM**		
		1625-2925	**975-1625**	**650-1138**	**1625-2925**	**975-1625**	**650-1138**	**1625-2925**	**975-1625**	**650-1138**
	unstable (varied depth)		PBC-15 (T)	PBC-25 (T)		PBC-15 (T)	PBC-25 (T)		SB10 (T)	SB25 (T)
	continuous	PBC-15 (F)	PBC-10 (F)	PBC-20 (F)		PBC-10 (F)	PBC-15 (T)		SB10 (T)	SB10 (T)
			PBC-15 (F)	PBC-25 (F)		PBC-15 (T)	PBC-10 (T)			SB25 (T)
	heavily + slightly interrupted	PBC-15 (T)	PBC-10 (T)	PBC-10 (T)	SBC1 (T)	PBC-10 (T)	PBC-10 (T)	SBC1 (T)	SBC1 (T)	SB10 (T)
			PBC-15 (T)			PBC-15 (T)				SBC1 (T)
S Super-alloys titanium titanium alloys	unstable (varied depth)									
	continuous	MDC	MDC	PDC-S	MDC	MDC	PDC-S			SB25 (T)
				PBC-25 (T)			PBC-25 (T)			
	heavily + slightly interrupted			PDC-S		SBC1 (T)	PDC-S		SBC1 (T)	SBC25 (T)
				PBC-25 (T)			SB25 (T)			

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

Turning

Materials	Conditions of chip removal	Range of application H01 - H40 — Ra + Vc								
		H01 - H15 see page 6			**H05 - H20** see page 6			**H20 - H40 (HPC)** see page 6		
		Ra µin			**Ra µin**			**Ra µin**		
		8-32	**32-63**	**63-125**	**8-32**	**32-63**	**63-125**	**8-32**	**32-63**	**63-125**
H Hard materials hardened steel HRc 48-54 hard turning	unstable (varied depth)			PBC-25 (F)			PBC-25 (F)			SB25 (F)
				520-715			488-618			455-585
	continuous	SB40 (T)	PBC-17 (T)	PBC-25 (F)	SB40 (T)	PBC-17 (T)	PBC-25 (F)	PBC-20 (T)	SB40 (T)	SB25 (T)
		390-520	423-585	520-715	358-520	423-553	488-618	325-455	390-520	423-553
	heavily + slightly interrupted	PBC-20 (T)	PBC-17 (T)	PBC-25 (T)	PBC-20 (T)	PBC-17 (T)	PBC-25 (T)	PBC-20 (T)	SB40 (T)	SB25 (T)
		390-520	488-618	423-585	358-488	455-585	358-585	390-488	423-553	390-520
H Hard materials hardened steel HRc 54-60 hard turning	unstable (varied depth)		PBC-30 (T)	PBC-25 (F)		PBC-30 (T)	PBC-25 (F)		SB25 (T)	SB25 (F)
			455-585	585-845		423-585	553-780		390-585	455-585
	continuous	SB40 (T)	PBC-40 (T)	PBC-40 (F)	SB40 (T)	SB25 (T)	PBC-40 (F)	SB40 (T)	SB25 (T)	SB25 (T)
		423-585	488-650	553-780	423-585	423-585	520-780	390-520	390-585	390-585
	heavily + slightly interrupted	PBC-20 (T)	SB40 (T)	PBC-25 (T)	PBC-20 (T)	SB25 (T)	PBC-25 (T)	PBC-20 (T)	SB25 (T)	SB25 (T)
		423-553	455-650	488-650	390-488	455-585	390-585	358-488	423-618	390-520
H Hard materials hardened steel HRc 58-65 hard turning	unstable (varied depth)		PBC-40 (T)	PBC-25 (T)		PBC-30 (T)	PBC-25 (T)		SB40 (T)	SB25 (T)
			520-780	455-585		423-553	455-553		390-520	390-520
	continuous	SB40 (T)	PBC-40 (T)	PBC-25 (T)	SB40 (T)	PBC-30 (T)	PBC-25 (T)	SB40 (T)	SB40 (T)	SB25 (T)
		455-520	520-780	455-585	390-585	390-553	455-553	358-520	390-520	390-520
	heavily + slightly interrupted	PBC-20 (T)	PBC-30 (T)	PBC-25 (T)	PBC-20 (T)	PBC-30 (T)	PBC-25 (T)	PBC-20 (T)	SB25 (T)	SB25 (T)
		390-488	455-585	488-650	358-488	455-585	488-618	325-455	455-585	455-585

T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

Turning

Materials	Conditions of chip removal	Range of application H01 - H40 — Vc								
		H01 - H15 see page 6			**H05 - H20** see page 6			**H25 - H40 (HPC)** see page 6		
		Vc: SFM			**Vc: SFM**			**Vc: SFM**		
		488-975	**325-650**	**163-488**	**488-975**	**325-650**	**163-488**	**488-975**	**325-650**	**163-488**
H Hard materials Chilled cast irons chilled cast iron rolls chilled cast iron alloys Ni-Hard	Turning									
	unstable (varied depth)									
	continuous	SB10 (T)	SB10 (T)			SBC1 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)
						SB10 (T)			SB10 (T)	
	heavily + slightly interrupted	SBC1 (T)	SBC1 (T)	SBC1 (T)		SBC1 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)	SBC1 (T)
		SB10 (T)	SB10 (T)							
H Hard materials hardfacing alloys	unstable (varied depth)									
	continuous									
	heavily + slightly interrupted		SBC1 (T)	SBC1 (T)		SBC1 (T)	SBC1 (T)		SBC1 (T)	SBC1 (T)
			PBC-10 (T)	SB10 (T)		PBC-10 (T)	SB10 (T)		SB10 (T)	SB10 (T)
H Hard materials sintered carbide	unstable (varied depth)									
	continuous			SB25 (T)			PDC-S			SBC1 (T)
				SBC1 (T)			SBC1 (T)			
	heavily + slightly interrupted									

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

High-Speed Milling

Materials	Conditions of chip removal	Range of application K01 - K40 — Vc								
		K01 - K15 (HSC) see page 6			**K10 - K25 (HSC)** see page 6			**K20 - K40 (HSC+HPC)** see page 6		
		Vc: SFM			**Vc: SFM**			**Vc: SFM**		
		3900-8125	**1625-2925**	**1138-1625**	**3900-8125**	**1625-2925**	**1138-1625**	**3900-8125**	**1625-2925**	**1138-1625**
K Cast irons (grey cast iron) GG10 GG15 GG20	High-speed milling									
	unstable (varied depth)	SBC1 (T)			SBC1 (T)			SBC1 (T)		
	continuous	PBC-10 (T)	PBC-17 (T)	PBC-25 (T)	PBC-10 (T)	PBC-17 (T)	PBC-25 (T)	SBC1 (T)		PBC-25 (T)
		PBC-15 (T)			SBC1 (T)			PBC-10 (T)		
	heavily + slightly interrupted	PBC-10 (T)	PBC-17 (T)	PBC-25 (T)	SBC1 (T)	PBC-17 (T)	PBC-25 (T)	SBC1 (T)		PBC-25 (T)
		PBC-15 (T)			PBC-10 (T)			PBC-10 (T)		
K Cast irons (grey cast iron) GG25 GG30 GG35	unstable (varied depth)	PBC-15 (T)			PBC-15 (T)			SBC1 (T)		
	continuous	PBC-10 (T)	PBC-17 (T)	PBC-25 (T)	PBC-10 (T)		PBC-25 (T)	SBC1 (T)		PBC-25 (T)
		PBC-15 (T)			SBC1 (T)			PBC-10 (T)		
	heavily + slightly interrupted	PBC-10 (T)	PBC-17 (T)	PBC-25 (T)	SBC1 (T)		PBC-25 (T)	SBC1 (T)		PBC-25 (T)
		PBC-15 (T)			PBC-10 (T)			PBC-10 (T)		
K Cast irons (nodular cast iron) GGG40 GGG50 GGG60 GGG70	unstable (varied depth)									
	continuous		PBC-17 (T)	PBC-25 (T)	SBC1 (T)	PBC-17 (T)		SBC1 (T)	PBC-17 (T)	
	heavily + slightly interrupted		PBC-17 (T)		SBC1 (T)	PBC-17 (T)		SBC1 (T)	PBC-17 (T)	

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
Milling: without coolant, T-land version only

Go Back

High-Speed Milling

Materials	Conditions of chip removal	Range of application N01 - N40 — Rt + Vc								
		N01 - N20 (HSC) see page 6			**N20 - N30 (HSC)** see page 6			**N25 - N40 (HSC+HPC)** see page 6		
		Rt (Rz) µ			**Rt (Rz) µ**			**Rt (Rz) µ**		
		3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin	3.2µin - 100µin	100µin - 200µin	200µin - 400µin
N Nonferrous metals Aluminum alloys without silicon	High-speed milling									
	unstable (varied depth)	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S
		4875-19500	2600-14625	2600-13000	4875-16250	2600-13000	2600-9750	4875-11375	2600-8125	2600-6500
	continuous	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S
		4875-19500	2600-14625	2600-13000	4875-16250	2600-13000	2600-9750	4875-11375	2600-8125	2600-6500
	heavily + slightly interrupted	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S	MDC	PDC-S	PDC-S
		4875-19500	2600-14625	2600-13000	4875-16250	2600-13000	2600-9750	4875-11375	2600-8125	2600-6500
N Nonferrous metals Aluminum alloys with less than 12% silicon	unstable (varied depth)		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	PDC-S
			2600-13000	2600-11375		2600-11375	2600-9750		2600-8775	1950-5850
	continuous		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	PDC-S
			2600-13000	2600-11375		2600-11375	2600-9750		2600-8775	1950-5850
	heavily + slightly interrupted		PDC-S	PDC-S		PDC-S	PDC-S		PDC-S	PDC-S
			2600-13000	2600-11375		2600-11375	2600-9750		2600-8775	1950-5850
N Nonferrous metals Aluminum alloys with more than 12% silicon	unstable (varied depth)			PDC-S			PDC-S			PDC-S
				2600-9750			2275-8125			1950-4875
	continuous			PDC-S			PDC-S			PDC-S
				2600-9750			2275-8125			1950-4875
	heavily + slightly interrupted			PDC-S			PDC-S			PDC-S
				2600-9750			2275-8125			1950-4875

Coolant: Air (plastics) or flood coolant (metals), it is tool life only that is reduced when cutting without cooling, the surface finish, however, is not affected.

High-Speed Milling

Materials	Conditions of chip removal	Range of application N01 - N40 — Rt + Vc								
		N01 - N20 (HSC) see page 6			**N20 - N30 (HSC)** see page 6			**N25 - N40 (HSC+HPC)** see page 6		
		Rt (Rz) µ			**Rt (Rz) µ**			**Rt (Rz) µ**		
		3.2µin - 80µin	100µin - 200µin	200µin - 400µin	3.2µin - 80µin	100µin - 200µin	200µin - 400µin	3.2µin - 80µin	100µin - 200µin	200µin - 400µin
N Nonferrous metals Copper and copper alloys brass, bronze, precious metals	High-speed milling									
	unstable (varied depth)	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-16250	2600-9750		4875-11375	2600-8125		3900-9750	2275-7150	
	continuous	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-16250	2600-9750		4875-11375	2600-8125		3900-9750	2275-7150	
	heavily + slightly interrupted	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-16250	2600-9750		4875-11375	2600-8125		3900-9750	2275-7150	
N Non-metallics pure plastics without re-inforcement (i.e. plexiglass)	unstable (varied depth)	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-13000	2600-9750		2925-8125	1950-7150		2275-7150	1625-5200	
	continuous	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-13000	2600-9750		2925-8125	1950-7150		2275-7150	1625-5200	
	heavily + slightly interrupted	MDC	PDC-S		MDC	PDC-S		MDC	PDC-S	
		4875-13000	2600-9750		2925-8125	1950-7150		2275-7150	1625-5200	
N Non-metallics plastics with re-inforcement (i.e. GRP, CRP)	unstable (varied depth)		PDC-S			PDC-S			PDC-S	
			1950-7150			1950-5200			1300-3900	
	continuous		PDC-S			PDC-S			PDC-S	
			1950-7150			1950-5200			1300-3900	
	heavily + slightly interrupted		PDC-S			PDC-S			PDC-S	
			1950-7150			1950-5200			1300-3900	

Coolant: Air (plastics) or flood coolant (metals), it is tool life only that is reduced when cutting without cooling, the surface finish, however, is not affected.

High-Speed Milling

Materials	Conditions of chip removal	Range of application H01 - H40 — Ra + Vc								
H Hard materials hardened steel HRc 54-60 hard milling	High-speed milling	**H01 - H15** see page 6			**H05 - H20** see page 6			**H20 - H40 (HPC)** see page 6		
		Ra µin			**Ra µin**			**Ra µin**		
		8-32	**32-63**	**63-125**	**8-32**	**32-63**	**63-125**	**8-32**	**32-63**	**63-125**
	unstable (varied depth)									
	continuous	SB40 (T)	PBC-17 (T)	PBC-25 (T)	SB40 (T)	PBC-17 (T)	PBC-25 (T)		SB25 (T)	SB25 (T)
		1625-2925	1463-2600	1625-2925	1463-2925	1300-2600	1463-2925		1138-2600	975-2275
	heavily + slightly interrupted	PBC-20 (T)	PBC-30 (T)	PBC-25 (T)	PBC-20 (T)	PBC-30 (T)	SB25 (T)		SB25 (T)	SB25 (T)
		1300-2275	1463-2925	1788-3900	1138-2113	1300-2925	1463-2925		1300-2600	1138-2275
H Hard materials hardened steel HRc 58-65 hard milling	unstable (varied depth)									
	continuous	SB40 (T)	PBC-17 (T)	PBC-25 (T)	SB40 (T)	PBC-17 (T)	SB25 (T)		SB25 (T)	SB25 (T)
		1625-3088	1625-2925	1950-2925	1463-2925	1463-2925	1788-2925		1300-2600	1138-2275
	heavily + slightly interrupted	PBC-20 (T)	PBC-30 (T)	PBC-25 (T)	PBC-20 (T)	PBC-30 (T)	SB25 (T)		SB25 (T)	SB25 (T)
		1463-2600	1625-2925	2113-3900	1300-2600	1463-2925	1625-2925		1463-2600	1300-2275

PCBN Grades, Position 1: Primary Choice | Position 2: Alternate Choice
T= (T-Land) for interrupted and continuous turning, F= (Sharp) continuous turning only

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Trouble Shooting - PCD Applications		
Problem	**Cause**	**Suggested Action**
Poor surface quality	Vibration	**1.** Check rigidity of tool & set-up
	Too high feed rate	**2.** Lower feed rate, increase nose radius or change to wiper
	Wrong grade	**3.** Choose finer grain size
Premature wear	Wrong speed	**1.** Decrease speed (Check cutting data tables)
	Wrong grade	**2.** Choose coarser grain size
Edge chipping	Vibration	**1.** Check rigidity of tool & set-up
	Wrong cutting data	**2.** Check speeds & feeds in cutting data for you application
	Wrong grade	**3.** Choose coarser grain size
Tip dislodging	Excessive cutting temperature	**1.** Increase coolant to tip
		2. Decrease speed
		3. Reduce depth of cut
		4. Increase tip size

In addition to the recommendations in this catalogue, the following general rules apply to PCD applications:

- Rigid machines and set-ups
- Minimum tool over hangs
- Choose most positive cutting edge angle possible
- Use coolant for metalics
- Use air for non-metalics

Trouble Shooting for CBN Applications

Trouble Shooting - CBN Applications		
Problem	**Cause**	**Suggested Action**
Poor surface quality	Vibration	**1.** Check rigidity of tool & set-up
	Too high feed	**2.** Lower feed rate, increase nose radius or change to wiper
	Too sharp insert	**3.** Increase chamfer angle
	Wrong grade	**4.** Choose finer grain size
Premature wear	Wrong speed	**1.** Increase speed (Check cutting data tables)
	Too sharp insert	**2.** Increase chamfer angle
	Wrong grade	**3.** Choose finer grain size
Edge chipping	Vibration	**1.** Check rigidity of tool & set-up
	Interruption	**2.** Increase chamfer angle and hone
	Wrong grade	**3.** Choose coarser grain size
Vibration	Poor set-up	**1.** Check rigidity of tool & set-up
	Too light feed	**2.** Increase feed / or D.O.C.
	Too much pressure	**3.** Choose more positive insert geometry / cutting edge angle
	Improper edge prep	**4.** Reduce chamfer angle
	Too much pressure	**5.** Reduce nose radius

In addition to the recommendations in this catalogue, the following general rules apply to CBN applications:

- Rigid machines and set-ups
- Minimum tool over hangs
- Choose largest cutting edge angle possible
- Negative inserts wherever possible