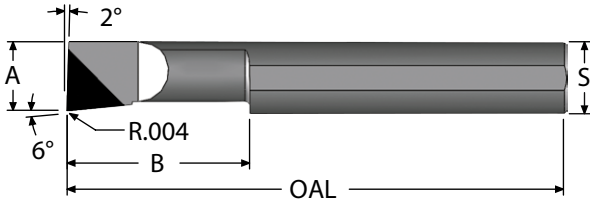


# BORING BARS - CBN TIPPED - PCD TIPPED



- PCD for abrasive non-ferrous materials
- CBN for hard ferrous metal - 45Rc plus
- Faster speeds and feeds
- Maintains tighter tolerances
- Solid carbide body for maximum rigidity

"A" MIN BORE	"B" MAX DEPTH	"S" SHANK DIA.	OAL	ORDER #		EDP #	
				PCD	CBN	PCD	CBN
0.120	0.250	0.1875	2.00	PCD-B120250	CBN-B120250	226001	226262
0.120	0.350	0.1875	2.00	PCD-B120350	CBN-B120350	226004	226265
0.120	0.500	0.1875	2.00	PCD-B120500	CBN-B120500	226007	226268
0.120	0.600	0.1875	2.00	PCD-B120600	CBN-B120600	226010	226271
0.120	0.700	0.1875	2.00	PCD-B120700	CBN-B120700	226013	226274
0.120	0.800	0.1875	2.00	PCD-B120800	CBN-B120800	226016	226277
0.140	0.250	0.1875	2.00	PCD-B140250	CBN-B140250	226019	226280
0.140	0.400	0.1875	2.00	PCD-B140400	CBN-B140400	226022	226283
0.140	0.500	0.1875	2.00	PCD-B140500	CBN-B140500	226025	226286
0.140	0.600	0.1875	2.00	PCD-B140600	CBN-B140600	226028	226289
0.140	0.700	0.1875	2.00	PCD-B140700	CBN-B140700	226031	226292
0.140	0.750	0.1875	2.00	PCD-B140750	CBN-B140750	226034	226295
0.140	0.800	0.1875	2.00	PCD-B140800	CBN-B140800	226037	226298
0.160	0.250	0.1875	2.00	PCD-B160250	CBN-B160250	226043	226304
0.160	0.400	0.1875	2.00	PCD-B160400	CBN-B160400	226046	226307
0.160	0.500	0.1875	2.00	PCD-B160500	CBN-B160500	226049	226310
0.160	0.600	0.1875	2.00	PCD-B160600	CBN-B160600	226052	226313
0.160	0.750	0.1875	2.00	PCD-B160750	CBN-B160750	226055	226316
0.160	0.900	0.1875	2.00	PCD-B160900	CBN-B160900	226058	226319
0.160	1.000	0.1875	2.00	PCD-B1601000	CBN-B1601000	226040	226301
0.180	0.350	0.250	2.50	PCD-B180350	CBN-B180350	226067	226328
0.180	0.500	0.250	2.50	PCD-B180500	CBN-B180500	226070	226331
0.180	0.600	0.250	2.50	PCD-B180600	CBN-B180600	226073	226334
0.180	0.750	0.250	2.50	PCD-B180750	CBN-B180750	226076	226337
0.180	0.900	0.250	2.50	PCD-B180900	CBN-B180900	226079	226340
0.180	1.000	0.250	2.50	PCD-B1801000	CBN-B1801000	226061	226322
0.180	1.100	0.250	2.50	PCD-B1801100	CBN-B1801100	226064	226325
0.200	0.400	0.250	2.50	PCD-B200400	CBN-B200400	226094	226355
0.200	0.500	0.250	2.50	PCD-B200500	CBN-B200500	226097	226358
0.200	0.600	0.250	2.50	PCD-B200600	CBN-B200600	226100	226361
0.200	0.700	0.250	2.50	PCD-B200700	CBN-B200700	226103	226364
0.200	0.800	0.250	2.50	PCD-B200800	CBN-B200800	226106	226367
0.200	0.900	0.250	2.50	PCD-B200900	CBN-B200900	226109	226370
0.200	1.000	0.250	2.50	PCD-B2001000	CBN-B2001000	226082	226343
0.200	1.100	0.250	2.50	PCD-B2001100	CBN-B2001100	226085	226346
0.200	1.200	0.250	2.50	PCD-B2001200	CBN-B2001200	226088	226349
0.200	1.300	0.250	2.50	PCD-B2001300	CBN-B2001300	226091	226352
0.230	0.400	0.3125	2.50	PCD-B230400	CBN-B230400	226133	226394
0.230	0.500	0.3125	2.50	PCD-B230500	CBN-B230500	226136	226397
0.230	0.600	0.3125	2.50	PCD-B230600	CBN-B230600	226139	226400
0.230	0.700	0.3125	2.50	PCD-B230700	CBN-B230700	226142	226403
0.230	0.800	0.3125	2.50	PCD-B230800	CBN-B230800	226145	226406
0.230	0.900	0.3125	2.50	PCD-B230900	CBN-B230900	226148	226409

THREAD MILLS

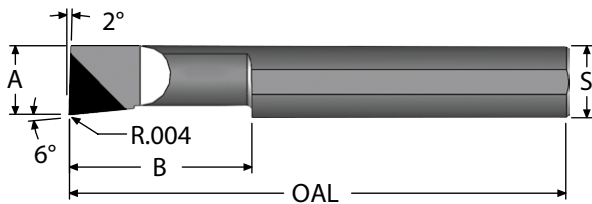
SINGLE POINT TOOLS  
BORING

INDEXABLE TOOLS

PORT - CAVITY

SPECIALTY

# BORING BARS - CBN TIPPED - PCD TIPPED



- PCD for abrasive non-ferrous materials
- CBN for hard ferrous metal - 45Rc plus
- Faster speeds and feeds
- Maintains tighter tolerances
- Solid carbide body for maximum rigidity

"A" MIN BORE	"B" MAX DEPTH	"S" SHANK DIA.	OAL	ORDER #		EDP #	
				PCD	CBN	PCD	CBN
0.230	1.000	0.3125	2.50	PCD-B2301000	CBN-B2301000	226112	226373
0.230	1.150	0.3125	2.50	PCD-B2301150	CBN-B2301150	226115	226376
0.230	1.200	0.3125	2.50	PCD-B2301200	CBN-B2301200	226118	226379
0.230	1.250	0.3125	2.50	PCD-B2301250	CBN-B2301250	226121	226382
0.230	1.400	0.3125	2.50	PCD-B2301400	CBN-B2301400	226124	226385
0.230	1.500	0.3125	2.50	PCD-B2301500	CBN-B2301500	226127	226388
0.230	1.600	0.3125	2.50	PCD-B2301600	CBN-B2301600	226130	226391
0.290	0.500	0.3125	2.50	PCD-B290500	CBN-B290500	226172	226433
0.290	0.600	0.3125	2.50	PCD-B290600	CBN-B290600	226175	226436
0.290	0.750	0.3125	2.50	PCD-B290750	CBN-B290750	226178	226439
0.290	0.900	0.3125	2.50	PCD-B290900	CBN-B290900	226181	226442
0.290	1.000	0.3125	2.50	PCD-B2901000	CBN-B2901000	226151	226412
0.290	1.100	0.3125	2.50	PCD-B2901100	CBN-B2901100	226154	226415
0.290	1.250	0.3125	2.50	PCD-B2901250	CBN-B2901250	226157	226418
0.290	1.350	0.3125	2.50	PCD-B2901350	CBN-B2901350	226160	226421
0.290	1.500	0.3125	2.50	PCD-B2901500	CBN-B2901500	226163	226424
0.290	1.600	0.3125	2.50	PCD-B2901600	CBN-B2901600	226166	226427
0.290	1.750	0.3125	2.50	PCD-B2901750	CBN-B2901750	226169	226430
0.320	0.500	0.375	2.50	PCD-B320500	CBN-B320500	226211	226472
0.320	0.600	0.375	2.50	PCD-B320600	CBN-B320600	226214	226475
0.320	0.750	0.375	2.50	PCD-B320750	CBN-B320750	226217	226478
0.320	0.900	0.375	2.50	PCD-B320900	CBN-B320900	226220	226481
0.320	1.000	0.375	2.50	PCD-B3201000	CBN-B3201000	226184	226445
0.320	1.100	0.375	2.50	PCD-B3201100	CBN-B3201100	226187	226448
0.320	1.250	0.375	2.50	PCD-B3201250	CBN-B3201250	226190	226451
0.320	1.500	0.375	2.50	PCD-B3201500	CBN-B3201500	226193	226454
0.320	1.600	0.375	2.50	PCD-B3201600	CBN-B3201600	226196	226457
0.320	1.800	0.375	2.50	PCD-B3201800	CBN-B3201800	226199	226460
0.320	2.000	0.375	4.00	PCD-B3202000	CBN-B3202000	226202	226463
0.320	2.500	0.375	4.00	PCD-B3202500	CBN-B3202500	226205	226466
0.320	3.000	0.375	4.00	PCD-B3203000	CBN-B3203000	226208	226469
0.360	0.500	0.375	2.50	PCD-B360500	CBN-B360500	226250	216511
0.360	0.600	0.375	2.50	PCD-B360600	CBN-B360600	226253	216514
0.360	0.750	0.375	2.50	PCD-B360750	CBN-B360750	226256	216517
0.360	0.900	0.375	2.50	PCD-B360900	CBN-B360900	226259	216520
0.360	1.000	0.375	2.50	PCD-B3601000	CBN-B3601000	226223	226484
0.360	1.150	0.375	2.50	PCD-B3601150	CBN-B3601150	226226	226487
0.360	1.250	0.375	2.50	PCD-B3601250	CBN-B3601250	226229	226490
0.360	1.500	0.375	2.50	PCD-B3601500	CBN-B3601500	226232	226493
0.360	1.600	0.375	2.50	PCD-B3601600	CBN-B3601600	226235	226496
0.360	1.800	0.375	2.50	PCD-B3601800	CBN-B3601800	226238	226499
0.360	2.000	0.375	4.00	PCD-B3602000	CBN-B3602000	226241	226502
0.360	2.500	0.375	4.00	PCD-B3602500	CBN-B3602500	226244	226505
0.360	3.000	0.375	4.00	PCD-B3603000	CBN-B3603000	226247	226508

THREAD MILLS

SINGLE POINT TOOLS  
BORING

INDEXABLE TOOLS

PORT - CAVITY

SPECIALTY

# SOLID CARBIDE BORING BAR FEED AND SPEED CHART

MATERIAL	HB/Rc	SPEED (SFM)		FEED IPR	CUTTING CONDITIONS					
		UNCOATED	ALTiN+		TOOL DIAMETER					
					.015-.045	.050-.100	.110-.160	.180-.230	.290-.320	.360+
					MAX DOC	MAX DOC	MAX DOC	MAX DOC	MAX DOC	MAX DOC
CAST IRON	160 HB	75-200	200-550	.0005-.010	0.006	0.008	0.010	0.014	0.020	0.031
CARBON STEEL	18 Rc	75-200	200-450	.0005-.007	0.003	0.005	0.006	0.008	0.012	0.017
ALLOY STEEL	20 Rc	75-200	200-425	.0005-.007	0.003	0.004	0.005	0.007	0.010	0.015
TOOL STEEL	25 Rc	75-175	175-300	.0005-.005	0.002	0.003	0.004	0.006	0.008	0.012
300 STAINLESS STEEL	150 HB	75-175	175-350	.0005-.005	0.003	0.003	0.004	0.006	0.008	0.013
400 STAINLESS STEEL	195 HB	75-210	130-420	.0005-.005	0.002	0.003	0.004	0.006	0.008	0.012
HIGH TEMP ALLOY (Ni & Co BASE)	20 Rc	50-130	130-300	.0005-.004	0.002	0.003	0.003	0.005	0.007	0.010
TITANIUM	25 Rc	50-120	120-275	.0005-.005	0.003	0.004	0.005	0.006	0.009	0.014
HEAT TREATED ALLOYS (38-45Rc)	40 Rc	50-100	100-200	.0005-.005	0.002	0.002	0.003	0.004	0.006	0.009
ALUMINUM	100 HB	75-250	250-750	.0005-.015	0.011	0.015	0.019	0.026	0.038	0.056
BRASS, ZINC	80 HB	75-300	250-650	.001-.010	0.009	0.012	0.015	0.021	0.030	0.045

SFM = Surface Feet Per Minute    DOC = Depth of Cut    IPR = Inches Per Revolution

Starting parameters only. Length-to-diameter ratios, setup, and machine rigidity may affect performance.

$$\text{SFM} = .262 \times \text{DIAMETER} \times \text{RPM}$$

$$\text{RPM} = 3.82 \times \text{SFM} \div \text{DIAMETER}$$

$$\text{IPM} = \text{FPT} \times \text{Number of Teeth} \times \text{RPM}$$

$$\text{Meters/Min} = \text{SFM} \times .3048$$

$$\text{Millimeters/Rev} = \text{IPR} \times 25.40$$

# SOLID CARBIDE BORING TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
RAPID FLANK WEAR	CUTTING CONDITIONS	Check for excessive speed and feed - See chart.
	TOOL	Select a coated tool.
	PART	Make sure prior operation did not work harden the metal.
BUILT-UP EDGE	TOOL	Select a coated tool.
	CUTTING FORCE	Check for excessive feed rate (IPR) - See chart.
	HEAT	Use the SCT coolant holder. If coolant is not available, use shop air and a coated tool.
CORNER BREAKAGE	CUTTING CONDITIONS	Check for excessive feed and speed and depth of cut - see chart.
	TOOL	Select a tool with a radius. A radius is stronger than a sharp corner.
	PART	Check the drilled hole.
SURFACE TOO ROUGH	CUTTING CONDITIONS	Check for excessive feed rate (IPR) - See chart.
	BUILT-UP EDGE	See above (Built-Up Edge).
CHATTER	SET UP	Set tool above center. Reduce the overhang ratio. Clamping length should be at least 3x the boring bar diameter. Change the speed of the machine. Speed change may break up harmonics and reduce chatter.
	BORING BAR	Select the largest diameter boring bar that will bore the required diameter.
TAPER SMALLER IN BACK	CHIP PACKING	If the boring bar is too large to allow chips to evacuate, then the chips may pack on the tool and cause the bar to deflect away from the bore.
	PROGRAM	If the taper is consistent, then the program can be altered to bore a taper in opposite direction resulting in a straight hole.
TAPER BIGGER IN BACK	CUTTING FORCES	Reduce forces. Deflecting bar below center causes hole to become larger.
	BUILT-UP EDGE	Built-up edge will cause the hole to become larger until the built edge breaks off, then the hole becomes smaller.
	PROGRAM	If taper is consistent, then the program can be altered to bore a taper in the opposite direction resulting in a straight hole.

# GROOVING TOOL FEED AND SPEED CHART

MATERIAL	HB/Rc	SPEED (SFM)		CUTTING CONDITIONS				
				TOOL DIAMETER				
		UNCOATED	ALTiN+	.060 -0.080	.090 -.120	.187	.250-.312	.375+
				MAX FPR	MAX FPR	MAX FPR	MAX FPR	MAX FPR
CAST IRON	160 HB	75-200	200-550	0.0010	0.0012	0.0017	0.0031	0.0044
CARBON STEEL	18 Rc	75-200	200-450	0.0007	0.0008	0.0011	0.0022	0.0030
ALLOY STEEL	20 Rc	75-200	200-425	0.0006	0.0007	0.0010	0.0019	0.0026
TOOL STEEL	25 Rc	75-175	175-300	0.0005	0.0006	0.0008	0.0015	0.0022
300 STAINLESS STEEL	150 HB	75-175	75-350	0.0006	0.0007	0.0010	0.0019	0.0026
400 STAINLESS STEEL	195 HB	75-210	130-420	0.0005	0.0006	0.0008	0.0016	0.0023
HIGH TEMP ALLOY (NICKEL & COBALT BASE)	20 Rc	50-130	130-300	0.0004	0.0005	0.0007	0.0013	0.0017
TITANIUM	25 Rc	50-120	120-275	0.0005	0.0006	0.0008	0.0016	0.0022
HEAT TREATED ALLOYS (38-45Rc)	40 Rc	50-100	100-200	0.0004	0.0004	0.0006	0.0011	0.0016
ALUMINUM	100 HB	75-250	250-750	0.0022	0.0026	0.0037	0.0065	0.0085
BRASS, ZINC	80 HB	250-300	250-650	0.0018	0.0021	0.0030	0.0053	0.0079

SFM = Surface Feet Per Minute

FPR = Feed Per Revolution

Starting parameters only. Length-to-diameter ratios, setup, and machine rigidity may affect performance.

## GROOVING TOOL TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
RAPID FLANK WEAR	CUTTING CONDITIONS	Check for excessive speed - see chart.
	TOOL	Select a coated tool.
	PART	Make sure prior operation did not work harden the material.
BUILT-UP EDGE	TOOL	Select a coated tool.
	CUTTING FORCE	Check for excessive speed rate (IPR) - see chart.
	HEAT	Use the SCT coolant holder. If coolant is not available, use shop air and a coated tool.
CHATTER	CUTTING CONDITIONS	Reduce RPM and increase feed rate within the feed and speed chart parameters.
	CLAMPING	Clamping length should be a minimum of 3x the shank diameter in the tool holder. Check tool holding rigidity.
	TOOL	Hone cutting edge. A light hone (0.0001-0.0003 inch) will help keep force constant.
TOOL BREAKAGE	CUTTING CONDITIONS	Check for excessive feed rate (IPR) - see chart.
	CHIP PACKING	Stagger - Peck grooving.

# SINGLE POINT THREADING TECHNICAL CHART

MATERIAL	HB/Rc	SPEED (SFM)		FIRST PASS DEPTH					
		UNCOATED	ALTiN+	TOOL DIAMETER					
				.040-.050	.060-.092	.120-.152	.180-.232	.290-.362	.373+
CAST IRON	160 HB	75-200	200-550	0.003	0.004	0.005	0.007	0.008	0.009
CARBON STEEL	18 Rc	75-200	200-450	0.003	0.005	0.006	0.007	0.008	0.009
ALLOY STEEL	20 Rc	75-200	200-425	0.003	0.004	0.005	0.006	0.007	0.008
TOOL STEEL	25 Rc	75-175	175-300	0.002	0.003	0.004	0.005	0.006	0.007
300 STAINLESS STEEL	150 HB	75-175	175-350	0.003	0.003	0.004	0.005	0.006	0.007
400 STAINLESS STEEL	195 HB	75-210	130-420	0.003	0.004	0.005	0.006	0.006	0.007
HIGH TEMP ALLOY (NICKEL & COBALT BASE)	20 Rc	50-130	130-300	0.002	0.003	0.003	0.004	0.005	0.005
TITANIUM	25 Rc	50-100	120-275	0.003	0.003	0.004	0.005	0.006	0.007
HEAT TREATED ALLOYS (38-45Rc)	40 Rc	50-100	100-200	0.002	0.002	0.003	0.004	0.004	0.005
ALUMINUM	100 HB	75-250	200-750	0.004	0.005	0.007	0.008	0.010	0.011
BRASS, ZINC	80 HB	75-300	250-650	0.003	0.005	0.006	0.007	0.008	0.009

Parameters are a starting point based on machinability rating at hardness listed.  
Check machinability rating of the material to be machined and adjust First Pass Depth.

## Helpful Formulas and Information

$$\text{PITCH} = \frac{1}{\text{TPI}}$$

TPI = Threads Per Inch

ACME Thread Depth = Pitch × 0.5

Stub ACME Thread Depth = Pitch × 0.3

NPT Pipe Thread Depth = Pitch × 0.76

Internal 60° Thread Depth = Pitch × 0.54

Feed Rate = Pitch × Number of Thread Starts

Minimum Depth per Pass should not be less than 0.0003

Threads not ending in a relief need at least one thread pitch length of pullout

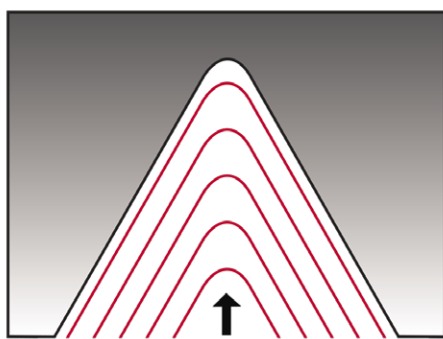
Make sure feed rate calculation does not exceed the maximum feed rate of the machine

# SINGLE POINT THREADING TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
RAPID FLANK WEAR	CUTTING CONDITIONS	Check for excessive speed - see chart.
	PART	Make sure prior operation did not work harden the material.
	TOOL	Select a coated tool.
BUILT-UP EDGE	TOOL	Select a coated tool.
	CUTTING FORCE	Increase the number of passes.
	HEAT	Use the SCT coolant holder. If coolant is not available, use shop air and a coated tool.
CORNER BREAKAGE	CUTTING CONDITIONS	Reduce the depth-of-cut on the first pass.
	PROGRAM	If there is no thread relief, withdraw the tool on an angle.
	PART	End in thread relief.
CHIPS WRAPPING AROUND TOOL	TOOL	Use a tool that is at least 30% smaller than the hole diameter.

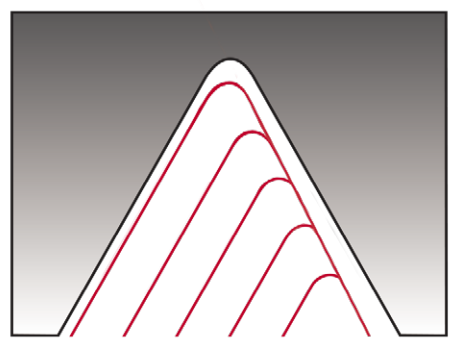
SINGLE POINT TOOLS  
TECH INFO

## RADIAL INFEEED



NOT RECOMMENDED

## MODIFIED FLANK



PREFERRED METHOD

Radial Infeed is not recommended. Modified flank at 1° is recommended.

For unfavorable length-to-diameter ratios or difficult-to-machine materials, the number of passes will need to be increased up to 40% more.

Depth of cut per pass should not be less than 0.0003 inch.

# SINGLE POINT CBN & PCD TECHNICAL & APPLICATION

## PCD TIPPED TOOL INFORMATION

SCT PCD tools and inserts are excellent for continuous cutting of a wide range of non-ferrous and non-metal materials. The products are precision ground for machining to sub-micron finishes with maximum tool life. PCD allows for higher cutting speeds with longer tool life.

SINGLE POINT TOOLS  
TECH INFO

MATERIAL	BHN/Rc	SPEED RANGE (SFM)	FEED IPR	SINGLE POINT PCD TIPPED BARS			
				TOOL DIAMETER			
				.120-160 MAX DOC	.180-.230 MAX DOC	.290-.320 MAX DOC	.360+ MAX DOC
LOW SILICON ALUMINUM	225-350 BHN	1000-5000	.001-.007	0.015	0.021	0.03	0.045
HIGH SILICON ALUMINUM	270-425 BHN	600-3000	.001-.007	0.015	0.021	0.03	0.045
METAL MATRIX COMPOSITIES	N/A	500-2000	.001-.007	0.008	0.012	0.02	0.03
COPPER ALLOYS, BRASS, BRONZE	80-120 BHN	750-3500	.001-.007	0.015	0.021	0.03	0.045
PRESINTERED TUNGSTEN CARBIDE	140-300 BHN	100-350	.001-.005	0.003	0.005	0.007	0.012
ACRYLICS	N/A	700-1500	.001-.007	0.015	0.021	0.03	0.045
FIBERGLASS	N/A	600-1000	.001-.007	0.012	0.02	0.03	0.045
GRAPHITES	N/A	600-1000	.001-.007	0.015	0.021	0.03	0.045
NYLON, PLASTIC	N/A	700-1500	.001-.007	0.015	0.021	0.03	0.045
HARD RUBBER	N/A	500-2500	.001-.007	0.015	0.021	0.03	0.045

APPLICATION GUIDELINES
Make sure the machine and setup is rigid and solid. Chatter will cause chipping.
Tool height when boring should be slightly above center. Tool deflection will put the tool on center.
Do not stop the machine with the tool in cut. This will result in tool breakage.
Use of coolant will reduce heat and improve surface finish.
Do not contact the tool to a hard surface prior to the machining process- this will cause chipping.
Higher speeds minimize tool buildup.
Depth of cut should not exceed 70% of PCD tip length.

As the DOC decreases the feed rate can increase DOC = Depth of Cut SFM = Surface Feet per Minute

## CBN TIPPED TOOL INFORMATION

SCT CBN tools and inserts are excellent for continuous cutting of a wide range of hardened steels, powdered metals, cast irons and super alloys. The products are precision ground with hones for machining to sub-micron finishes with maximum tool life. CBN tipped tools and inserts can take the place of grinding.

MATERIAL	BHN/Rc	SPEED RANGE (SFM)	FEED IPR	SINGLE POINT CBN TIPPED BARS			
				TOOL DIAMETER			
				.120-160 MAX DOC	.180-.230 MAX DOC	.290-.320 MAX DOC	.360+ MAX DOC
HEAT TREATED ALLOY	45-60Rc	200-600	.001-.005	0.003	0.004	0.006	0.009
TOOL STEEL	45-60Rc	200-600	.001-.005	0.003	0.004	0.006	0.009
NODULAR IRON	N/A	600-1500	.001-.005	0.006	0.01	0.02	0.03
PEARLITIC IRON	220-240BHN	600-2500	.001-.007	0.006	0.01	0.02	0.03
WHITE/CHILLED IRON	54-60Rc	200-500	.001-.005	0.005	0.008	0.012	0.015
SUPER ALLOY Ni BASE	240-475 BHN	200-800	.001-.005	0.003	0.004	0.006	0.025
COBOLT BASED ALLOY, STELLITE	45-55Rc	200-500	.001-.005	0.003	0.004	0.006	0.009
INCONELS	45-55Rc	200-500	.001-.005	0.003	0.004	0.006	0.009

APPLICATION GUIDELINES
Make sure the machine and setup is rigid and solid. Chatter will cause chipping
Tool height when boring should be slightly above center. Tool deflection will put the tool on center.
Do not stop the machine with the tool in cut. This will result in tool breakage.
Coolant use is not advised as it could cause thermal cracking.
Do not contact the tool to a hard surface prior to the machining process. This will cause chipping.
Depth of cut should not exceed 30% of CBN tip length.

As the DOC decreases the feed rate can increase DOC = Depth of Cut SFM = Surface Feet per Minute