



superabrasive
CUTTING TOOLS and WEAR PARTS



CUTTING TOOLS Polycrystalline Diamond (PCD)

PCD Cutting Tools

PCD tools are as abrasion resistant as natural diamond tools and are much tougher. The diamond layer consists of diamond particles that are randomly oriented and do not have any cleavage planes or soft wear directions.

PCD tools are recommended to machine non-ferrous and very abrasive materials. They have the capacity to out produce carbide tools 10 to 100 times.

We manufacture PCD tooling for all turning, boring, drilling, milling and reaming applications. Cutting tools and inserts of any make can be tipped with PCD sections.

There are two options:

- We can supply the tool complete.
- We can tip our customers' new tools or inserts.

Range of Product Line:

PCD sections are available in three grades:

1. Fine: For finishes less than 15 Micro inches (4 micrometers).
2. Medium: For standard finishes.
3. Coarse: For very abrasive materials.

Recommended Use:

PCD tools offer superior wear resistance. They are recommended on the following materials:

Metallic: Aluminum, Babbitt, Brass, Bronze & Copper, High Cobalt Sintered Carbide, Magnesium, Pre-sintered Carbide, Zinc Alloys.

Non-Metallic: Carbon, Carbon Fiber Composites, Chip Board, Pre-sintered Ceramic, Graphite, Hard Rubber, Wood Products.

Plastics: Acrylic, Fiberglass Epoxy, Nylon Composites Phenolics, Poly Carbonate, P.V.C. Composites Teflon® Composites

STARTING PARAMETERS FOR PCD TOOLS

Workpiece	Nose Radius (inch) (mm)	Clearance Angle (degrees)	Back Rake Angle (degrees)	Speed (SFPM) (M/min.)	Depth of Cut (inch) (mm)	Feed Rate (inch/rev) (mm/rev)
Aluminum alloys	0.006" – 0.040" 0.15 – 1.0mm	5 – 10	+ 0 – 10	3000 - 5000 914 - 1524	0.005" – 0.020" 0.13 – 0.51mm	0.002" – 0.008" 0.051 – 0.20mm
Copper alloys including bronze	0.010" – 0.040" 0.25 – 1.0mm	5 – 30	+ 10 – 20	1500 - 3500 457 - 1067	0.005" – 0.020" 0.13 – 0.51mm	0.001" – 0.006" 0.025 – 0.15mm
Sintered cemented tungsten carbide	0.040" – 0.125" 1.0 – 3.2mm	5 – 12	0	500 - 1500 152 - 457	0.0005" – 0.005" 0.013 – 0.13mm	0.001" – 0.003" 0.025 – 0.076mm
Glass fiber/plastic composites	0.030" – 0.090" 0.76 – 2.3mm	5 – 20	+ 0 – 6	400 - 3600 122 - 1097	0.001" – 0.003" 0.025 – 0.076mm	0.001" – 0.010" 0.025 – 0.25mm
Carbon/plastic composites	0.020" – 0.040" 0.51 – 1.0mm	5 – 20	+ 0 – 6	500 - 2000 152 - 610	0.010" – 0.100" 0.25 – 2.54mm	0.005" – 0.015" 0.13 – 0.38mm
High-alumina ceramics	0.010" – 0.40" 0.25 – 1.0mm	5 – 20	+ 0 – 6	1500 - 3000 457 - 914	0.0005" – 0.005" 0.013 – 0.13mm	0.001" – 0.004" 0.025 – 0.10mm

Samples of our Custom-Designed Tools

- We offer brazed tipped cutting tools, boring tools and cut off tools.
- Tools are custom designed by our design engineers, working from a customer supplied drawing.
- Custom tools are quoted on request.



Piston Turning Tool



PCD Boring Tool



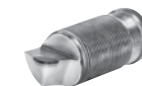
PCD Commutator Tool



PCD Form Tools



PCD Boring Tool



PCD Microbore Adjustable Cartridge



PCD Router



PCD Router



Milling Cartridge



Innovation delivers a unique PCD drill

We have successfully developed the solution to the manufacturing and engineering industries' need to apply PCD (polycrystalline diamond) technology to today's machining challenges.

Existing products exhibit short life, failing fabrication joints, and a lack of a rugged cutting edge. Our patented design of a PCD section, fully integrated into the carbide drill, has overcome these problems.

The benefits of machining non-ferrous materials with PCD are well established. Applying PCD technology to the drilling process has long been an objective for many companies.

While electroplated, CVD coated or fabricated drills have failed to meet the expectations and technical challenges of modern machining, the Everlast™ drill meets and exceeds those expectations.

Specifications:

- Available in 1/8" (3mm) and 15/32" (12mm) diameters.
- Standard lengths up to 8" (200mm), others by application.
- Helical flute.
- Straight flute.
- Made to customers' specifications.



EVERLAST™ PCD Drill

U.S. Pat. No. 5,580,196 European Patent: EP0560951

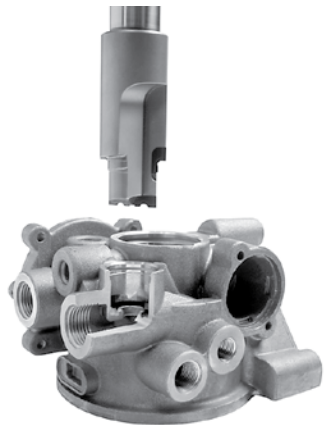
Advantages:

- Vastly improved drill life (the drill is not a fabrication).
- Improved drill hole surface finish.
- Greater tolerance control.
- Greatly reduced downtime due to fewer drill changeovers and quality checks.
- Rugged construction enables the Everlast™ drill to handle difficult conditions that damage other drills beyond use.
- Faster drill speeds and feeds.
- Designed for many current composite and aerospace materials such as Kevlar® and CFC.
- Designed for very high silica aluminum.
- Sharper cutting

Designed for use on:

- Very high Silica Aluminum
- Carbon Fiber Reinforced Plastics (C.F.R.P.)
- Reinforced Ceramic Composites (RCC)
- Carbon Fiber/Aluminum stack material (C.F.R.P./AL)
- Metal Matrix Composites (M.M.C.)
- Green Carbide

COMBINATION TOOLS Polycrystalline Diamond (PCD)



Machining high silica aluminum diecasting



Machining high pressure aluminum cylinders



Brass cylinder reamer



Twin diameter and chamfer tool - 18% silica aluminum diecasting



Spark plug port reamer



Diameter and face forming tool -aluminum diecasting



Multiple diameter and face forming tool - aluminum diecasting



Drill form and chamfering tool -aluminum component

PCD Combination Tooling

Designed to meet our customers' specific applications. For machining non-ferrous materials, including high silica aluminum and other exotic materials.

- Combines several tool operations in one pass.
- Diamond cutting edge = high precision.
- Long life = reduced downtime.
- Reduced number of machining stations.
- Reduced tooling stock holding.
- Tamperproof tooling.
- High component consistency.

CASE STUDIES

Tool Function: Drill and Form
Product being machined: High pressure aluminum housing
Surface speed: 2,100 ft./min. (650m/min.)
Stock Removal: .236"-.315" (6-8mm) on top recess face
Feed Rate: 120 IPM (3000mm/min.)
Surface Finish achieved: 0.7Ra
Fitting Standard: ISO40
Number of forming Operations: 7

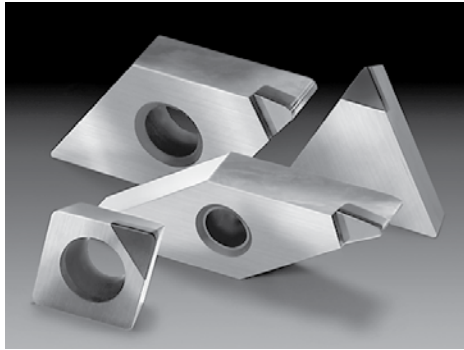
- Benefits:**
- Increase production capacity by 60-70% due to the ability to perform 2 functions in one pass.
 - Reduced machine downtime.
 - Reduced machine changeover time.

Tool Function: Size and Form
Product being machined: High pressure aluminum housing
Surface speed: 1,500 ft./min. (450m/min.)
Stock Removal: .02" (0.5mm)
Feed Rate: 6 IPM (150mm/min.)
Surface Finish Achieved: 0.4Ra
Fitting standard: MK3
Number of Forming Operations: 15

- Benefits:**
- Ability to achieve a very high level of surface finish which eliminates the burnishing operation.
 - Reduced machine downtime.
 - Reduced machine changeover time.

Tool Function: Reaming
Product being machined: Spark plug ports
Surface Speed: 160 ft./min. (50m/min.)
Stock Removal: .024" (0.6mm)
Feed Rate: .008"/Revolution (0.2mm/Revolution)
Surface Finish Achieved: 0.2Ra
Fitting standard: Steiber Chuck
Number of Forming Operations: 8

- Benefits:**
- Number of pieces being machined now with this tool: 250,000.
 - Number of pieces being machined with previously used carbide tools: 15,000.
 - Reduced machine downtime.
 - Reduced machine changeover time.



High Performance PCD Tipped Inserts

For rough and finish machining of non-ferrous and non-metallic parts

- Longer PCD edge lengths allow larger depths of cut, reducing the number of passes - resulting in shorter cycle time and increased productivity.
- Large PCD sections provide more holding power - resulting in more re-laps and fewer tip pull offs.
- Polished PCD tops for keener edges and better chip flow.
- Can be used to machine aluminum in both neutral and negative holders.
- Edges ground on CNC equipment for consistency and quality finishes.
- All inserts are manufactured to the latest ISO standard for assured quality.



PCD Wear Parts

The life of PCD components is typically 100 times that of the carbide or HSS predecessor. The low friction coefficient of PCD, together with its ultra hardness, ensures that high levels of component accuracy are maintained over the component's life span.

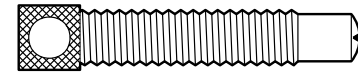
PCD wear surfaces are used for:

- Vee Supports.
- Backing Plates.
- Gauging Fingers.
- Gauging Points.
- Back Stops.
- Face Grinding.
- PCD Rings.

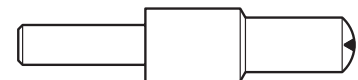
Advantages:

- Reduced whole life costs.
- Reduced downtime.
- Reduced changeover rates.
- Increased component accuracy.

Shaped Specialties



Gauge Point



Burnishing Tool



CUTTING TOOLS Polycrystalline CBN (PCBN)

PCBN CUTTING TOOLS

Abrasive Technology features PCBN tools for all turning, boring and milling applications. We offer two groups:

- BRAZED TIPPED PCBN tools and inserts.
- SOLID inserts with PCBN in a ceramic binder throughout the insert, or a full face 1/32" (.787mm) thick layer on a carbide substrate.

Physical Properties

The hardness of PCBN falls between diamond and carbide. It is considerably more abrasion resistant than both carbide and ceramic cutting tools. PCBN combines a high degree of toughness and hot hardness. These properties make it particularly suited to machine hardened steels, cast irons and super alloys.

Grades

CBN is available in several grades, each having specific properties and usage. There are two basic categories:

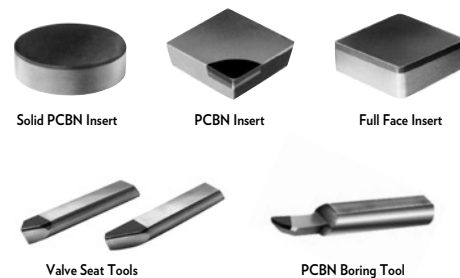
- Low content CBN grain primarily designed for finishing cuts on hardened steel.
- High content CBN grain designed for machining cast iron, hard facing material and Nickel alloys.

Insert Designations

Our polycrystalline inserts use the ANSI/ISO standard to identify indexable inserts.

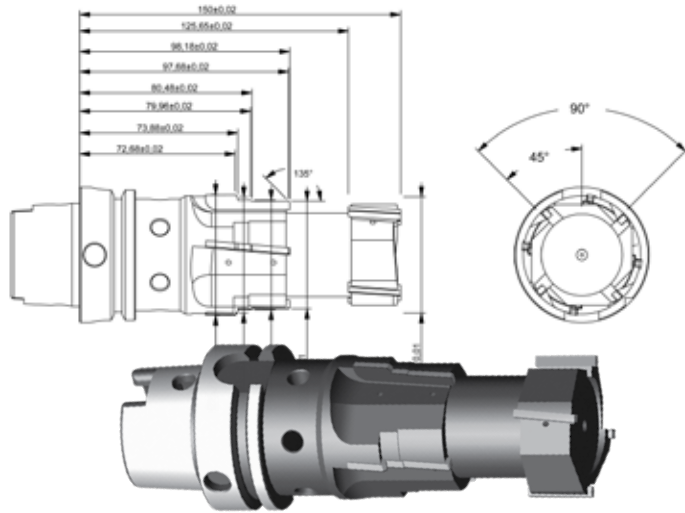
We also offer brazed tipped "shank" cutting tools, boring tools and cut-off tools. These are usually specified by print.

Standard PCBN Tool Examples



STEEL Grade Comparison Chart - Polycrystalline Cubic Boron Nitride (PCBN)				
Grade	Description	Features	Materials	Application
CLA	Low PCBN Content	Long Tool Life	Hardened Steels, Gray Cast Irons Die Steels, Bearing Steels	Light Continuous Cuts
CLB	Low PCBN Content	Long Tool Life	Alloy Steels, Die Steels Hardened Steels	Continuous Cuts to Light Interrupted Cuts
CL	Low PCBN Content	Good Balance Between Tool Life and Shock Resistance	Hardened Steels, Cast Irons, Powdered Metals, Tool Steels	Moderate Interrupted Cuts
CHA	High PCBN Content	Excellent Wear and Fracture Resistance in Severe Interrupted Cuts Powdered Iron Alloys	Ni-Hard, High Chrome Alloys, Cast Irons, Sintered Irons,	Severe Interrupted Cuts, Heavy Stock Removal
CHB	High PCBN Content	Excellent Wear and Fracture Resistance in Severe Interrupted Cuts Hard Facing Materials	Ni-Hard, Chilled Irons, Gray Cast Irons,	Severe Interrupted Cuts, Heavy Stock Removal
CHC	High PCBN Content	Excellent Toughness and Abrasion Resistance	Gray Cast Irons, Super Alloys, Nickel Alloys, Sintered Ferrous Metals	Severe Interrupted Cuts, Heavy Stock Removal
CH	High PCBN Content	Excellent Toughness and Abrasion Resistance	Gray Cast Irons, Super Alloys, Nickel Alloys Sintered Ferrous Metals	Moderate Interrupted Cuts

Machining Parameters for CBN Turning/Boring Tools									
Material Hardness	HRC	Stock Removal		Feed		Finishing Cuts -1.0mm		Feed	
		ft./min.	m/min.	in/rev	mm/rev	ft./min.	m/min.	in/rev	mm/rev
Cold Work Tool Steels	60	197-394	60-120	.002-.01	0.05-0.25	3,937-5,906	100-150	.002-.008	0.05-0.2
High Speed Steels	62	197-394	60-120	.002-.01	0.05-0.25	3,150-4,724	80-120	.002-.008	0.05-0.2
Ni Hard White Irons	55-68	131-262	40-80	.002-.008	0.05-0.20	-	-	-	-
Gray Cast Irons	220HR	1,640-2,625	500-800	.004-.012	0.1-0.3	-	-	-	-
Bearing Steels	58-60	-	-	-	-	3,937-5,906	100-150	.002-.008	0.05-0.2
Hard Facing Cobalt Alloys	-	656-820	200-250	.008	0.2	-	-	-	-
Hard Facing Nickel Alloys	-	394-492	120-150	.008	0.2	-	-	-	-
Surface Hardened Parts	55-58	-	-	-	-	3,150-4,724	80-120	.002-.008	0.05-0.2



Product Design Engineering Services

Rapid manufacture of bespoke special cutting tools is at the core of our business and these can be designed and quoted on request. Please refer to the drawings in this catalog as an aid in communicating your request for quote. Also, the following information is required to best determine your needs:

1. Part drawing indicating the position of the tool and the direction of tool travel.
2. Type of equipment and maximum feeds and speeds available.
3. Maximum depth of cut. The size of the polycrystalline diamond section will influence the price of the product. It is therefore important that the maximum depth of cut be specified when a tool is ordered. This determines the CEL (cutting edge length) desired for maximum effectiveness.

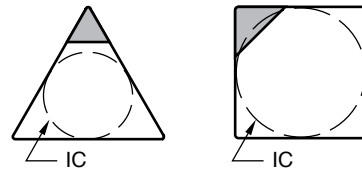
4. Material to be machined and Rockwell hardness (if ferrous metals are involved).
5. The objective of this design:
 - Increase in tool life.
 - Better surface finish.
 - Minimize chipping.
6. Drawing or description of tools presently used or insert designation.
7. Identify the carbide fabricator for special inserts.

PCD/PCBN Tipped Cutting Tools - Tool Service

We offer two types of service:

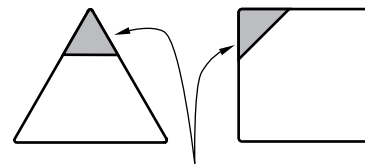
Class 1 - Relap

The tools are contour ground. However the IC/Tool geometry is reduced. If it is essential that the tool geometry remains unchanged, a class 2-3 service can be done.



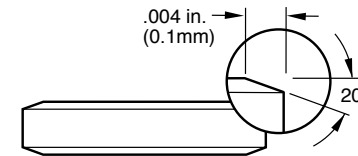
Class 2 - Retip

The PCD/PCBN material is replaced and reground to the original tool geometry.



Edge Preparation

'T'/K' Lands or honed edges can be applied to PCBN tools as required.





WORLD HEADQUARTERS

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