Diamond Tooling

tipco

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Introduction

Diamond and PCBN tooling is undoubtedly a key factor in achieving the necessary economic goals of industries of today. As the drive toward higher productivity and cutting speeds increases, the case for using diamond tooling of all types continue to rise.

As the market for diamonds and cubic nitride tooling continues to develop so do the technologies for the machining of the raw material. Such have been the advances in the past few years that natural diamonds are no longer alone in the growing range of ultra hard materials now available to toolmakers and CNC machining concepts.

The introduction of synthetic diamond grit early on in the development of cutting tool material has resulted in the introduction of Polycrystalline diamond products, a synthesised mass of randomly orientated diamond crystals bonded to a tungsten carbide base material making it ideal for machining abrasive non ferrous materials, such as hardened steels and grey cast iron. The introduction of "PCBN" cutting tool materials has further extended scope resulting in a range of technical and economical machining advantages, particularly when compared to grinding.

The arrival of the next generation of cutting tool materials made up of large synthetic single crystal materials and a product developed out of the Chemical Vapour Deposition "CVD" process is now available for specialized applications.

Continuing development in cutting tool materials are playing a significant role in advances in machining technologies. This results in improved performance and increased tool life at the same time assists in achieving tighter tolerances and improved surface finish. A major development using these materials is the increase in cutting speeds. This allows more flexibility when machining difficult and exotic materials when conventional tool materials are increasingly unable to meet the requirements of performance, precision, quality and reliability when machining such materials in automated production.

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Product application

Natural Diamond:

High quality Natural diamond, for use in a wide range of cutting tool, draw die and wear part applications. The diamond used in the manufacturing process fall into one of two quality bands, General (G) and Precision (P). A General quality diamond will have points which are slightly more rounded than those on precision quality stones and may also contain flaws or defects although these will be away from the dressing point. "G" quality are suitable for most workshop use, "P" quality need only be specified when a very sharp point is required for fine dressing.

PCD:

Is produced by sintering together micron sized diamond particles at ultra high pressure and temperature, in the presence of a metallic catalyst. The presence of the metal in the PC structure together with the tungsten carbide substrate, gives a level of toughness and electrical conductivity not found in single crystal diamond products. For use as a braze-able cutting tip in all types of standard inserts, and single or multi-edge rotary tools and as a full face clamp type insert.

Used for the majority of cutting operations in non ferrous metals or composite materials. Neutral or positive rake geometry is used. Designed for machining highly abrasive materials due to its extreme wear resistance will contribute to better cutting edge quality and better chip flow characteristics. The main advantages are tool life and volume of material removal, compared to standard carbide products.

P.C.B.N.

Produces offer excellent hardness characteristics, toughness and thermal stability, that are highly suited to machining a wide range of cast irons and hardened steels. It has the capability of extending and improving tool life, faster machining speeds and better component tolerance. Available in shapes and sizes for most types of cutting tool.

C.V.D.

Has outstanding thermal conductivity and abrasion resistance, engineered for mechanical applications for machining highly abrasive non ferrous materials, plastics, wood based materials and wear parts. Designed to give extremely high thermal stability.

Polycrystalline Diamond Tooling

Boring, Turning & Routing Tools

Diamond and Cubic Boron Nitride turning tools are extensively used for machining non- ferrous materials and ferrous materials in the high hardness ranges, often achieving very high performance, finish, major increases in tool life and reducing the need for tool changes.

Natural Diamonds tools are still used in selective manufacturing techniques. Polycrystalline diamond is the most popular due to the lower cost, ease of fabrication and often superior life. These tools are most efficient in the machining of high silicon content aluminium, copper, brass, bronze alloys, sintered and green carbides, resin filled fabrics, ceramics and many other like materials,due to its high abrasive resistance.

Cubic Boron Nitride tools are used in the main for machining ferrous material with hardness values about 45R and 75R Rockwell C. Cutting tool angles and radii are usually the same as those to WC tips, though variations may produce better results. The tools can be supplied as inserts for standard tool holders or brazed directly to a steel shank.

Costs can vary widely depending on the dimensions of the polycrystalline diamond or CBN dependant on the edge length "L" and the included angle. The sizes available are detailed in the chart below:

Information Required for Selection

1. Edge Length
2. Included Angle
3. Point Radius
4. Top Rake
5. Front and Side Clearance
6. Boring Tools – State the bore diameter, straight, left or right hand cutting angle
7. Shank Dimensions
8. I.S.O Tip
9. Diamond or CBN Type

When in doubt submit a sketch

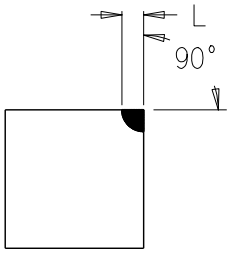
Chart of polycrystalline sizes available

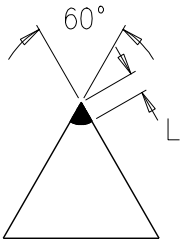
< 45° = Up to and including 45° Included angle>

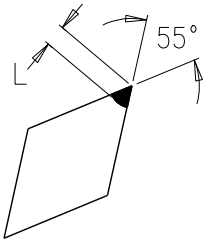
Edge Length mm	< 45°	< 60°	< 90°	< 180°
3.0	√			
3.5	√	√	√	
4.0	√			
4.3	√	√		
4.5	√	√	√	
6.0	√	√	√	
6.5			√	
8.1				√
8.4				√
9.5				√
12.7				√
13.2				√
13.7				√

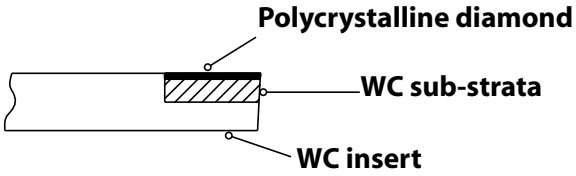
Routers, Countersink, Reamer blades and Natural Diamond etc, will require a drawing to be submitted for quotation purposes.

Tungsten carbide inserts



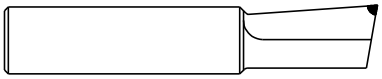




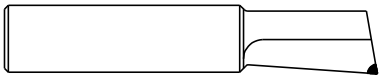


Catalogue prefix No. 070	Edge Length mm	<45°	<60°	<90°
WC INSERTS	3.5	001	002	003
	4.5	004	005	006
	6.0	007	008	009

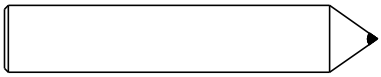
Catalogue prefix No. 071	Edge Length mm	<45°	<60°	<90°
WC INSERTS	3.5	001	002	003
	4.5	004	005	006
	6.0	007	008	009



Turning Tool Right Hand

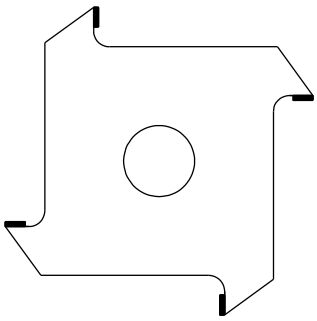


Turning Tool Left Hand

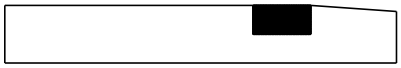


Turning Tool Straight

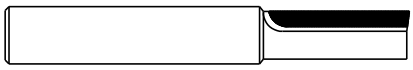
Other types of tool available



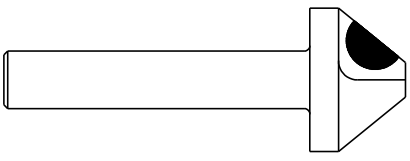
Four Blade Milling Cutter



Reamer Blade



Turning Tool Straight



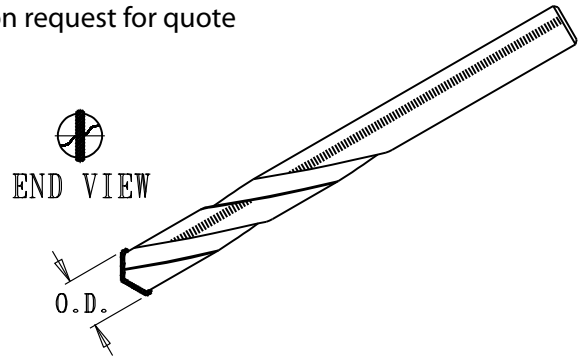
Countersink Tool 90° incl.

Polycrystalline Twist Drills & Endmills

Part Number	Outside Diameter
PC-D-3	3mm
PC-D-4	4mm
PC-D-5	5mm
PC-D-6	6mm
PC-D-7	7mm
PC-D-8	8mm
PC-D-9	9mm
PC-D-10	10mm
PC-D-11	11mm
PC-D-12	12mm
PC-D-13	13mm
PC-D-14	14mm

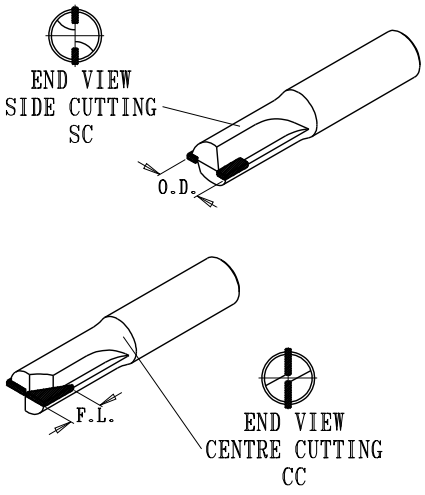
PC-D Polycrystalline Tipped Twist Drill

Custom sizes available on request for quote



DC-END Polycrystalline Tipped Endmills

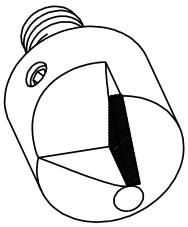
Catalog Number	Outside Diameter	Number of Flutes NF	Flute Length FL	pc – plunge cutting sc – side cutting
PC-END-6-1-10	-6mm	1	10	pc sc
PC-END-10-2 x FL	10mm	2	10 15 20 15	pc pc pc sc
PC-END-12-2 x FL	12mm	2	10 15 20 15	pc pc pc sc
PC-END-16-2 x FL	16mm	2	10 15 20 15	pc pc sc sc
PC-END-20-2 x FL	20mm	2	10 15 20 15	pc pc sc sc

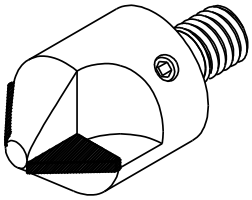


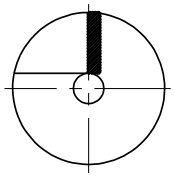
Available on request for quote. Custom sizes and No. of flutes

PCD Countersinks

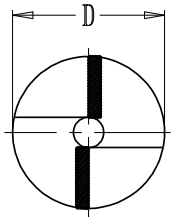
Polycrystalline Tipped Countersink



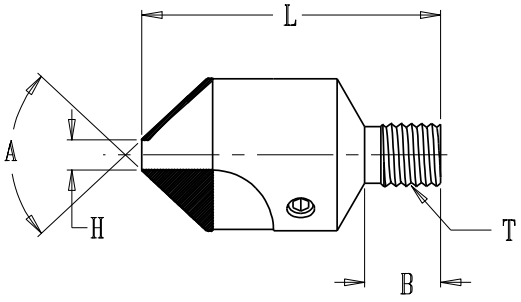




Single Flute



Double Flute



Available on request for quote:
Larger diameters, number of flutes, pilots and special pilots

Catalog Number	Outside Diameter D	Number of flutes	Angle degrees A	Overall Length	Thread Size T	Thread Length	Pilot Hole Diameter B
PC-C-10	10mm	1	90	28	M6	8	2
	10mm	2	100	28	M6	8	2.5
			130	28	M6	8	2.5
PC-C-14	14mm	1	90	28	M8	8	2.5
	14mm	2	100	28	M8	8	4.0
	14mm	2	130	28	M8	8	4.0
PC-C-17	17mm	2	100	28	M8	8	5
	17mm	3	180	28	M8	8	5
PC-C-21	21mm	2	any	28	M8	8	to suit
		3	any	28	M8	8	to suit
		4	any	28	M8	8	to suit

PCD Router Cutters

Introduction

Polycrystalline Diamond (PCD) Routers have developed over the past years, characterized by their free ability and long life, for many applications in the wood working and plastic industries. PCD has become a major player in the machining of materials such as MDF, laminating chipboards and many of the glass filled epoxy resins. The TIPCO, range of PCD Cutters have been specifically designed to meet both standard and non standard designs.

Advantages of PCD Compared to Standard Tooling

Unlike conventional tools, PCD offers considerable benefits and cost advantages over and above other tooling when used in the correct manufacturing applications. These may be briefly stated as follows:-

- The exceptional long life of the tool between relaps, gives longer production runs and significant reductions in production costs.
- Consistency of finished product can be guaranteed due to the closer tolerance control that can be held throughout the machining cycle, is a major benefit of the extended tool life.
- Higher Surface finish can be obtained with PCD than conventional tooling

Tool Construction

PCD, has significant advantages over tungsten carbide, however it may initially appear to be relatively more expensive material to use as a tool blank. The resulting cost savings with increased production, lower down time, consistency of finished product and surface finish far out way the initial investment

Several different approaches can be adopted to reduce tool costs in cases where tooling costs is pre-eminent, as in the case of short runs.

Additional manufacturing considerations that may also effect the type and cost of the router selection, are as follows:-

- Does the router need to plunge through the material to be machined prior to the routing cycle, as it would if commencing the cut from the centre of the board or used for profiling only.
- Will the router require straight edge cut or is a formed profile needed for example – Edge Molding Cutters.
- Will the material to be routed laminated, in this case the router may require 1 or 2 shear angles depending on whether the material is laminated on one side or on both sides. The purpose of the shear angle is to provide positive pressure on the laminated edge of the material during the cutting cycle, to prevent it from lifting.

Segmental Router

The following notes describe some of the fabrication methods and range of standard tools available. The essence of the segmental router is the use of either rectangular or half round PCD pieces to build up the cutting length in an inexpensive manner. Fig's 1&2 illustrate the construction, it is important to note that the tips on each side of the tool overlap to give an effective continuous cutting length. Figure 2, shows that plunge tip positioned so that it crosses the centerline of the tool to provide a drilling facility.

Fig. 1 **Standard Segmental PCD Router – without plunge facility**

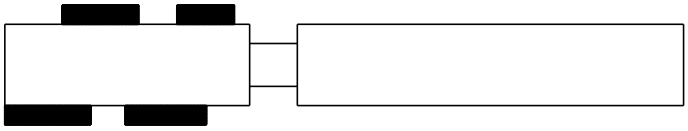
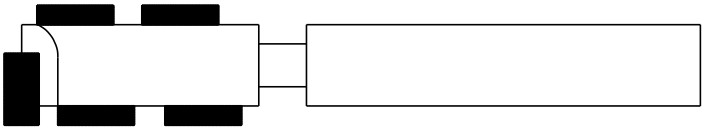


Fig. 2 **Standard Segmental PCD Router – with plunge facility**



PCD Router Cutters

Providing the tool diameter is large enough the segmental principle may be utilized to produce tooling of varying depth of cut. Table. 1. Gives the tool codes and dimensions of TIPCO standard range of PCD routers.

Table 1 Standard Segmental Routers.

Cutting O/Diameter	Tool Code	Length of Cut						Standard Holder
		15mm	20mm	25mm	30mm	35mm	40mm	
½" or 12mm	TR1-	TR1-15	TR1-20	TR1-25	TR1-30			½' Dia x 50mm
½" or 12mm	TR2-	TR2-15	TR2-20	TR2-25	TR2-30			½' Dia x 50mm
5/8" or 16mm	TR3-	TR3-15	TR3-20	TR3-25	TR3-30	TR3-35		5/8" Dia. x 70mm
5/8" or 16mm	TR4-	TR4-15	TR4-20	TR4-25	TR4-30	TR4-35		16mm x 50mm
¾" or 20mm	TR5-	TR5-15	TR5-20	TR5-25	TR5-30	TR5-35	TR5-40	¾" Dia x 85mm
¾" or 20mm	TR6-	TR6-15	TR6620	TR6-25	TR6-30	TR6-35	TR6-40	20mm Dia x 85mm
1.0" or 25mm	TR7-	TR7-15	TR7-20	TR7-25	TR7-30	TR7-35	TR7-40	1.0" x Dia x 100mm
1.0" or 25mm	TR8-	TR8-15	TR8-20	TR8-25	TR8-30	TR8-35	TR8-40	25mm Dia x 100mm

> Note: If you require Plunge Cut please modify the above code by adding /P - eg: SR1/P-20

Advantages of Segmental Routers:

- Lower cost – for length of cut obtained
- Flexibility – segments can be removed for re-lapping
- Top and Bottom segments can be positioned for shear cuts
- Individual segments can be replaced if damage occurs

Disadvantages of Segmental Routers

- Witness marks may be visible on certain types of material where teeth are overlapping, during the machining cycle, this can in some circumstances be unacceptable.

Non- Segmental Routers

Are designed to overcome the problems with marks that are left in the material during the machining cycle, using a range of tools manufactured from full PCD strips. This approach is more expensive, particularly for longer cutting lengths, as the PCD strips have to be cut from the centre of a larger disc.

The availability now of 70mm diameter discs, increases the selection of tools that can be manufactured in this manner.

PCD Router Cutters

Figure 3 & 4, illustrate the non-segmental tools. Table 2 details the range of standard tooling

Fig. 3 **Standard Non- Segmental PCD Router without Plunge facility**

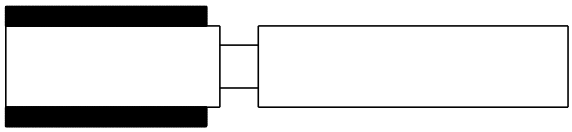
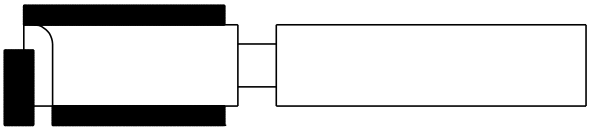


Fig. 4 **Standard Non- Segmental PCD Router with Plunge facility**



Advantages of Non-Segmental Routers

- Produces high surface finish without witness marks or other blemishes
- Improved tool balance on high spindle speed machines

Disadvantages of Non-Segmental Routers

- Increased cost of manufacture
- Expensive to repair if badly damaged

Table 2 Standard Non Segmental Routers.

Cutting O/Diameter	Tool Code	Length of Cut						Standard Holder
		15mm	20mm	25mm	30mm	35mm	40mm	
½" or 12mm	TR1-	TR1-15	TR1-20	TR1-25	TR1-30			½' Dia x 50mm
½" or 12mm	TR2-	TR2-15	TR2-20	TR2-25	TR2-30			½' Dia x 50mm
5/8" or 16mm	TR3-	TR3-15	TR3-20	TR3-25	TR3-30	TR3-35		5/8" Dia. x 70mm
5/8" or 16mm	TR4-	TR4-15	TR4-20	TR4-25	TR4-30	TR4-35		16mm x 50mm
¾" or 20mm	TR5-	TR5-15	TR5-20	TR5-25	TR5-30	TR5-35	TR5-40	¾" Dia x 85mm
¾" or 20mm	TR6-	TR6-15	TR6620	TR6-25	TR6-30	TR6-35	TR6-40	20mm Dia x 85mm
1.0" or 25mm	TR7-	TR7-15	TR7-20	TR7-25	TR7-30	TR7-35	TR7-40	1.0" x Dia x 100mm
1.0" or 25mm	TR8-	TR8-15	TR8-20	TR8-25	TR8-30	TR8-35	TR8-40	25mm Dia x 100mm

> Note: If you require Plunge Cut please modify the above code by adding /P –eg: SR1/P-20

PCD Router Cutters

Advantages – Thin Layer Routers.

- Inexpensive
- Mechanical fixing, as opposed to brazing can be considered
- Are available in Small diameter or complex tools that are not suited to other production methods
- Suitable for short production runs

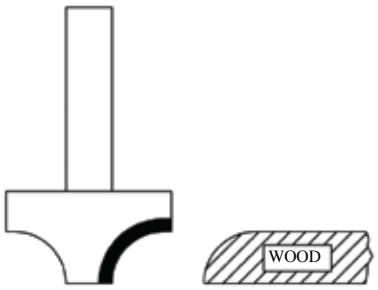
Disadvantages – Thin Layer Routers.

- Limited re-lap life due to depth of PCD
- Tools may be written off, if badly damaged

Formed Routers

There are many applications that require a profiled router, particularly in the wood working industry for operations such as panel raising and Ovolo cutters, Fig 6, shows a typical example.

Fig. 6



TIPCO diamond manufacture employs computer aided design in the manufacture of this type of tooling to ensure optimum utilization of the PCD. A number of techniques are utilized during manufacturing including wire erosion, die sinking and lapping to ensure that the correct profiles are obtained. Where required routers are balanced after manufacture to ensure optimum performance. This is of particular importance when used on high speed routing machines and in the case of single flute routers .

All styles of formed routers are available to order. Special tools working from component drawings, samples of existing tooling or formed components can be undertaken.

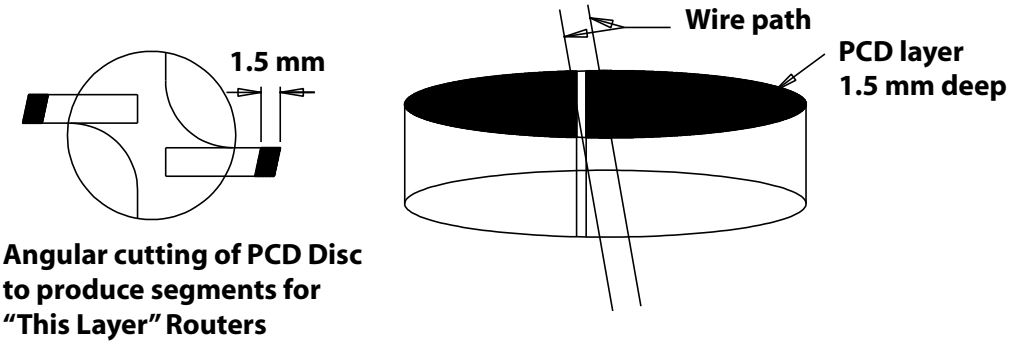
PCD Router Cutters

Thin Layer Router

Tool blanks are produced by a special technique, from deep layer disc of PCD such that a long length of PCD is machined with a minimum of 1.5mm, diamond depth (see fig. 5)

This is a more cost effective way of obtaining a long section of PCD. It also has the advantage of being seated on 8mm depth of tungsten carbide substrate for easier methods of fabrications.

Figure 5. **End View – Thin Layer Router**



Angular cutting of PCD Disc to produce segments for "This Layer" Routers

This process if often employed for manufacturing thin machine knives and cutter blocks. It is also useful when producing routers on grounds of;

- Technical merit
- Small diameter shanks, etc.
- Costs

Currently, this type of tooling is normally made to order. We do offer customers technical support and advise on the application of the product, upon request.

PCD Router Cutters

NOTE: "For the Protection and Usage of PCD ROUTERS"

1. Polycrystalline diamond is very hard wearing but is also very brittle, and may be chipped easily, particularly if knocked by metal objects or tools etc. Always handle the tools with care and store in a protective box when not in use.
2. PCD tools are most vulnerable when being installed or removed from the machine. We recommend that you protect the cutting edges when carrying out these operations, a wooden block bored to suit the tool, is a convenient method.
3. After setting the tool always carryout a short test cut to ensure that the correct depth of cut has been programmed
4. When the tools are ready for re-lapping they may become blunt and in the event chipping may occur tools should not be left running in this condition as more extensive damage may be caused.
5. Bluing of the steel shank, due to the build up of excessive heat and increasing cutting noise are often good indicators of the condition of the tools. Should this occur, remove the tool concerned and return to the factory for re-lapping or replacement.

Single Point Diamond Dressing Tools

Single point diamond dressing tools

When assessing the suitability of diamonds for Single Point Dressing Tools, two general features are considered. Firstly the integrity of the diamond in terms of the absence of flaws or inclusions, secondly it's natural shape which ideally should be that of an octahedron which will provide six useful dressing points. The majority of diamonds mined do not meet the ideal requirements and those that do, command premium prices.
TIPCO grades the diamond tools for both integrity and shape.

Integrity

All industrial diamonds are less than perfect and require grading for different applications so that we have a range of tools to satisfy demands for high quality or low initial cost.

We grade our stones as follows:

GRADE A

A high quality diamond used in fine dressing applications where low diamond wear gives good life and dimensional stability.

GRADE B

An above average quality diamond, any minor flaws not in a position to effect life or resetting, giving above average performance.

GRADE C

A good general purpose diamond of a quality widely available giving a good compromise between cost and life.

GRADE D

A diamond which will contain flaws which could effect tool life or may effect resetting ability of the tool. It would normally be used for non-critical and off hand work or where abuse of the diamond may be expected.

Shape

To indicate the number of useful points a number occurs after the grade letter. Hence a grade A3 would be a good quality diamond with three good points and a B4 would be a general purpose diamond with four good points.

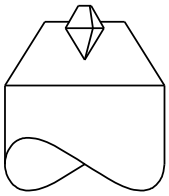
Re-setting of single diamond tools

Tipco offers a rapid service, often dispatching on the same day as the tools are received. The diamonds are always set into new shanks and are optically centred, as indeed are all new tools.

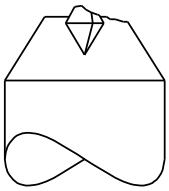
Case of single point diamonds

The most economical use of the tool will be achieved if the following guide lines are observed.

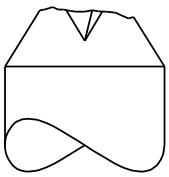
1) Select the correct diamond size
2) Mount the tool rigidly, avoid all vibration.
3) Use a copious supply of coolant. NEVER apply coolant to a hot diamond. Ensure that the coolant is flowing continuously and is correctly directed before dressing commences.
4) Single point diamonds must be mounted at a drag angle to the wheel of about 10O and be rotated regularly to keep a sharp point.
5) Do not dress more than 0.002" (0.05mm) off the radius of the wheel.
6) Do not wear the diamond excessively before re-setting as this will adversely effect the life of the tool by reducing the number of useful points.



Ready for Re-setting



Overdue points lost



Set worn to far

Selecting the diamond size

To determine the diamond weight in carats use the following formulae.

IMPERIAL - Where all dimensions are in inches

1) General Purpose Dressing Applications

$$\text{Diamond Size Carat} = \frac{\text{Diameter of Wheel (D)} + [2 \times \text{width (w)}]}{10}$$

2) Severe Dressing Applications

$$\text{Diamond Size Carat} = \frac{\text{Diameter of Wheel (D)} + [2 \times \text{width (w)}]}{7}$$

Metric - Where all dimensions are in millimeters

1) General Purpose Dressing Applications

$$\text{Diamond Size Carat} = \frac{\text{Diameter of Wheel (D)} + [2 \times \text{width (w)}]}{250}$$

2) Severe Dressing Applications

$$\text{Diamond Size Carat} = \frac{\text{Diameter of Wheel (D)} + [2 \times \text{width (w)}]}{180}$$

Selecting the diamond quality

While the cost per tool is important also consider other factors such as:

- **Frequency of use**
- **Do you expect to have the diamond re-set and how often**
- **The standard of operator care**
- **Size control requirements** *(remember that size control partly depends on the lack of wear of the diamond point.)*

Ordering your single point tool

If you are asking us to supply further tools to an existing specification, it will be sufficient to give the previous tool number.

If not, proceed as follows.

Select diamond size

See the chart on page 6 - Select the carat weight from sizes: 0.25 0.33 0.5 0.75 1.00 1.5 2.00 2.5 3.0

Select diamond quality

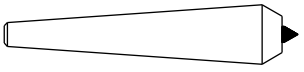
See comments on page 19 - (1) When selecting grade and shape.

Consumable	Resettable				
A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1					

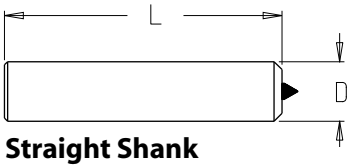
Select tool shape

Tools using diamonds of one carat and larger may require a head on the shank if the shank has a small diameter. Examples of common tool shapes are shown but we need to know.

Length of shank	L
Head length	HL
Head diameter	HD
Shank diameter	D
Taper number	T

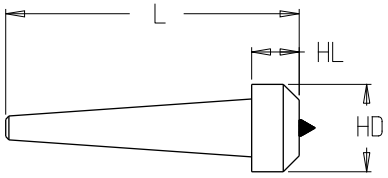


Taper Shank

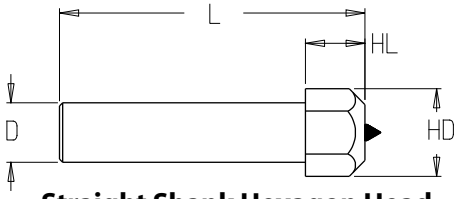


Straight Shank

Straight Shank Stud Head



Taper Shank Stud Head



Straight Shank Hexagon Head

Threaded Shank

Ordering example straight shank stud head single point dressing tool

L= 2″	D= 1/2″	HD= 5/8″	HL= 1/4″	2 Carat Grade B4
L= 50	D= 12	HD= 16	HL= 6	2 Carat Grade B4

Multi-point diamond dressing tools

Why use multi point tools?

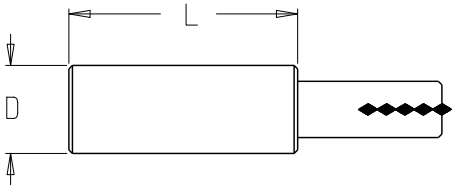
Multi-point tools dress more consistently than single stones who's dressing action changes with point wear and rotation. Also when dressing large wheels large single diamonds are needed which command high prices. Small diamonds are cheaper per carat and a number of them acting together will provide adequate heat dissipation and excellent life.

Therefore the advantages are: -

- Cheaper tools – consistent performance
- No rotation required and no re-setting
- Lower tool stocks
- Robust tools

IN-LINE DRESSER

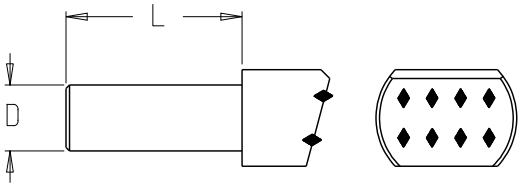
An economic single point tool giving good life without the need to re-set. Approximately 1 carat per tool but can be made with other weights to customer specification.



Specify Shank D and L - Catalogue No. 060.001

ANGLE CLUSTER

Medium to heavy dressing on centreless grinding machines. This type of tool uses selected long diamonds arranged to give progressive dressing from layer to layer. The diamonds can be set in a variety of configurations.

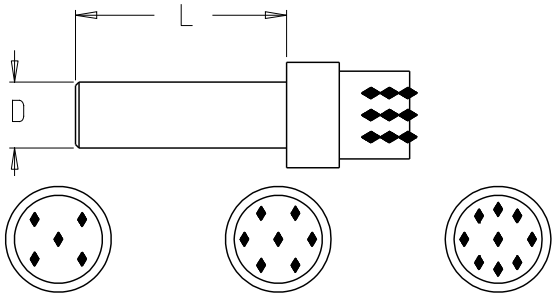


Popular shapes are given in chart. Specify D and L.

Catalogue No.	No. of Layers	No. of Stones
061.00	1	18
061.002	2	16
061.003	3	24

FLAT CLUSTER

Medium to heavy dressing on centreless grinding machines similar to the angle cluster. 1, 2 or 3 Layers of 5, 7 or 9 Diamonds

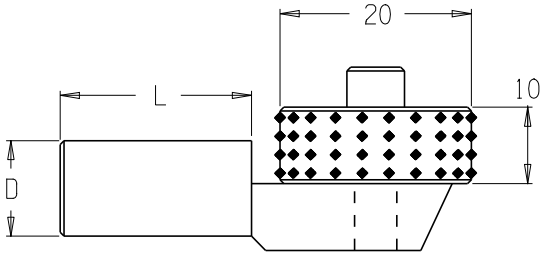


Catalogue No.	No. of Layers	No. of Stones
062.001	1	5
061.002	2	10
062.003	3	15
062.004	1	7
062.005	2	14
062.006	3	21
062.007	1	9
062.008	2	18
062.009	3	27

Multi-row index dresser type. MR1

Selection

Duty	Suitable for grinding wheels
Light	20" x 3" 500 x 75
Heavy	24" x 3" 600 x 75
Super	30" x 3" 750 x 75



Catalogue number	Type	Duty	Number of rows	Number of diamonds	Diamond type
063.013	MRI/L	LIGHT	3	60	Selected longs
063.014	MRI/H	HEAVY	4	80	Selected longs
063.015	MRI/S	SUPER	4	80	Selected longs

Randomly impregnated

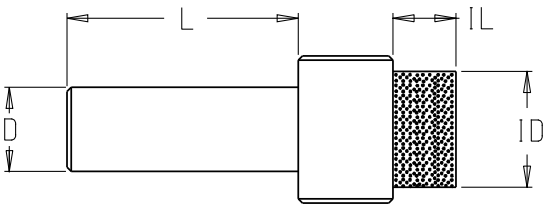
These told are made from small diamonds set into a metal matrix. They are very robust and require no rotation or re-setting. Used in centre-less, cylindrical and surface grinding machines. Unlike single point diamond tools, this type requires no drag angle. If you are intending to fit this tool to a machine with a built in drag angle remember to give us the angle so that we can crank the head to present the tool to the wheel correctly.

Rectangular tool

Length of shank	L
Diameter of shank	D
Length of impregnation	IL
Width of impregnation	IW
Depth of impregnation	ID
If required crank angles	X Y & Z

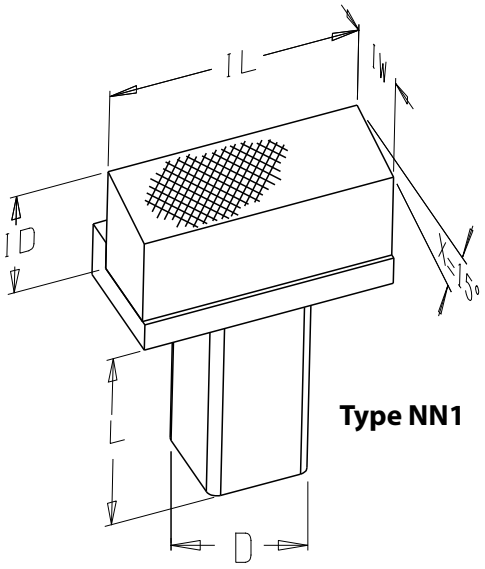
Circular tool

Length of shank	L
Diameter of shank	D
Diameter of impregnation	ID
Length of impregnation	il

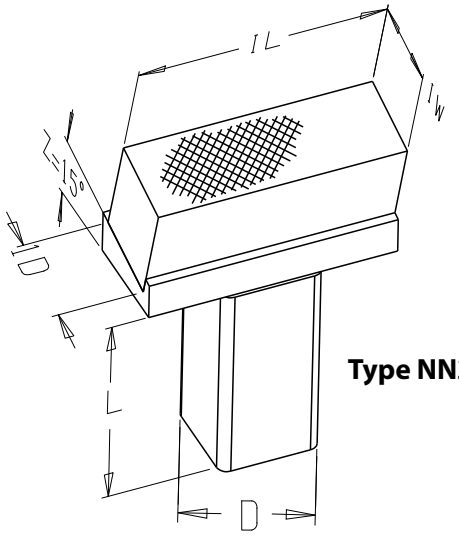


Circular				
Catalogue No.	ID"	IDmm	IL"	ILmm
064.001	¼	6	1/8	3.2
064.002	¼	6	¼	6.4
064.003	3/8	9.5	1/8	3.2
064.004	3/8	9.5	¼	6.4
064.005	3/8	9.5	3/8	9.5
064.006	½	12.7	1/8	3.2
064.007	½	12.7	¼	6.4
064.008	½	12.7	3/8	9.5
064.009	5/8	16.0	1/8	3.2
064.010	5/8	16.0	¼	6.4
064.011	5/8	16.0	3/8	9.5
064.012	¾	19.0	1/8	3.2
064.013	¾	19.0	1/4	6.4
064.014	¾	19.0	3/8	9.5

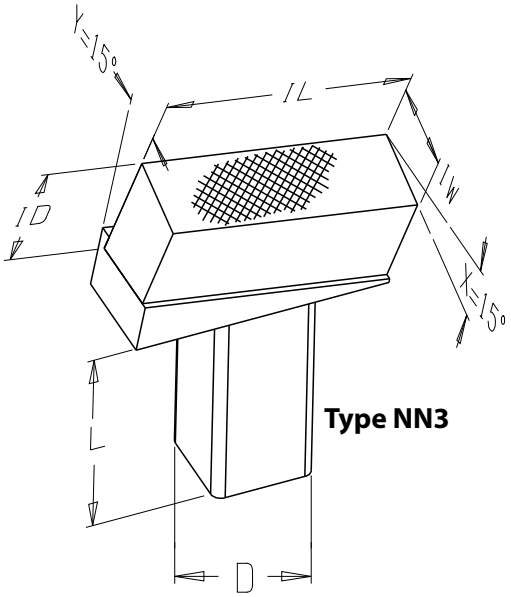
Also give us the grinding wheel size and grit specification



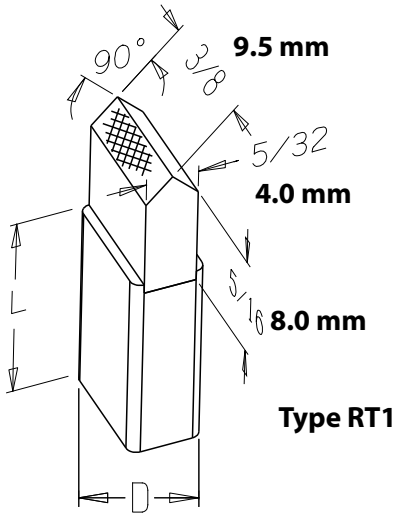
Type NN1



Type NN2

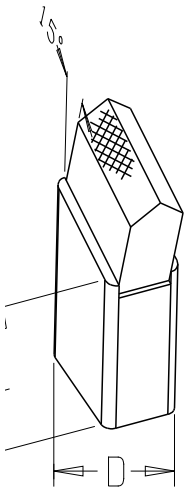


Type NN3



Type RT1

Catalogue No.
064.019



Type RT2

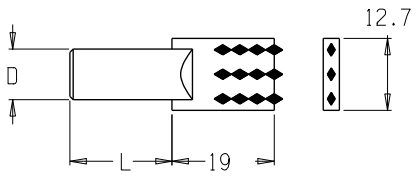
Catalogue No.
064.020

Rectangular						
Cataloue No.	IL		IW		ID	
	Inches	mm	Inches	mm	Inches	mm
064.015	3/8	9.5	5/32	4.0	¼	6.0
064.016	½	12.7	¼	6.0	3/8	9.5
064.017	¾	19.0	¼	6.0	5/16	8.0
064.018	¾	19.0	¼	6.0	3/8	9.5

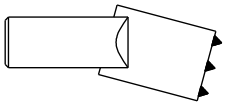
Blade tools

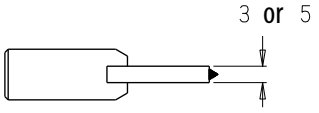
Used for profile and form grinding of a less intricate nature than those achieved with profiling blades or polished chisels but where greater tool economy is required.

The blade can be cranked to present the tool to the wheel on a true radius line and can be turned left or right to assist in dressing profiles. Specify when ordering.

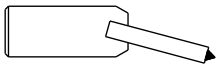


Cranked





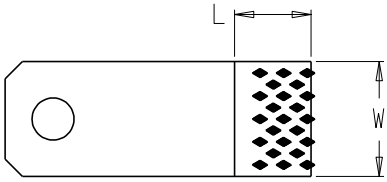
Straight

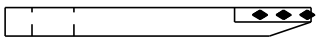


Turned

Profiling blades

By careful selection of diamond shape and care in manufacturing an accurate profiling tool is produced which can be attached to a separate holder permitting the blade to be cranked or the blade can be supplied brazed to a shank and to the customer's requirement. It combines the advantages of a chisel tool with those of a multi-point diamond tool. The narrow working edge stays constant until completely used up. No re-setting or re-lapping is required.





Precision blade

This tool uses thin Maacles to achieve a very accurate layer giving continuous close profiling without re-lapping and with good tool life

Standard blade

Selected needles give similar results to Maacles where accuracy is slightly less demanding and at a lower cost per tool.

Random impregnated blade

This tool uses grains placed closely in a flat later for straight pass dressing giving consistent results without turning or re-setting at lower costs than single stones. Use on:- Cylindrical grinding, Centreless grinding, Angular grinding, Profile grinding.

Precision Blades

Catalogue No.	Wmm	Lmm
066.001	10	10
066.002	10	15
066.003	15	10
066.004	20	10
066.005	20	15

Standard Blades

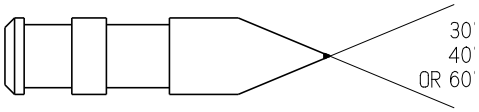
Catalogue No.	Wmm	Lmm
066.006	10	10
066.007	10	15
066.008	15	10
066.009	20	10
066.010	20	15

Randon Impregnated Blades

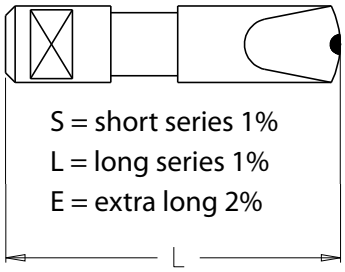
Catalogue No.	Wmm	Lmm
066.011	10	10
066.012	10	15
066.013	15	10
066.014	20	10
066.015	20	15

Shaped diamond tools

Diaform chiesel



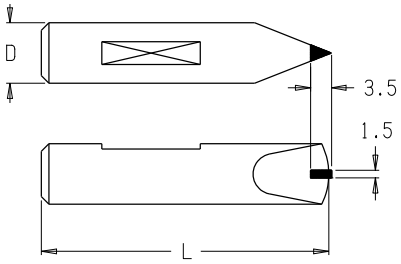
NOTE: Natural diamond weights are prior to polishing.



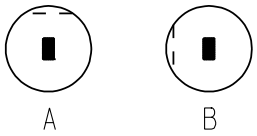
Available in natural or polycrystalline diamond
Specify S, L or E when ordering

Catalogue prefix No. 067	Natural diamond			Polycrystalline diamonds	
	Consumable	1/3 Cart	½ Carat	Consumable	Re-Lappable
30° x .005	.001	.002	.003	.004	.005
30° x .010	.006	.007	.008	.009	.010
30° x .020	.011	.012	.013	.014	.015
40° x .005	.016	.017	.018	.019	.020
40° x .010	.021	.022	.023	.024	.025
40° x .020	.026	.027	.028	.029	.030
60° x .005	.031	.035	.033	.034	.035
60° x .010	.036	.037	.038	.039	.040
60° x .020	.041	.042	.043	.044	.045

Straight shank chisel



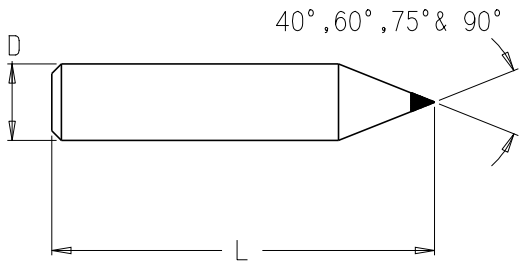
polycrystalline dimensions



Available in natural or polycrystalline diamond.
Give Shank sizes D and L when ordering. Also state Flat "A" or "B".

Catalogue prefix No. 068	Natural diamond			Polycrystalline diamonds	
	Consumable	1/3 Cart	½ Carat	Consumable	Re-Lappable
30° x .005	.001	.002	.003	.004	.005
30° x .010	.006	.007	.008	.009	.010
30° x .020	.011	.012	.013	.014	.015
40° x .005	.016	.017	.018	.019	.020
40° x .010	.021	.022	.023	.024	.025
40° x .020	.026	.027	.028	.029	.030
60° x .005	.031	.035	.033	.034	.035
60° x .010	.036	.037	.038	.039	.040
60° x .020	.041	.042	.043	.044	.045

Straight shank cone



Available in Natural and Polycrystalline Diamond.
Give Shank sizes D and L and Radius required when ordering.

Natural diamond

Catalogue prefix No. 067	Consumable	1/3 Cart	½ Carat	¾ Carat	1Carat
40°	.001	.002	.003	.004	.005
60°	.006	.007	.008	.009	.010
75°	.011	.012	.013	.014	.015
90°	.016	.017	.018	.019	.020

Polycrystalline diamond

	Consumable	Relappable			
40°	.021	.022			
60°	.023	.024			
75°	.025	.026			
90°	.027	.028			

Available in radii .003" to .030"
Depending on diamond size

Other Types of Tools Supplied

INDENTORS

- Avery 120o cone tips radius .008"
- Rockwell 120o cone tip radius .008"
- Vickers 136o pyramid
- Firth 136o pyramid
- Avery-Edgwick 136o pyramid

THREAD & GEAR FORMING TOOLS

- Reishauer
- Newall cube and chisel
- Matrix chisel and cone
- Blade Chisel
- Jones and Lamson

CHISELS

- Naxos Union
- Lund Precimax
- Schaudt
- Fortuna
- Orcutt

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