

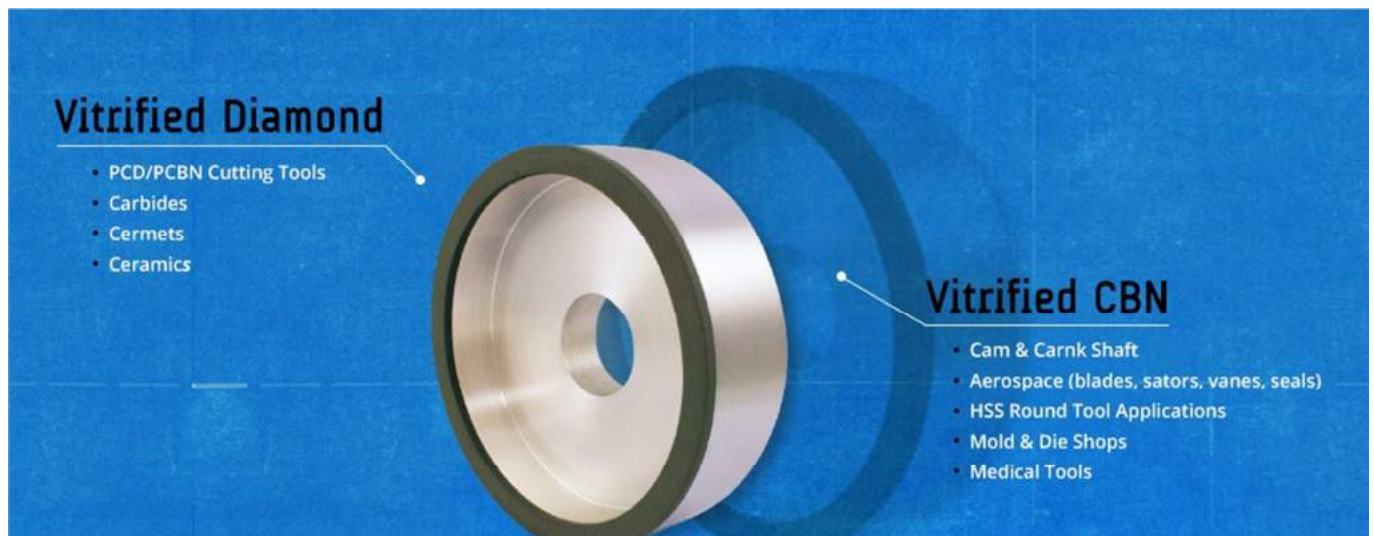
**NTB *DiaCer***  
**NTB *CeraCBN***



**Diamond & CBN Grinding Wheels**

## 1.0 Super-Abrasive Diamond and CBN Vitrified Grinding Wheels

Super-Abrasive wheels play a key role in the grinding process for Advanced Ceramics, Semi-Conductor, Automotive, Bearing, Carbide, Cermet, Aerospace, Glass, PCD/PCBN Cutting Tools, and Mould and Die making industries. In general applications, super-abrasive wheels can be resin, metal, vitrified or mono-layer electroplated bond. Diamond and Cubic Boron Nitride (CBN) are the super-abrasive materials of choice. The wheel grinding ability and wheel life depend on the combination of binding material, super-abrasive grit type and mesh size, concentration, and porosity. Some provide higher material removal rate, others wear more slowly or give better precision on final size.



For many years, resin bond & metal bond wheels have been widely used and offer the valuable feature of structural flexibility. Phenolic, Polyimide and their derivatives are still the most commonly used bond types. In metal bond super-abrasive wheels, the binding material is made from metallic powders of copper, tin, iron, cobalt etc. However, both resin and metal bond wheels deflect or ‘give-in’ under load, due to their inherent elasticity resulting in poorer grinding tolerances.

However, when it comes to shaping hard materials – Quickly, Accurately and Inexpensively, then the Vitrified Super-Abrasive wheels have few rivals. These wheels provide much higher stiffness because the vitrified wheel is essentially composed of super-abrasive grit, which is mechanically and chemically bound in a glassy or crystalline ceramic matrix. The rigid, porous structure delivers low wear, high heat stability, and this when combined with a free cutting nature, efficient chip removal, and excellent ability to be “Dressed” provides very high material removal rates, with minimum downtime and resultant lower machining/manufacturing costs.

As an additional benefit, the coolant carries through the pores in the grinding zone, which results in lower temperature at the interface and consequent reduced risk of work-

piece thermal damage and stresses. Also, lower temperatures and the rigid nature of the wheel helps in maintaining control over the final size and finish, and also allows for 'Dry' grinding. Consequently, very high tolerances can be achieved throughout a production run with vitrified wheels, due to their low thermal expansion and negligible wheel deflection.

Vitrified wheels typically run at 35-60 m/s compared to 60-80 m/s for resin bond wheels, which means less heat generation and less workpiece burn. Vitrified wheels with steel & composite cores can be rated for use up to 150 m/s operation. The harder the bond, the longer is the wheel life achieved. On the contrary, the softer the bond, better grinding ability is achieved due to the higher porosity.

Vitrified CBN grinding wheels are preferred for grinding hard ferrous workpieces like crankshafts and camshafts, as well as tool steels and aerospace alloys, since diamond has a strong affinity for iron resulting in rapid wear. On the other hand, vitrified diamond grinding wheels are good in non-ferrous applications such as shaping of hard ceramics, carbides and PCD and PCBN cutting tools.

## 2.0 How to choose a proper wheel for PCD and PCBN?

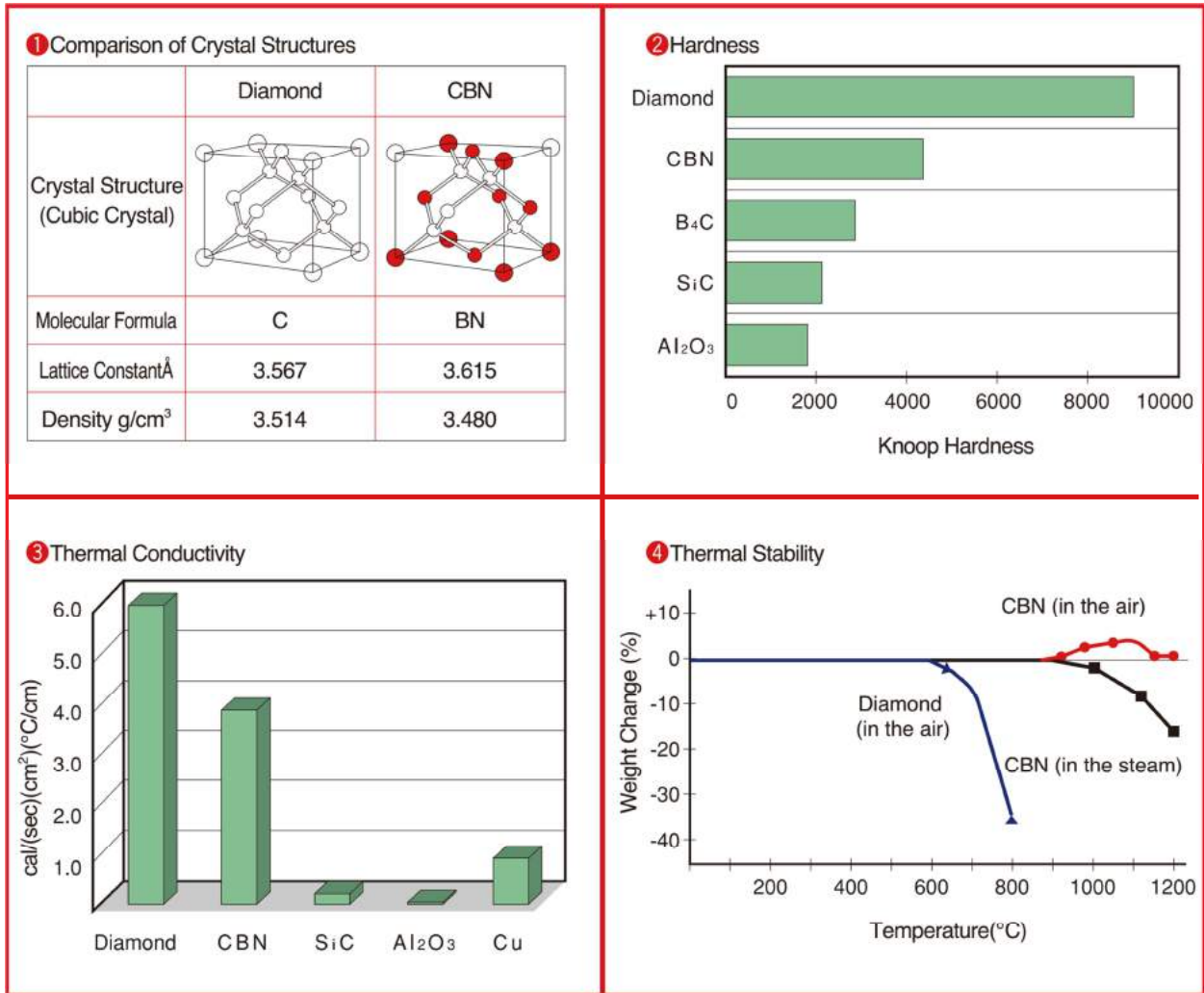
The most important criterion in grinding wheel selection is the required surface quality of the sharpened tools. In wheels for sharpening PCD & PCBN inserts, five micron size grains are commonly used (see table below). Other wheel parameters like grain concentration, its hardness and structure are chosen individually for each application, and depend on the type of machining, the grinder equipment and properties of the grinding tool. For ceramics and steels, an indicative relationship between the Diamond and CBN grain mesh size and surface roughness are shown in the following figure. This will facilitate the ease of wheel selection in grinding of hard ferrous steels, ceramics and carbides.

### Grain size selection

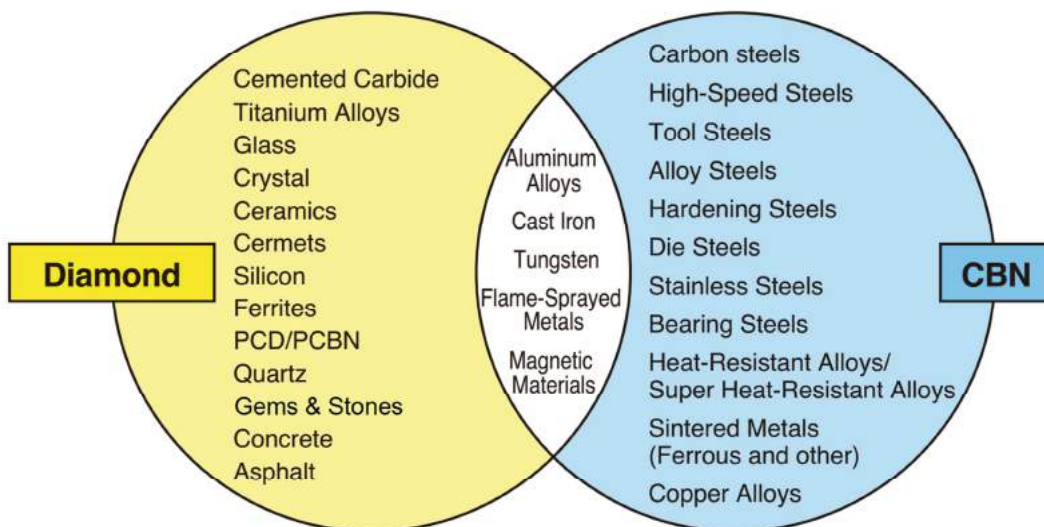
Grain size	Machining type	Application
D22 or D36	<b>rough</b>	Regenerative grinding, blade edge profiling and sharpening of worn-out inserts.
D15 or D22	<b>universal</b>	Standard grain size. There is a possibility of getting a high sharpening efficiency and high quality machined surfaces, by taking advantage of additional spark-out passes.
D9 or D15	<b>finish</b>	Finishing grinding – getting a very high quality of machined surfaces.
D6 or D9	<b>super-finish</b>	Super-finish grinding – getting a highest quality of machined surfaces.

### 3.0 Characteristics of Abrasives and Materials To Be Ground

#### (1) Characteristics of Abrasive



#### (2) Materials to be ground with Diamond and CBN



## 4.0 How to set the machining parameters?

During PCD & PCBN inserts sharpening, one should pay a careful attention to the proper selection of machining parameters. Even with the most advanced technology, diamond or CBN grinding wheels can never be efficient, if their working conditions or machining parameters are improper.

### Machining Parameter Selection

#### Grinding velocity

20 m/s – recommended  
15 to 30 m/s – acceptable\*

#### Allowance

rough grinding: 0.02 - 0.05 mm / pass  
standard grinding: 0.01 - 0.025 mm / pass  
finish grinding: 0.005 - 0.01 mm / pass

#### Oscillation frequency

60 1/min – recommended  
50 to 120 1/min – acceptable

#### Number of sparking out passes

3 to 8

#### Recommended abrasive stick

Aluminium oxide abrasive stick  
Type - 20x10x100 99A 320 J7V

#### Coolant

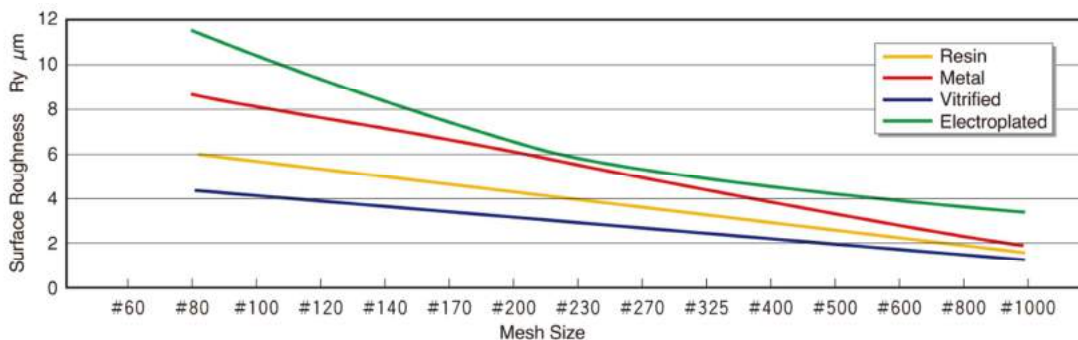
Water-oil emulsion 3 to 5%

#### Remarks

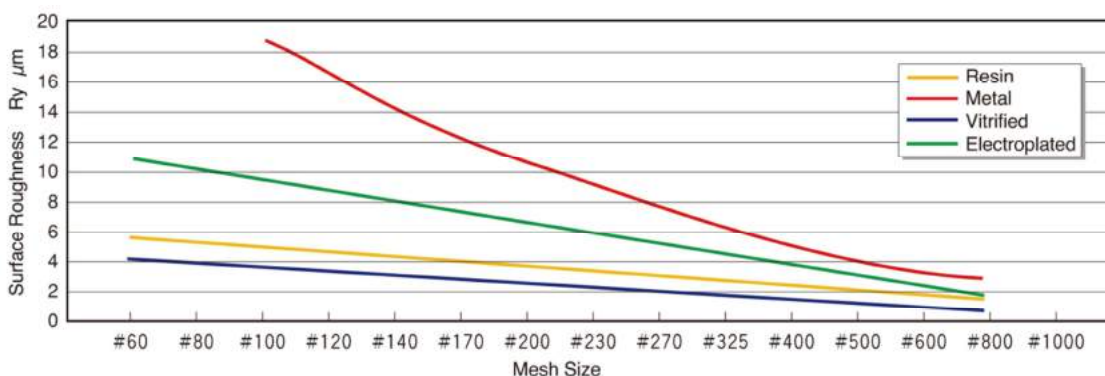
Infeed of grinding wheel must always be  
Set out of machining zone.

\* If the wheel appears to be too hard, one should decrease the grinding velocity to 15 to 18 m/s and dress the wheel more frequently. If the wheel wears out too fast then, one should increase the grinding velocity to 22 to 30m/s.

**Fig. Mesh Size and Surface Roughness (Indicative  $R_a \approx R_y/10$ )**

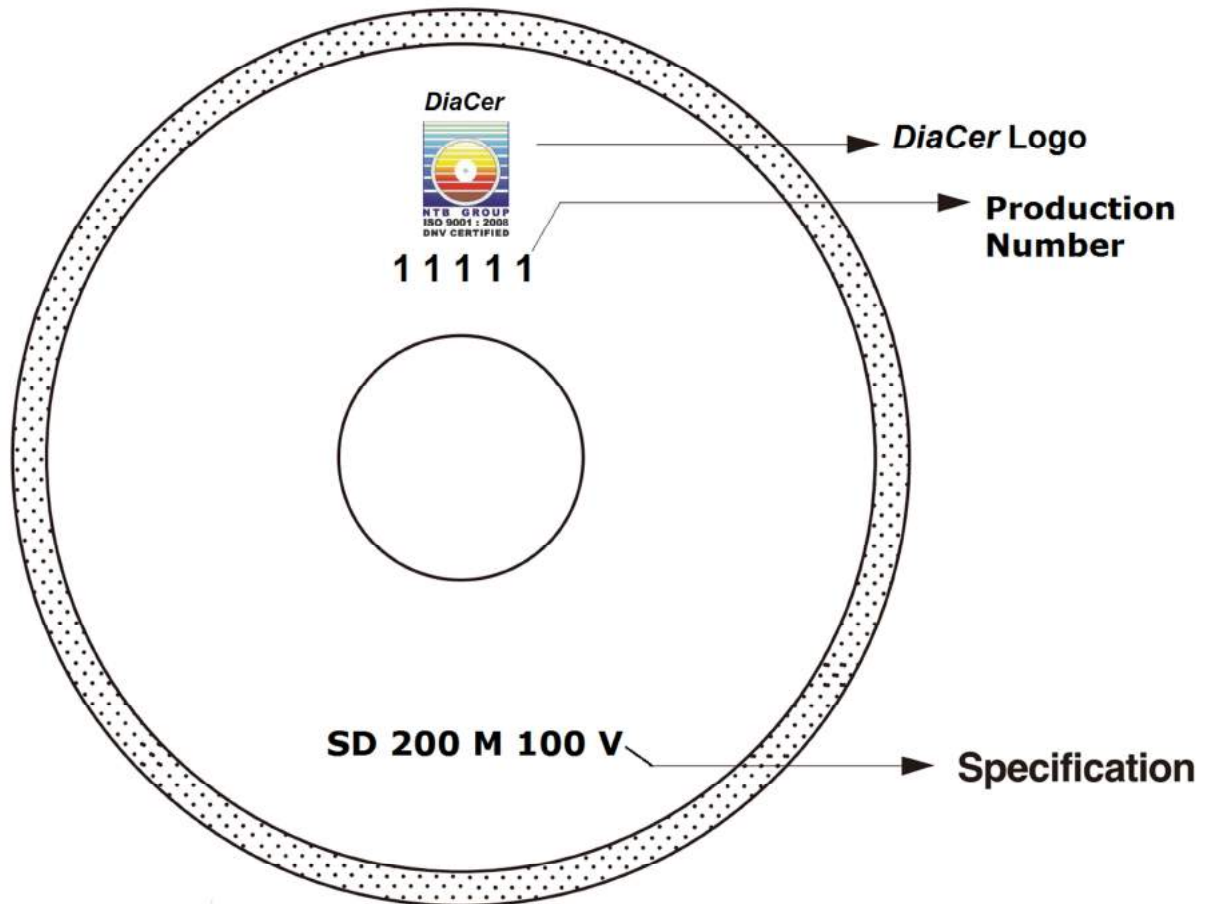


**Ceramics  
(Diamond)**



**Hardening  
Steel (CBN)**

## 5.0 Wheel Markings



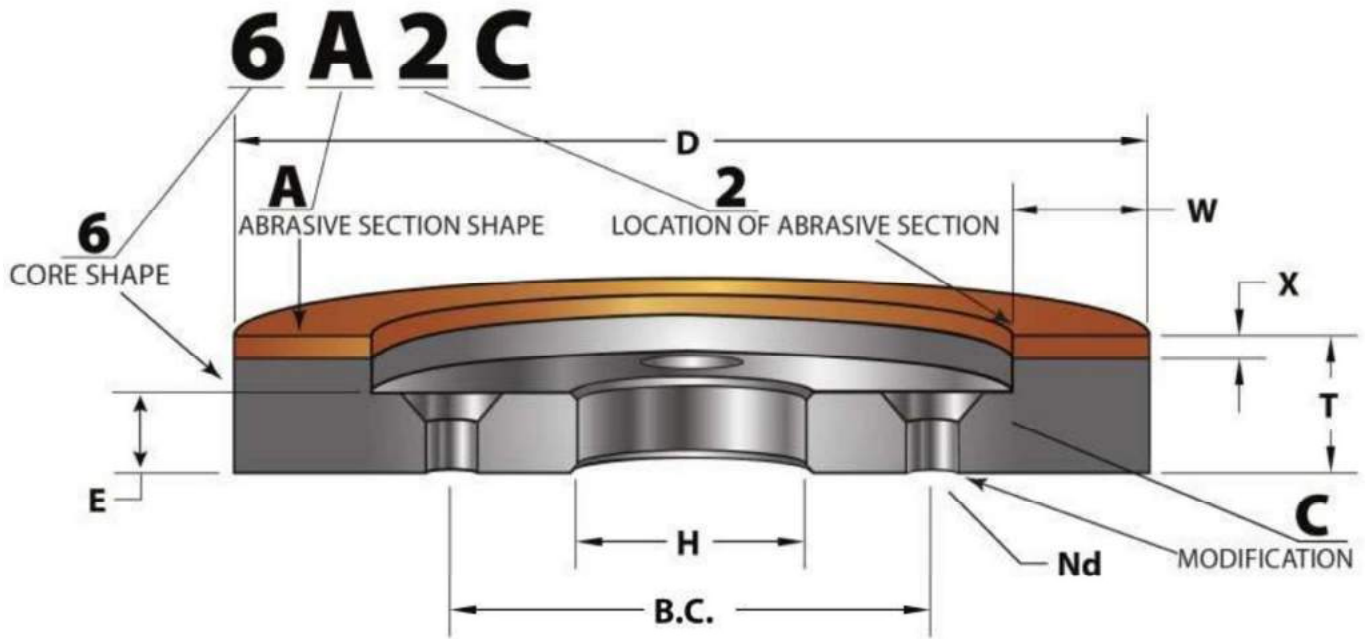
## Interpretation Of The Markings

**SD                      200                      M                      100                      V                      3.0**

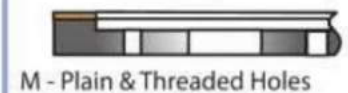
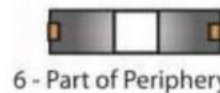
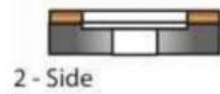
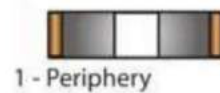
Super-Abrasive Type	Mesh Size*	Bond Hardness	Concentration*	Bond Type	Abrasive Depth (mm)*
SD : Synthetic Diamond	60 170 400	J-K-L : Soft			3.0
MSD : Multi - Crystalline	80 200 600		100		5.0
BN : Cubic Boron Nitride	100 230 800	M-N-O : Medium	150	V : Vitrified	10.0
MBN : Multi - Crystalline BN	120 270 1000		200		
	140 325 1500	P-Q-R : Hard			

\* Other mesh sizes, concentrations, diameters, and abrasive depths available on request

## 6.0 Standard Shapes and Types of Super-Abrasive Wheels



Basic Core Shape	Abrasive X-Section Shape	
1	A	H
2	AH	J
3	B	K
6	C	L
9	CH	LL
11	D	M
12	DD	Q
14	E	QQ
15	EE	S
	F	U
	FF	V
	G	Y

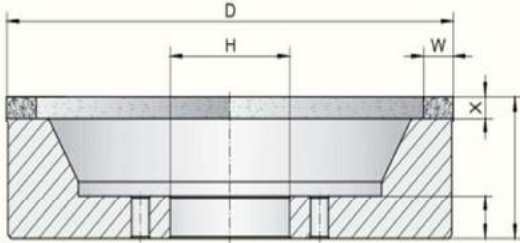


# 7.0 Wheel Selection and Drawings

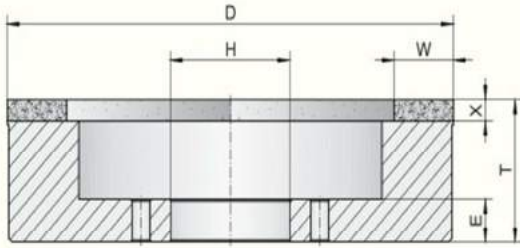
Wheel type

## 6A2 VCM

version  $W \leq 15 \text{ mm}$



version  $W = 20 \text{ mm}$



### Wheel dimensions

D	W	X	T	E	H
30	3	5	25	8	on request
50	3·5	5	25	10	
75	3·5·10	5	25	10	
80	3·5·10	5	25	10	
100	3·6·10·15	5	25	10	
125	3	5	25·40	12	
	5·6·10·15·20	5·10	25·40	12	
150	3·4·5·6·8·10·15·20	5·6·10	40	12	
200	4·5·6·10·15·20	5·8	57	13	
250	4·6	5·8	70	15	
	10·15·20	6·10	70	15	

### Wheel parameters

#### Grain Size

D6 - D9 - D15 - D22 - D36

### Order example

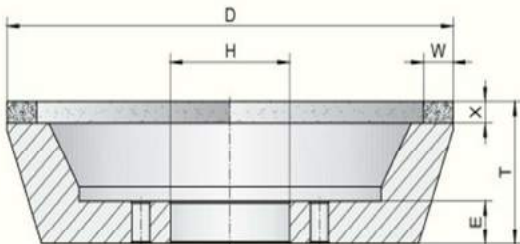
D W X H

6A2 150 X 5 X 10 X 40 VCM D15

6A2 250 X 6 X 10 X 40 VCM D9

Wheel type

## 11A2 VCM



### Wheel dimensions

D	W	X	T	E	H
30	3	5	25	8	on request
50	3·5	5	25	10	
75	3·5·10	5	25	10	
80	3·5·10	5	25	10	
100	3·6·10·15	5	25	10	
125	3	5	25·40	12	
	5·6·10·15·20	5·10	25·40	12	
150	3·4·5·6·8·10·15·20	5·6·10	40	12	
200	4·5·6·10·15·20	5·8	57	13	
250	4·6	5·8	70	15	
	10·15·20	6·10	70	15	

### Wheel parameters

#### Grain Size

D6 - D9 - D15 - D22 - D36

### Order example

D W X H

6A2 150 X 5 X 10 X 40 VCM D15

6A2 250 X 6 X 10 X 40 VCM D9



## Trouble-Shooting with Super Abrasive Wheels

Most common errors result from inappropriate selection of grinding wheel or incorrect machining parameters. The most important selection criteria are the required material removal rate, surface quality and grinding wheel life.

DEFECT	CAUSE	SOLUTION
Ground surface overheats	Too hard grinding tool Poorly balanced grinding tool Play in axle bearings	Reduce grinding tool hardness with more open structure. Reduce operating pressure and grinding tool peripheral speed
Machine vibrations appear	Too hard grinding tool Poorly balanced grinding tool	Choose softer or more porous grinding tool. Check for and eliminate grinding tool unbalance. Check and repair machine if necessary
Quick wearing of grinding tool	Overly soft grinding tool Insufficient operating pressure	Choose harder or less porous grinding tool Reduce operating pressure. Increase grinding tool peripheral speed
Deformed cutting edge on grinding tool	Overly soft grinding tool Overly coarse grit	Choose harder or more closed grinding tool structure Choose finer grinding tool
Poor cutting	Overly fine or overly hard grinding tool	Choose coarser and softer grinding tool Reduce cutting depth
Grinding tool surface covered with chips Too hard rough ground surface	Overly fine, too hard or overly closed grinding tool structure Overly coarse grit	Choose coarser grinding tool Choose softer grinding tool with a more open structure Choose finer grit

## Order/Enquiry for NTB *DiaCer* Diamond and *CeraCBN* Wheels

Please indicate the following when placing a new order/enquiry

<b>1. Materials to be ground (What type of products do you produce?)</b>	
(1) Name :	
(2) Material:	
(3) Hardness :	
(4) Size :	
(5) Stock removal:	
(6) Required Surface Roughness :	
(7) Required Accuracy/ Tolerances:	
<b>2. Machine Type (What kind of machine do you use?)</b>	
(1) Type and Model:	
(2) Spindle Capacity:	
(3) Grinding: Surface, Cylindrical, others	
(4) Wheel Revolution:	
(5) Peripheral Speed:	
(6) Feed Rate:	
(7) Depth of Cut:	
(8) Coolant Type:	
(9) Other Conditions:	
<b>3. Type of Wheel Used?</b>	
(1) Shape and Size:	
(2) Manufacturer:	
(3) Specification:	
(4) Problems:	
<b>4. Quantity and Time for Delivery</b>	
(1) Quantity:	
(2) Required Time for Delivery	
<b>5. Other Requirements</b>	
Company:	
Address/Telephone#:	
Your Order/Enquiry No.:	



**NTB GROUP**  
**ISO 9001 : 2008**  
**DNV CERTIFIED**

# NTB HITECH CERAMICS

(A Division of NTB International Pvt. Ltd.)

**Corporate Office & Works :**

622/2 Kuruli, Near Chakan, Pune - Nashik Highway, Tal - Khed, Pune - 410 501, India

Tel: 091.2135-662762/766 Fax: 091.2135-662761/777

Email : [ceramics@ntbindia.com](mailto:ceramics@ntbindia.com)

Website: [www.ntbindia.com](http://www.ntbindia.com)

Kamal Kacholia : +919168684501  
Jahangir Shaikh : +919168684507

[k.kamal@ntbindia.com](mailto:k.kamal@ntbindia.com)  
[j.shaikh@ntbindia.com](mailto:j.shaikh@ntbindia.com)