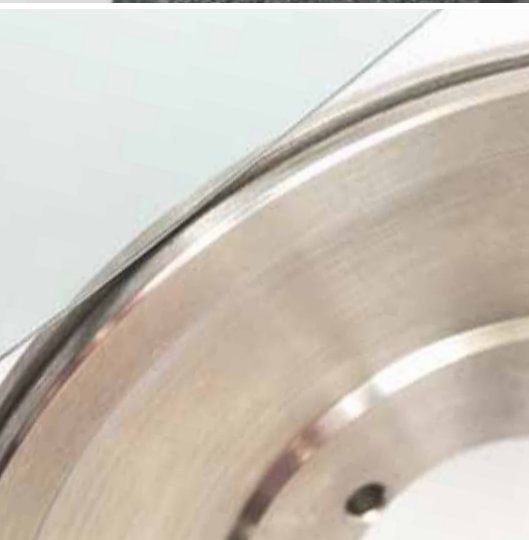




SUPERABRASIVE GRINDING WHEELS



Automotive
Bearing
Glass
Cutting tools
Medical
Turbine
Stationary dresser



- [illegible]



Worldwide competence -

The most advanced technology for diamond tools and quality

EHWA has become an international benchmark for success because of our ability to adapt quickly to the changing markets and diverse needs of customers, and by leading the way in applying the most advanced technology for manufacturing industrial diamond tools.

Since 1975, EHWA has been able to greatly expand its market share throughout the world because we have established a world renowned reputation of high quality products, service and expertise in the industry. EHWA is deeply committed to keeping customers up-to-date and equipped with the most competitive products and technical information. Our success can only be measured by the success of our customers.

The key to our flexibility and strength in the global marketplace is our many alliances with reliable overseas partners and customers throughout the world. EHWA purchases only the highest quality raw materials, industrial diamonds and CBN from reputable sources. In addition to having strong supply lines with major suppliers, EHWA has successfully teamed up with high-tech manufacturers in Europe, Japan, and U.S. under several joint-ventures for the research and development of high precision diamond tools, rotary dressers, and precision electroplated diamond tools.

The success of a company depends on its ability to adapt and compete in the global marketplace. EHWA is able to survive in the age of globalization because we are already globalized.

EHWA diamond tools are your partner for success.



EHWA = Cooperation

'E(二)' means Two Parties: EHWA and People such as customers, employees, partners and our society. 'HWA(和)' means Cooperation. Our philosophy is to nurture and grow long-term partnerships with our customers. Ever since 1975 when EHWA was established, EHWA has been striving to develop into the very best in our industry not only in size but more importantly in quality. We are convinced that we are the best partner for you.

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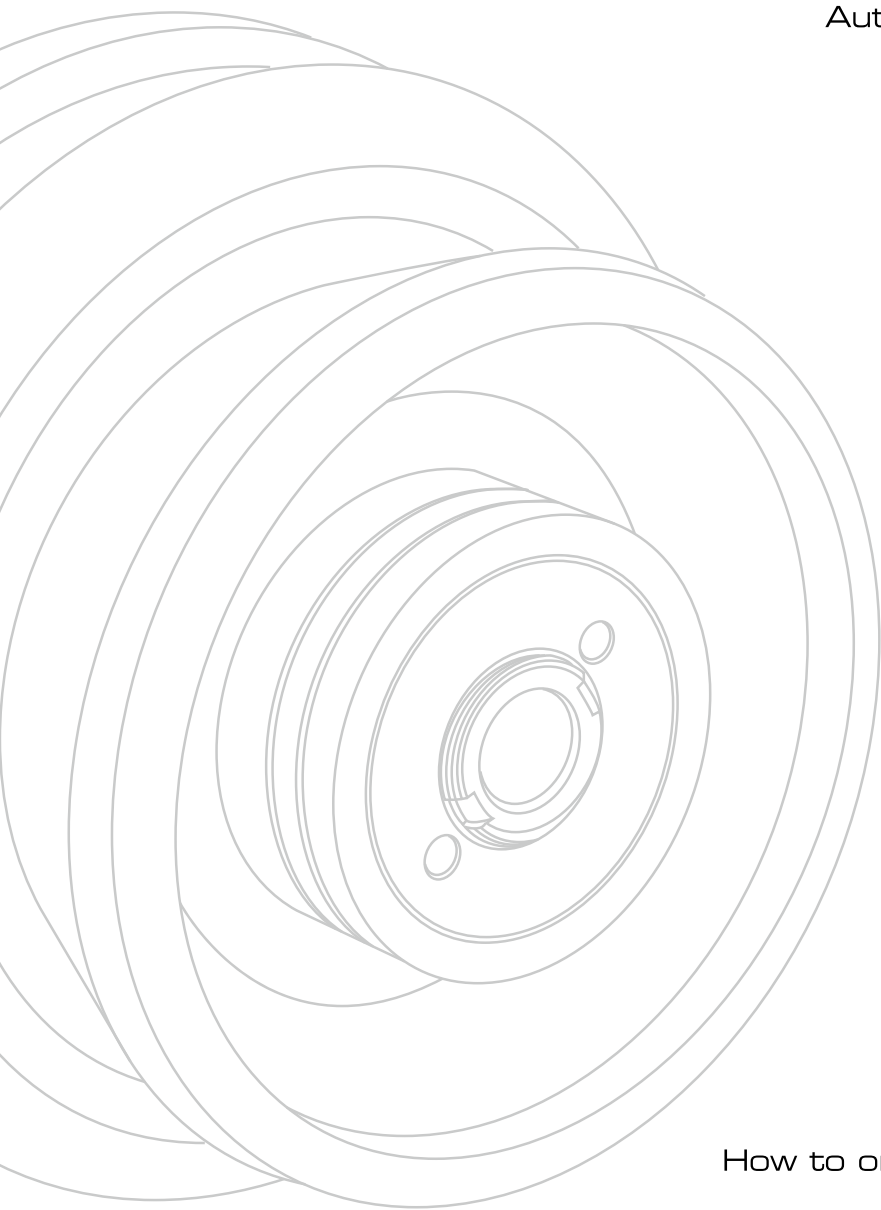
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Superabrasive grinding wheels

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Superabrasive grinding wheels

Diamond tools for

nd

Applications



08-15

Automotive
engine • turbochager



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gear • steering • brake



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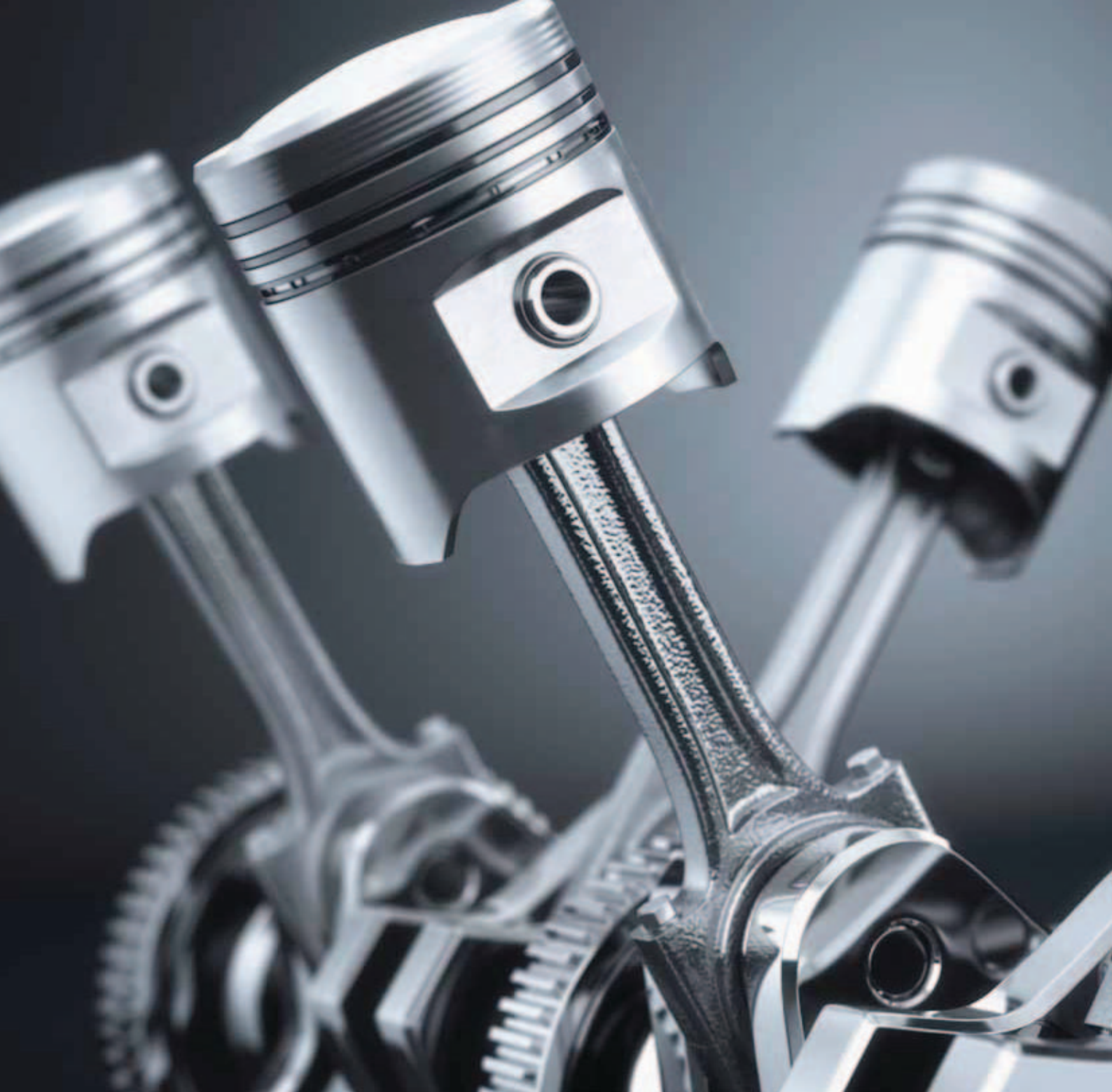
54-55

Turbine



56-59

**Stationary
dresser**



Vitrified CBN wheel
For camshaft



Vitrified CBN wheel
For crankshaft



EHWA industrial diamond tools are widely used in this industry, and play a key role in machining main automotive components including the cylinder head and the cylinder block.

Diamond tools for **Automotive**

engine • turbochager



Nozzle bore grinding wheel
For fuel injection



Metal honing stones
For cylinder block and connecting rod



Rotary dresser
For turbocharger

Automotive | engine

Camshaft grinding



Vitrified CBN wheel
For camshaft



Camshaft grinding

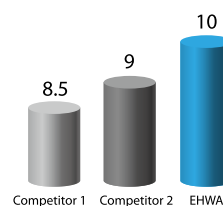
■ Benefits of EHWA vitrified CBN wheels for camshafts

- High removal rate & low grinding force
- Excellent surface finish and profile stability
- Increased dressing intervals and longer wheel life

■ Increased material removal rate

EHWA vitrified wheels enable the removal rate to increase up to 18% when grinding camshafts, compared to the competitor's.

- **Work material** – chrome molybdenum steel (Sintering)
- **EHWA wheel specification** – B126L200VEW
- v_s (wheel speed) – 120m/s
- v_f (feed rate) – 0.08mm/s
- ∂_e (stock removal) – 0.8mm
- d_w (work diameter) – 30-50mm camLobe
- d_s (wheel diameter) – 450mm



Qw' (removal rate)

$$Qw' = \pi \times d_w \times v_f \times \partial_p / b_s \text{ [mm}^3\text{/mm/s]}$$

d_w - work diameter

v_f - feed rate

∂_p - lobe width

b_s - wheel width



Automotive | engine

Crankshaft grinding



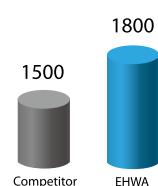
Crankshaft grinding

■ Benefits of EHWA vitrified CBN wheels for crankshafts

- Longer dressing intervals and tool life
- Consistent surface finish and high profile stability
- Reduced thermal and mechanical damage to workpiece

■ Wheel life increased by 20%

- Work material – FCD (casting)
- EHWA wheel specification – B151L200VEWN
- v_s (wheel speed) – 80m/s
- v_f (feed rate) – 0.05mm/s
- ∂_e (stock removal) – 1.2mm
- d_w (work diameter) – 60mm
- d_s (wheel diameter) – 650mm



G-RATIO

G-ratio =
workpiece's removal volume /
CBN wheel wear volume

Automotive | engine

Injector bore grinding



Bore grinding wheel
For fuel injection



Seat grinding wheel

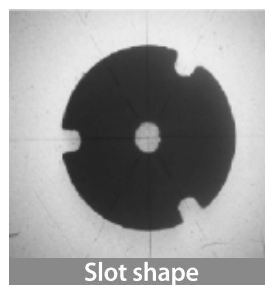


| Advantages |

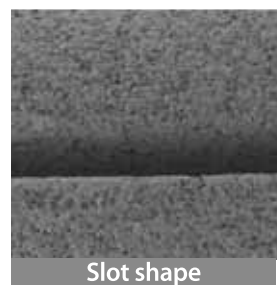
- Free cutting abrasive
- Longer dressing interval & more efficient utilization
- Consistent grinding performance
- Highly precise wheel shape including coolant hole and slots

| Standard Specifications |

Grinding	Bore, Seat
Coolant hole size	H 0.5~1.0mm
Wheel size	D 1.5~20mm
CBN grit size	29μm~76μm
Slot	0.4~1.5mm



Slot shape



Slot shape

Automotive | engine

Metal honing stones

Metal honing stones

For cylinder block and connecting rod



For cylinder block



| Advantages |

- Longer tool life & cost saving

Type	Stone mesh	Bond modification
Rough	D251~D91	MB,MS,MJ series
Semi-Finish	D76~D30	
Finish	D25~D8	MJ,MH series

For connecting rod



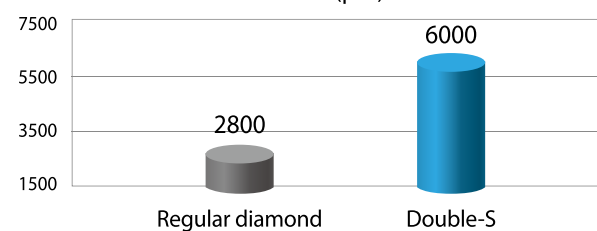
| Advantages |

- Longer tool life & cost saving

Stone Mesh	Bond modification
D151~D25	MJ,MH,MS series

| Performance |

Tool life (pcs)



| Double -S |

- Newly developed diamond with special coating
- Excellent roundness and surface finish
- Double the tool life

Rotary dresser



| Engine valve |

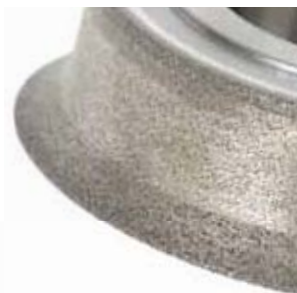
The valve consists of a head, face and stem. It is installed to control the mixed gas required for power stroke into the combustion chamber and to exhaust the gas generated after combustion.

| Advantages |

- Customized design
- Highly precise dressing with long life
- Able to be designed as either a single product or an assembly

Rotary dresser Grinding part

01 Face and neck



02 Stem centerless



03 Groove and chamfer



Automotive | turbocharger

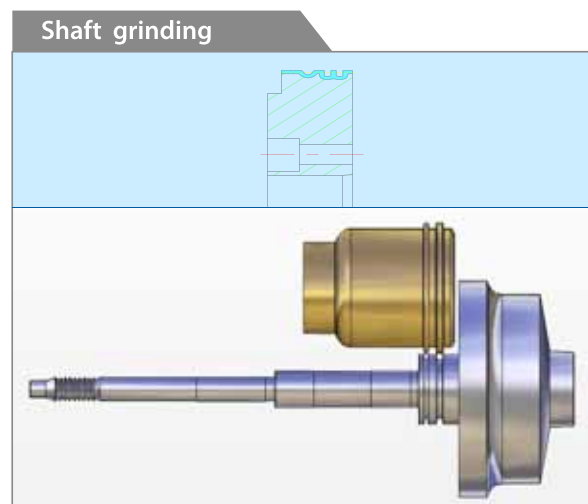
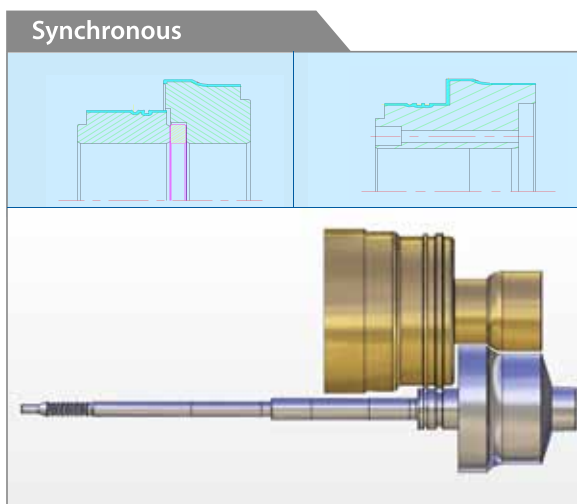
Rotary dresser



A turbocharger, or colloquially turbo, is a turbine-driven-forced-induction device that increases the efficiency of an internal combustion of engine and output of power by forcing extra air into the combustion chamber.

| Advantages |

- Customized design
- Highly precise dressing with longer life
- Increased tool life with CVD reinforcement in key wear areas





Gear grinding dresser
For gear



Metal honing stone
For gear



Vitrified CBN wheel
For gear and
shaft angular grinding



Vitrified CBN wheel
For gear internal grinding

Diamond tools for
Automotive

gear • steering • brake



Vitrified CBN wheel
For CV joint



Rotary dresser
For CV joint



CBN segment
For brake disc



BSL & electroplated wheel
For brake pad

Gear grinding dresser



Workpiece



Gear grinding dresser

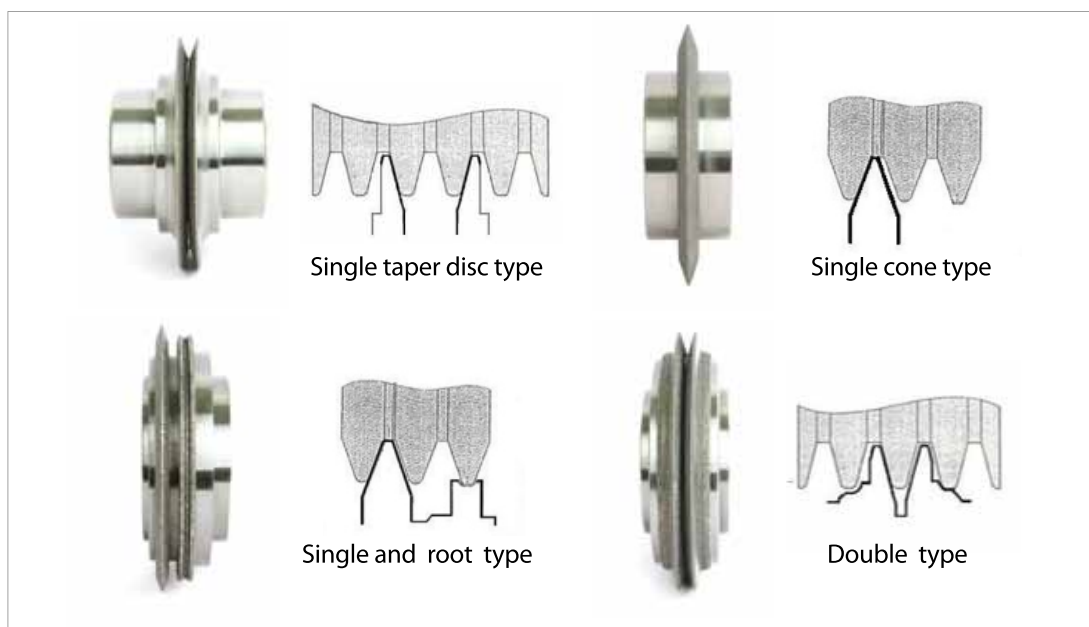
For dressing of worm wheel for gear grinding



| Advantages |

- Highly precise gear dresser due to strict raw material management
- Achieve the optimal gear profile with EHWA's precisely polished gear dresser

| Type of dresser |



Automotive | gear

Metal honing stone



Metal honing stone

For pinion gear, speed gear, sleeve gear, DCT gear, etc.



Pinion, speed, DCT gear

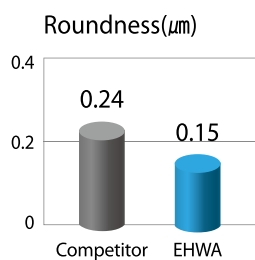
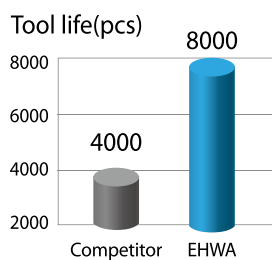


| Advantages |

- Longer tool life & cost saving
- Less grinding load
- Excellent roundness

Stone mesh	Bond modification
D181~D15	MB,MH, MS,MJ series

| Performance |



Synchro sleeve gear



| Advantages |

- Effective inner diameter honing of a sleeve gear
- Longer tool life and better precision than a competitor's product

Stone mesh	Bond modification
D76~D20	MB,MS series



Sleeve gear honing stone



Workpiece

Automotive | gear

Angular grinding



Vitrified CBN wheel
For angular grinding



| Advantages |

- Excellent grinding performance for gear component
- Longer dressing interval for cost saving and high production capacity
- High removal rate due to the free cutting capability
- Reduced cycle time
- Less mechanical & thermal damage to grinding surface

| Grinding condition |

- **Wheel speed** : 25 ~ 80 m/s
- **Removal amount** : 0.1 ~ 0.35mm D
- **Dressing amount** : 5 μ m ~ 30 μ m
- **Dresser** : diamond rotary dresser
- **Spindle axle degree** : 15 ~ 30 ~ 45
- **Shank material** : steel , aluminum alloy



Automotive | gear

Internal grinding

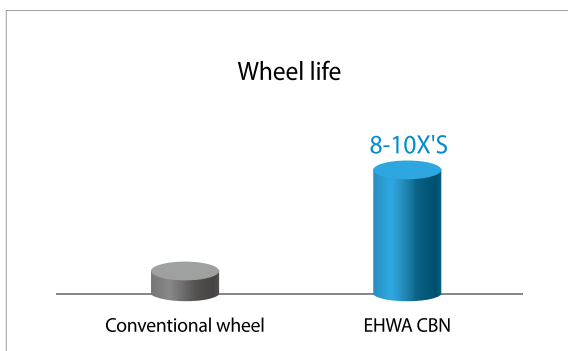


CBN wheel
For internal grinding



| Advantages |

- Excellent surface quality
- Longer wheel life and cost saving
- Faster setup of production line
- High stock removal rate



Automotive | steering

CV Joint grinding



Vitrified CBN wheel
For CV joint

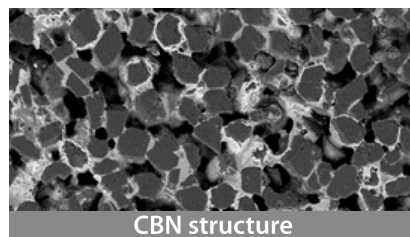


| Advantages |

- High stock removal for improved production capacity
- Outstanding surface quality with low heat and tight tolerance
- Longer dressing intervals & less wheel wear to reduce cost and improve consistency
- EHWA has specialized solution for cv joint part grinding

Cage window grinding

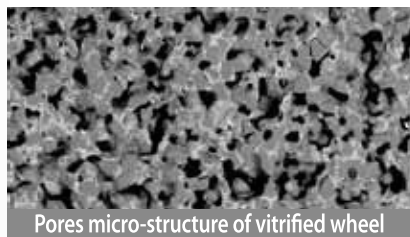
Standard specification
B126M180VBTM



CBN structure

Outer race grinding

Standard specification
B181M160VBTM



Pores micro-structure of vitrified wheel

Automotive | steering

CV Joint grinding rotary dresser



Rotary dresser
For CV joint



| CV joint |

Components that transmit the power of the engine delivered to the transmission to the wheels at constant speed.

| Advantages |

- Customized design
- Highly precise tolerance
- Outstanding grinding performance due to high diamond exposure

Inner race



Cage



Outer diameter of
outer race

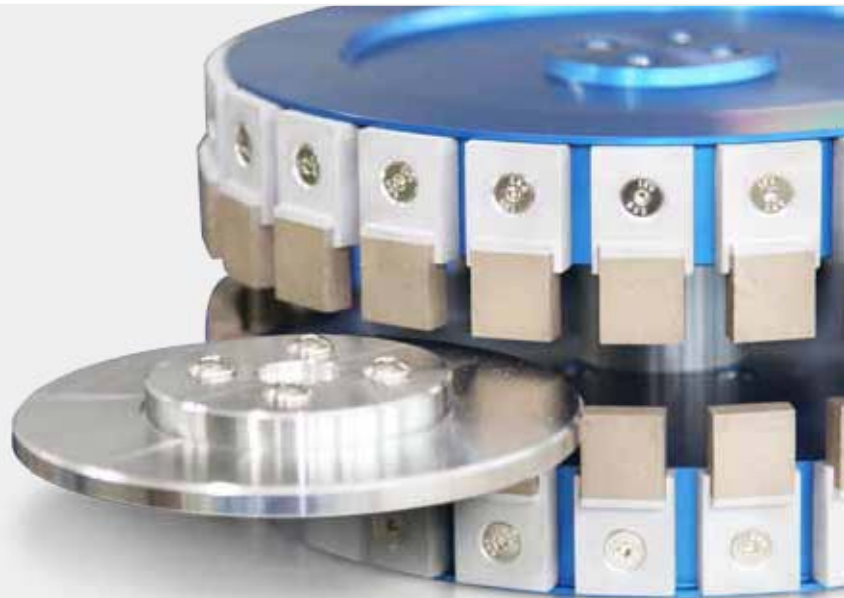


Automotive | brake disc

CBN segments



CBN segments
For brake disc

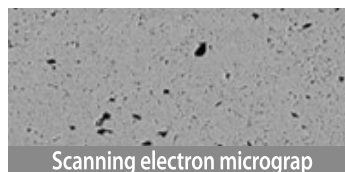


| Advantages |

- Longer tool life & cost saving
- Shorter cycle time due to high grinding speed

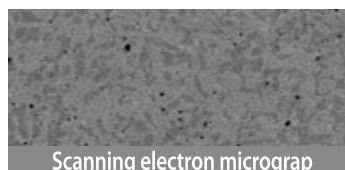
| Bond modification |

Workpiece
4WD (FC)



- Stone mesh : D181~D54
- Bond modification : MH series

Workpiece
2WD (SUS)



- Stone mesh : D181~D54
- Bond modification : MP series

Automotive | brake pad

BSL & Electroplated wheels



BSL & Electroplated wheels
For brake pad

Workpiece : Brake pad



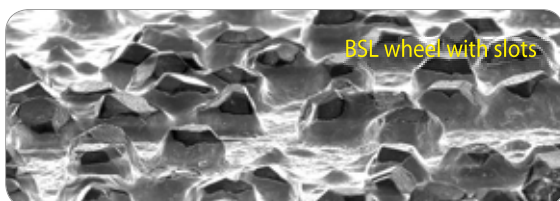
BSL wheel



BSL wheel with slots

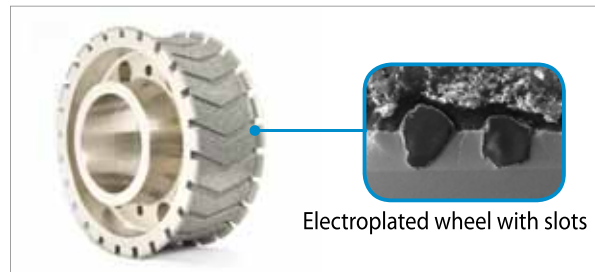
| Advantages |

- Excellent free cutting performance & easy chip flow due to high diamond exposure
- Longer wheel life than E/P wheels reduce cost



BSL wheel with slots

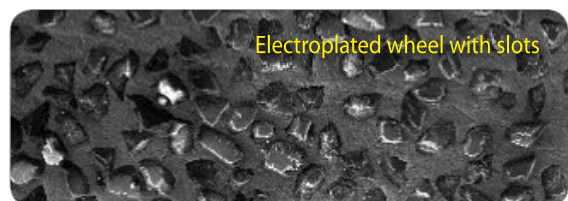
Electroplated wheel



Electroplated wheel with slots

| Advantages |

- Synchronized for chamfer, slot, and face grinding
- Available in various, complex designs
- Proper for various materials such as composites, ceramic and rubber
- Outstanding grinding performance
- Can be refurbished multiple times



Electroplated wheel with slots



Vitrified CBN wheel
For bearing



Superfinish CBN honing stone
For bearing



Rotary dresser
For water pump, ball bearing



Metal cup dresser
For bearing ID grinding

EHWA industrial diamond tools are indispensable in modern industries and are often applied to bearing and aerospace industries. In particular, EHWA has been providing the worldwide leading aerospace engine manufacturing and bearing companies as its main customers with the very best products.

Diamond tools for **Bearing**



Double disc surface
grinding wheel
For bearing



Taper roller face
grinding wheel
For bearing



Rotary dresser
For LM guide



Rotary dresser
For ball screw

Vitrified CBN wheel



Grinding parts

① ID (Inner race internal diameter) / ② IR (Inner race) / ③ OR (Outer race) / ④ Lip / ⑤ Ring face

| Advantages |

- Higher removal rates and shorter cycle times
- Reduced grinding force
- Reduced mechanical & thermal damage to bearing
- Stable and precise grinding performance for superior quality, surface finish, cylindricity and less size deviation

| Grinding Condition |

- **Wheel speed** : 30 ~ 80 m/s
- **Removal amount** : 0.1 ~ 0.35mm D
- **Dressing amount** : 5 ~ 30 μ m
- **Dressing ratio** : 0.3~0.6
- **Dresser** : Diamond rotary dresser
- **Coolant** : Oil, emulsion

| Mounting type |



Bearing Super finishing stone



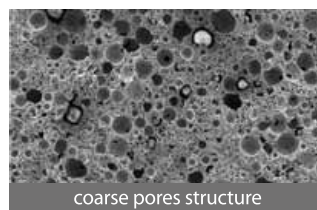
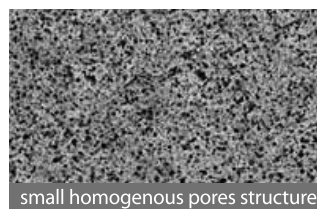
Superfinish CBN honing stone
For bearing



| Advantages |

- **Longer tool life and improved productivity**
 - 5~10 times longer tool life than conventional stone
 - Shorter cycle time for honing
 - higher stock removal rate
- **Excellent performance**
 - improved surface finish
- **ECO-friendly**
 - No sulfur
 - More consistent performance with less scrap

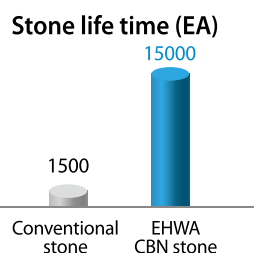
Micro structure of CBN stone



| Taper roller bearing raceway super finishing |

Condition

- Vw : 100~200rpm
- Removal : 5 μ m
- Surface roughness : Ra 0.06 μ m
- Stone specification : B2400K120VHWP



Rotary dresser



Rotary dresser
For water pump & ball bearing



- Diamond rotary dresser for ball / roller / hub bearings & water pump bearing

| Advantages |

- Highly precise and complex grinding
- Less dressing load and excellent dressing performance
- Longer tool life and cycle time reduction
- Available for dressing of vitrified CBN wheel



Bearing

Metal cup dresser



Metal cup dresser
For bearing ID grinding



| Advantages |

- **Longer life**
 - 20,000~30,000 times (depending on the wheel size)
- **Precise dressing**
 - Less grinding deviation after dressing
- **Longer dressing interval and outstanding performance**



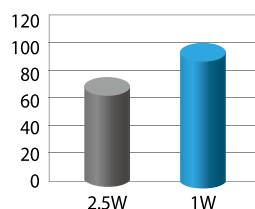
Metal cup dresser



Rotary cup dresser

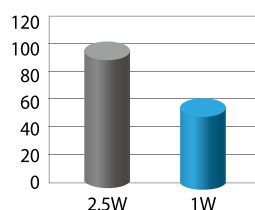
| Reference |

With steel quill
Vitrified wheel



Dressing performance
depending on tip width
on width of diamond layer

With steel head
Vitrified wheel



Workpiece dimensional stability
depending on tip width
on width of diamond layer

Face grinding wheel



Double disc surface grinding wheel
For bearings



| Ring & roller face grinding wheel |

EHWA diamond manufactures wheels for bearing face grinding

It improves the productivity by reducing cycle time

It is suitable for cost saving and quality improvement with longer life and better surface finish

| Advantages |

- Longer life
- Short cycle time
- Excellent surface finish

Face grinding

for IR/OR ring of ball bearing



| For application |

- Roller of needle bearing
- Roller of roller bearing
- IR/OR ring of bearing

Face grinding

for roller of roller bearing



Taper roller face grinding wheel



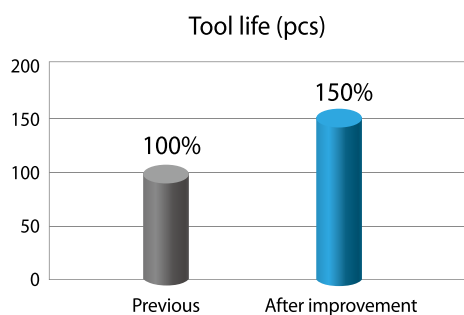
Taper roller face grinding wheel
For bearings



| Advantages |

- Longer tool life & cost saving
- Higher stock removal rate and superior performance
- Excellent surface finish

| Performance |



Bearing

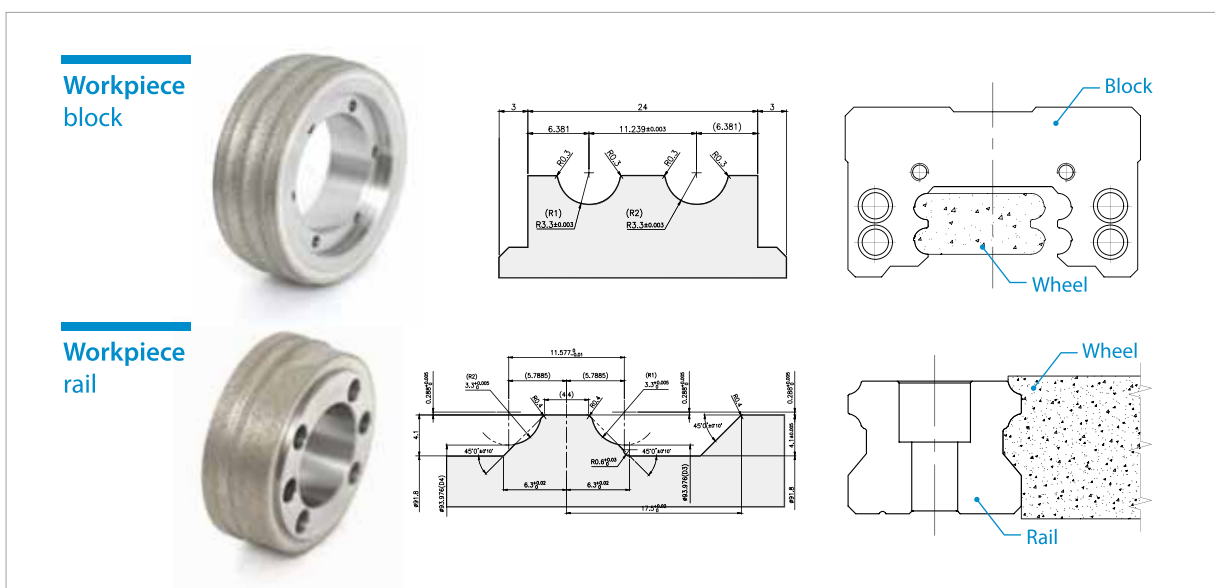
Rotary dresser · for LM guide



Rotary dresser
For LM guide



- LM guide is a linear motion product that is used to manufacture automotive equipment.
- LM guide consists of a block and rail, and balls between them rotating.
- Rotary dresser is used for dressing the CBN wheel that polishes the seat of the ball between a block and rail.



Bearing

Rotary dresser · for ball screw



Rotary dresser
For ball screw



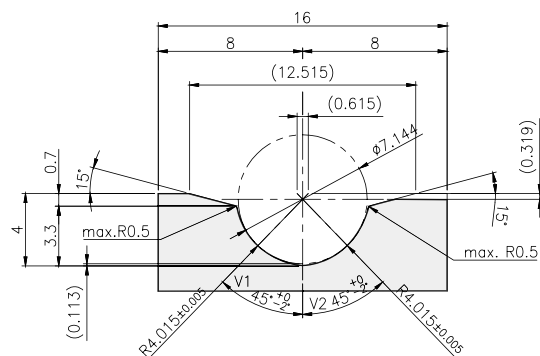
| Ball screw |

- An assembly that converts rotational motion into linear motion.
- Consists of ball screw and nut.

| Advantages |

- Highly precise dressing with longer life
- High diamond concentration

Workpiece
R type





Automotive glass



Home appliance glass

EHWA industrial diamond tools are widely used in the optical industry, owing to characteristics of glass and optic's raw materials. For instance, the diamond tools are effectively used for grinding eye glass lens, automotive safety glass, crystal, and various other lenses.

Diamond wheels for **Glass**



Architectural glass



Optical lens

Automotive / home appliance / optics



Metal edge wheel
For automotive & architectural glass

Automotive glass



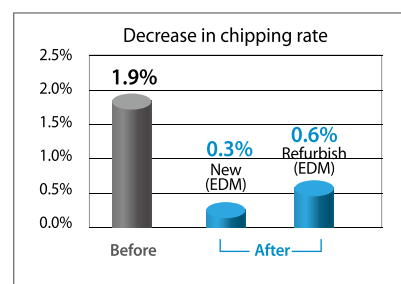
Grit size	Bond	Scanning electron micrograph	Bond features
D107~D30	MB series		Softer
	MC series		Standard
	MG series		Harder

Home appliance glass



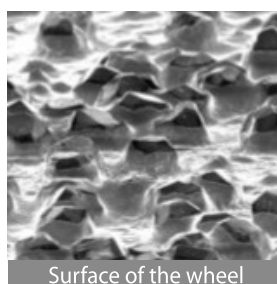
Newly developed wheels to improve edge quality and reduce chips.
The deviation of chipping rate is less than 1% after refurbish.

| Performance |





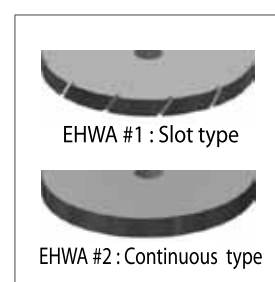
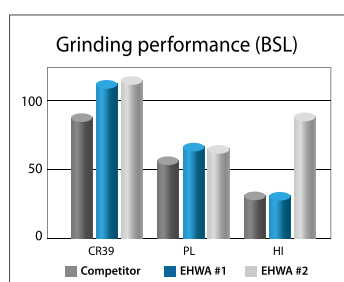
Optical lens

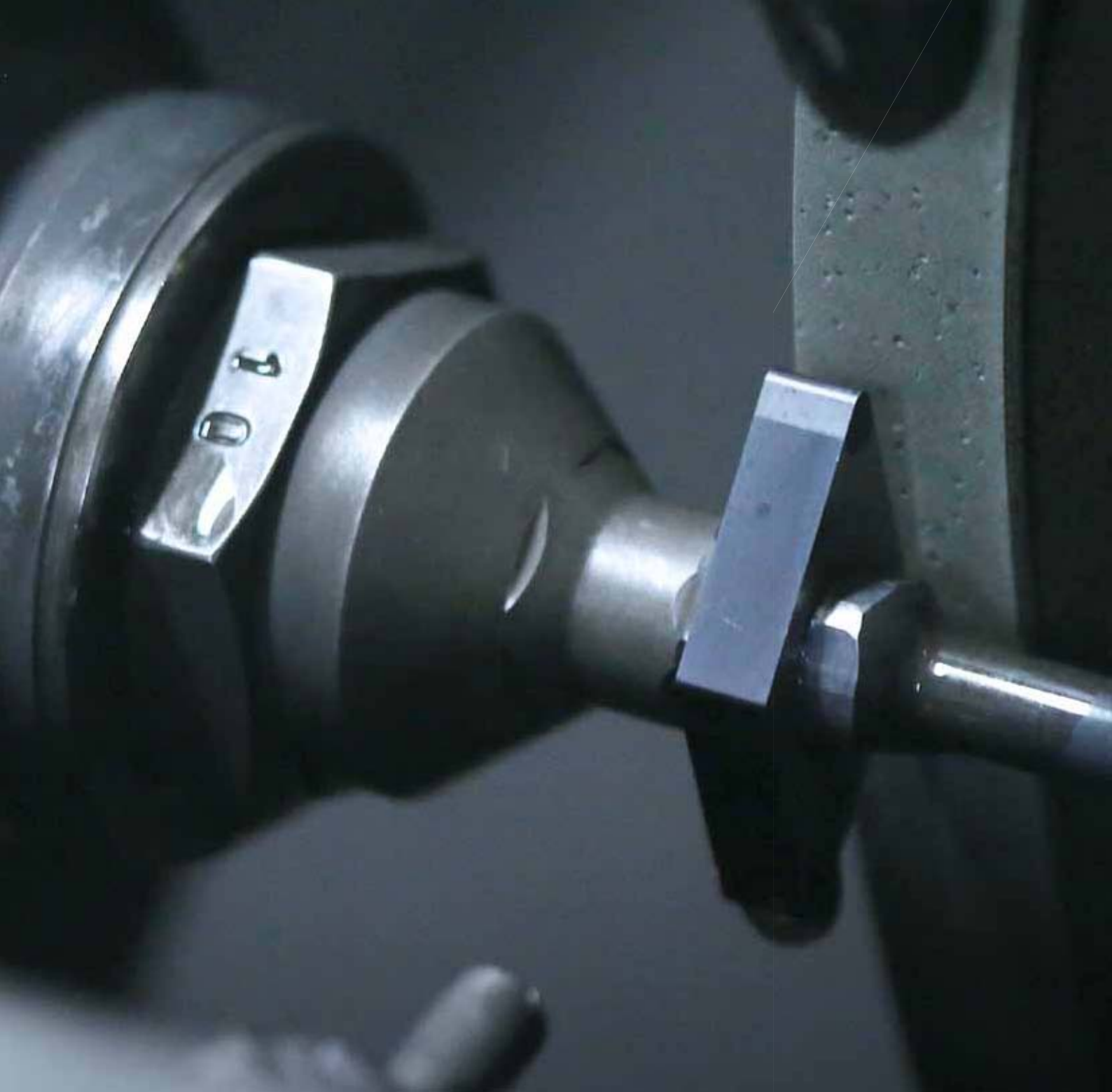


| Specification |

Application	Type	Mesh
Roughing (GL)	MD-1A1	D251~D151
Roughing (PL)	MD-BSL	D301~D151
Finishing	MD-1EE6Y	D46~D30
Polishing	MD-1EE6Y	D2

| Performance |





Periphery wheel
For inserts



Top & bottom wheel
For inserts



Top & bottom wheel
For inserts

EHWA industrial diamond wheels are widely used to grind various cutting tools. The cutting tools are classified by raw material type, such as high speed steel, carbon steel, ceramics, carbide, and PCD/PCBN tools, and EHWA products are often used to grind cemented carbide tools whose main raw material is tungsten.

Diamond grinding wheels for

Cutting tools



Hybrid wheel pack
For rotating tool



Precision wheel pack
For mirco rotating tool



Tool grinding wheel
For tip saw

Cutting tools

Insert · periphery wheel, top & bottom wheel



Periphery wheel
For insert



Top & bottom wheel
For insert

■ Insert grinding wheel

EHWA manufactures a full line of insert grinding wheels for carbide, ceramic, cermet and PCD/PCBN materials. These wheels are designed with the optimal specifications considering the cycle time and dressing intervals for optimum productivity. Their grinding performance is excellent, therefore, they produce uniform inserts with a superior finish and chip-free edge.

| Periphery grinding |

- Shorter cycle time by high feed rate
- Small chip size
- Longer dressing intervals
- Machine : Agathon, Wendt, Waida, Ewamatic and Ewag

| Top & bottom grinding |

- Shorter cycle times
- Longer dressing intervals
- Improved dimensional stability
- Machine : Stahli, Peter Wolters, Wendt WBM, Agathon T&B and Fujisanki

| Bond table by application |

Product		Low content —————→ High content					
Periphery	PCD	Bond hardness weak		VDGF		Bond hardness strong	
	PCBN			VHGN			
		High performance resin				Hybrid	
	Carbide			BXT	SA2	XA20	BMX series
	Cermet	BXB	BXC	SA4		RM series	
	Ceramic						
Top & bottom		Standard resin			High performance resin		
	Carbide						
	Cermet	B32		BQ / BG	BXCM	BXS4	SA5
	Ceramic	B26					

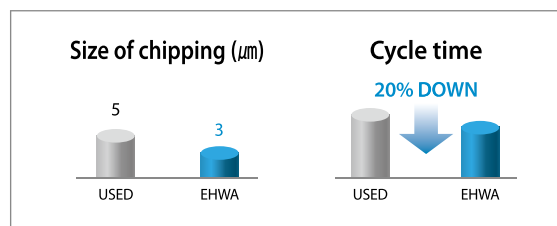
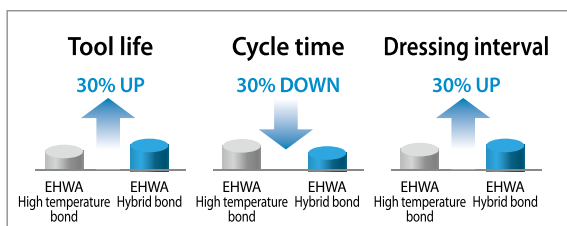


■ Periphery grinding

High temperature polyimide bond is commonly applied for periphery grinding. Recently, hybrid and soft-metal bonds are the new trend for reduced cycle time, smaller chip size, and better dimensional stability and productivity.

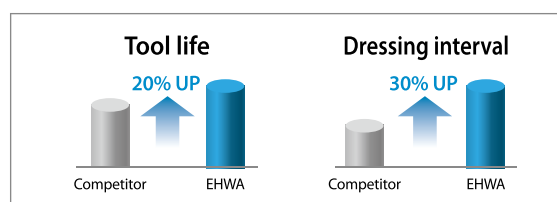
- **Machine :** Wendt 715 WAC Quattro
- **Workpiece :** Carbide insert
- **Wheel speed :** 20 m/s
- **Wheel spec :** RD-11A2, 400D-39T-10W-6X-355.06H
- **Bond :** D46 High temperature resin bond & D40 Hybrid bond

- **Machine :** Agathon
- **Workpiece :** PCBN Insert
- **Wheel speed :** 18 m/s
- **Wheel spec :** VD-11A2, 400D-39T-15W-6X-355.06H
D6M120VHGN



■ Top & bottom grinding

- **Machine :** Wendt WBM221-Duo Lift
- **Wheel :** RD-2A2T, 501D-5X-40W, D126BXS4
- **Workpiece :** Various carbide inserts
- **Oil coolant**



Cutting tools

Rotating tool



Hybrid wheel pack
For rotating tool



Precision wheel pack
For micro rotating tool

■ Polyimide bond

Thermal stability of polyimide bonds is better than phenol or epoxy bonds, therefore, their grinding performance and wheel life are better than phenol and epoxy bonds.

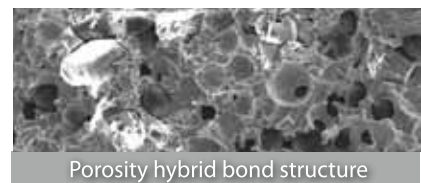
■ Hybrid bond

Hybrid bond, a combination of polyimide and metal bond, are able to meet more challenging requirements as this bond has the best advantages of both polyimide and metal bond :

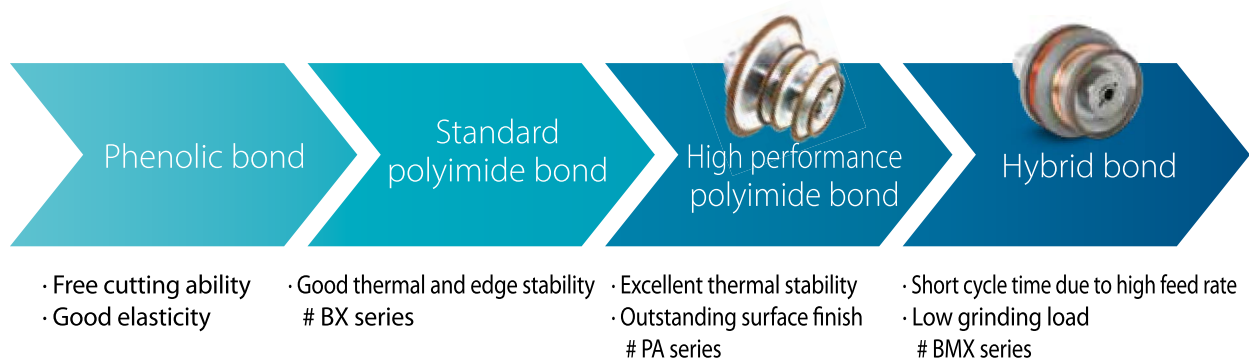
Polyimide's good grinding performance and elasticity and metal bond high wear resistance and high thermal stability.

■ Porosity hybrid bond

This pore structure helps diamond protrusion and makes coolant flow easily. It also lowers the grinding load, and thereby increases the max allowable feed rate, which reduces cycle time.



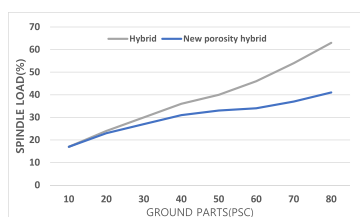
Porosity hybrid bond structure





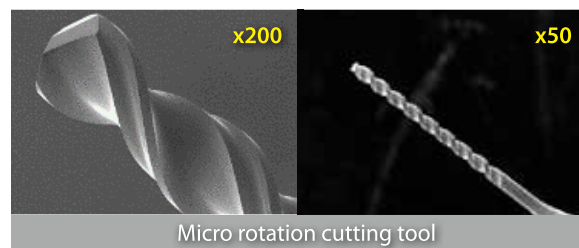
Drill & endmill

- **Machine** : ANCA FX7(19kW)
- **Material** : Carbide Φ 12–50mm(LOF), 2 Flutes (K10)
- **Wheel speed** : 18 m/s
- **Feed rate** : 120 mm/min
- **Depth of cut** : 2.4 mm



Precision cutting tool

- High Productivity at the lowest tool cost
- Greatly improved surface and edge quality
- Accurate edge stability



Tap



Rotary dresser



| Specification |

Type	
VB-1A1 (grinding)	R/D-RR(dressing)

Rotary burr



Workpiece



| Specification |

Type	Specification	Bond
MD-1V1	110D ~ 160D / 30V~60V	ME4 series

Cutting tools

Circular tip saw / hob cutter / broach



Tool grinding wheel
For circular tip saw

■ Circular tip saw

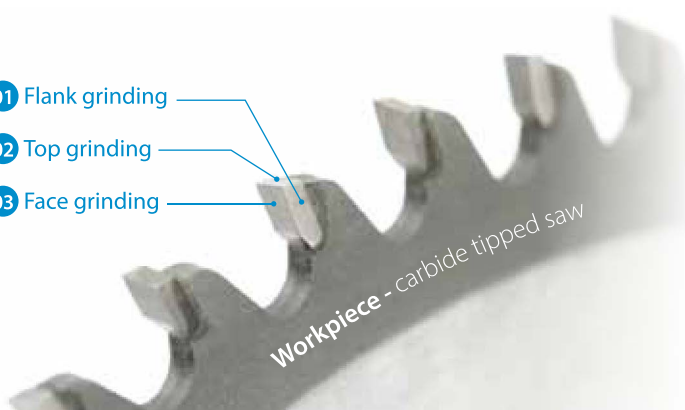
| Advantages |

- Longer life time
- Shorter cycle time
- Fine surface finish
- High dimensional stability

01 Flank grinding

02 Top grinding

03 Face grinding



Workpiece - carbide tipped saw

01 Flank grinding



02 Top grinding



03 Face grinding



Workpiece
high speed steel saw blade

Profile grinding





| Profile grinding of high speed steel saw blade |

• Wheel specification : RB-14F1/S, CBN107

Type	D	x1	x2	U	Bond type
RB-14F1/S	150	6	8	1,1.3, 1.6, 2, 2.5	Hardened resin bond
		6	10	3	
		8	12.5	3.5	
		8	12.5	4	
		10	15	5, 6	
	200	6	8	1, 1.3, 1.6, 2, 2.5	
		6	10	3	
		8	12.5	3.5	
		8	12.5	4	
		10	15	5, 6	

■ Hob cutter



■ Broach





Vitrified wheel
(CFRP body)
For artificial knee joint



Vitrified wheel
(Al alloy body)
For artificial knee joint



Vitrified wheel
(Steel + Al body)
For artificial knee joint



Electroplated wheel
(Steel + Al body)
For artificial knee joint

Superabrasive wheels are new trend
for this rapidly developing industry.

Diamond wheels for **Medical**



Rotary dresser
For artificial knee joint



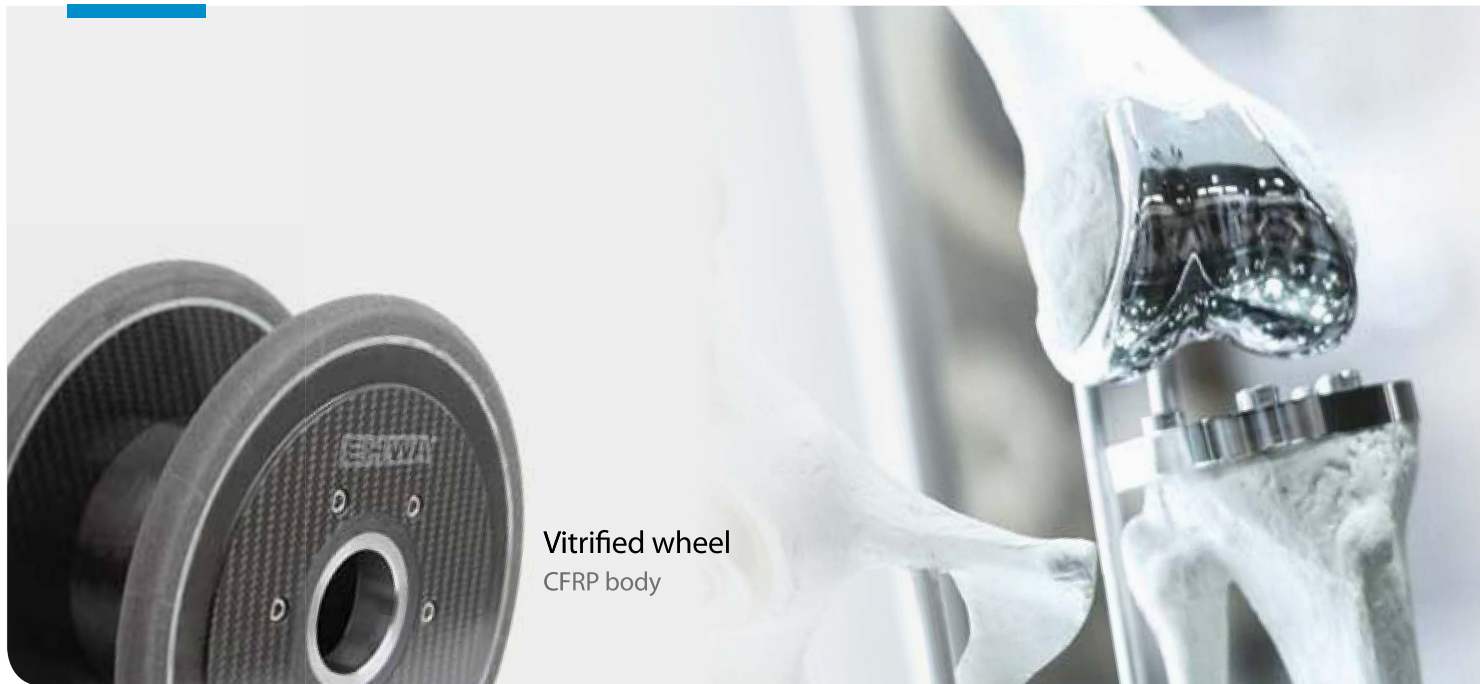
Wire grinding wheel
For medical wire



**Electro chemical
grinding wheel**
For needles(SUS,SUS304)

Medical

Artificial knee joint



Vitrified wheel
CFRP body

Vitrified wheel / CFRP body



Vitrified wheel / Al alloy body



Vitrified wheel / Steel + Al body



Electroplated wheel / Steel + Al body



Rotary dresser
For artificial knee joint



| Features |

- Ideal for artificial knee joint grinding application
- High stock removal
- Well balanced for high speed operation
- Longer dressing interval & wheel life
- Excellent grinding performance and good surface quality



Rotary dresser

Standard dimensions for artificial knee joint grinding

Item	Wheel size	Specification
Vitrified CBN	VB-14F1, 250D-120T-20X-16U-8R-51H,	B252L150VBW
	VB-14F1, 240D-120T-20X-18U-10R-51H	B252L150VBW
Diamond rotary dresser	ROTARY-RP 98D-25T-10R-25H	
	ROTARY-IP1, 175D-2R-22T-52H	
Electroplated CBN	EB-1FF1, 200D-120T-20U-12R-51H	B427
	EB-1FF1, 200D-120T-12U-6R-51H	B252,B301
	EB-1FF1, 160.45D-16T-8R-20H B427	B427

Medical

Medical wire



Wire grinding wheel
For medical



Wire grinding wheel / For medical wire

| Advantages |

- Low pressure & free cutting performance
- Excellent surface quality of wire
- Long wheel life & cost saving
- Well balanced wheel



Workpiece
Medical wire

Wire grinding wheel / For medical wire

| Advantages |

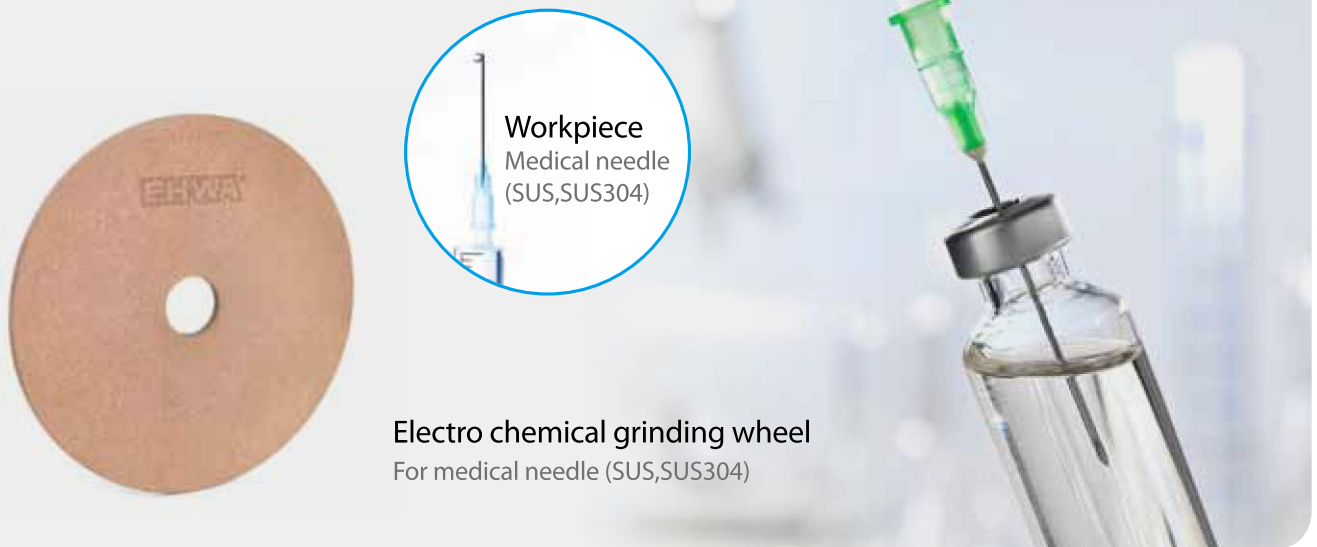
- Very straight face with a sharp edge
- Low cutting force & free cutting wheel
- Excellent surface quality of wire



Workpiece
Medical wire

Medical

Medical needle



- Electrolytic polishing wheel for hypodermic needle.

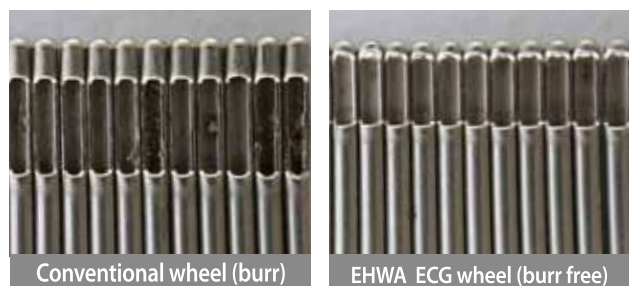
| Standard dimensions |

Type	Specification	Bond
MB-1A1	204D-3T ~ 15T	
MB-3A1	204D-1U~2.9U	

| Features |

- Low cost per part
- Increased stock removal
- Superior surface quality (burr free)
- Consistant grinding performance

Comparison of surface quality

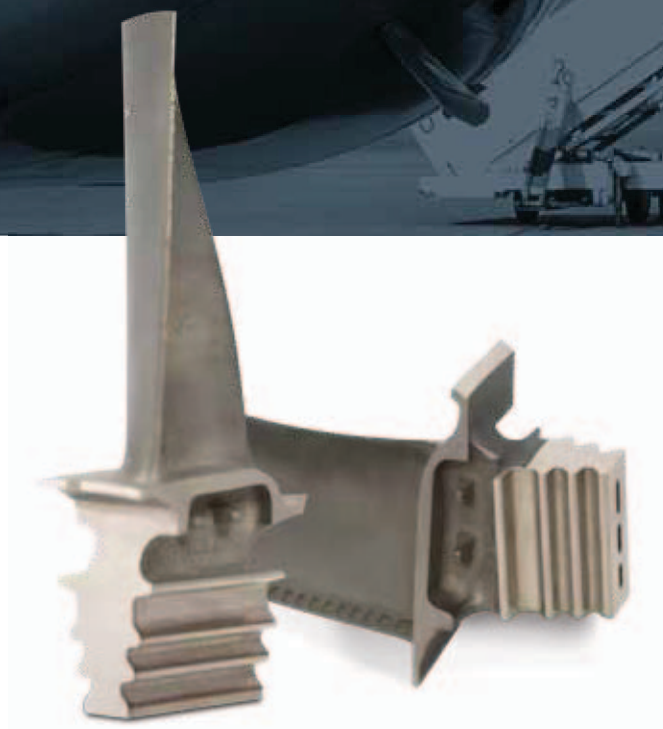




Rotary dresser for
Turbine



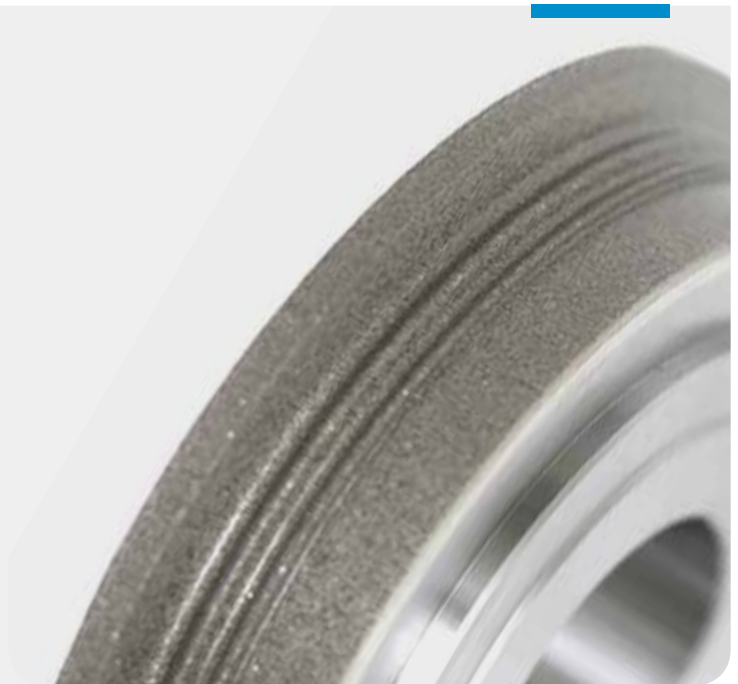
Rotary dresser
For turbine blade



Rotary dresser **Turbine blade**



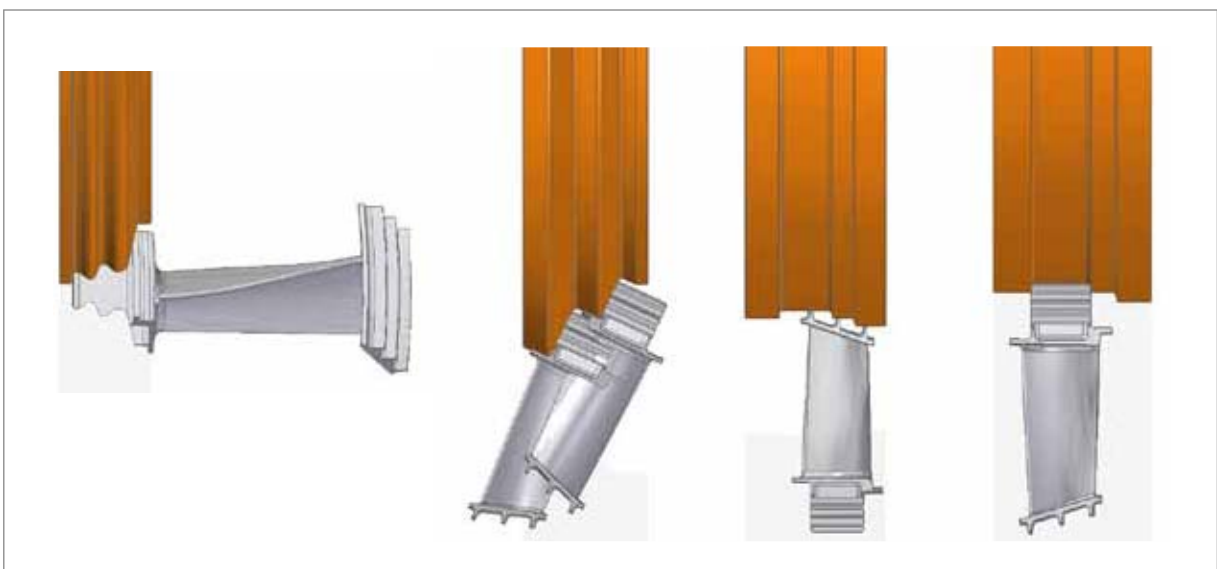
Rotary dresser
For turbine blade

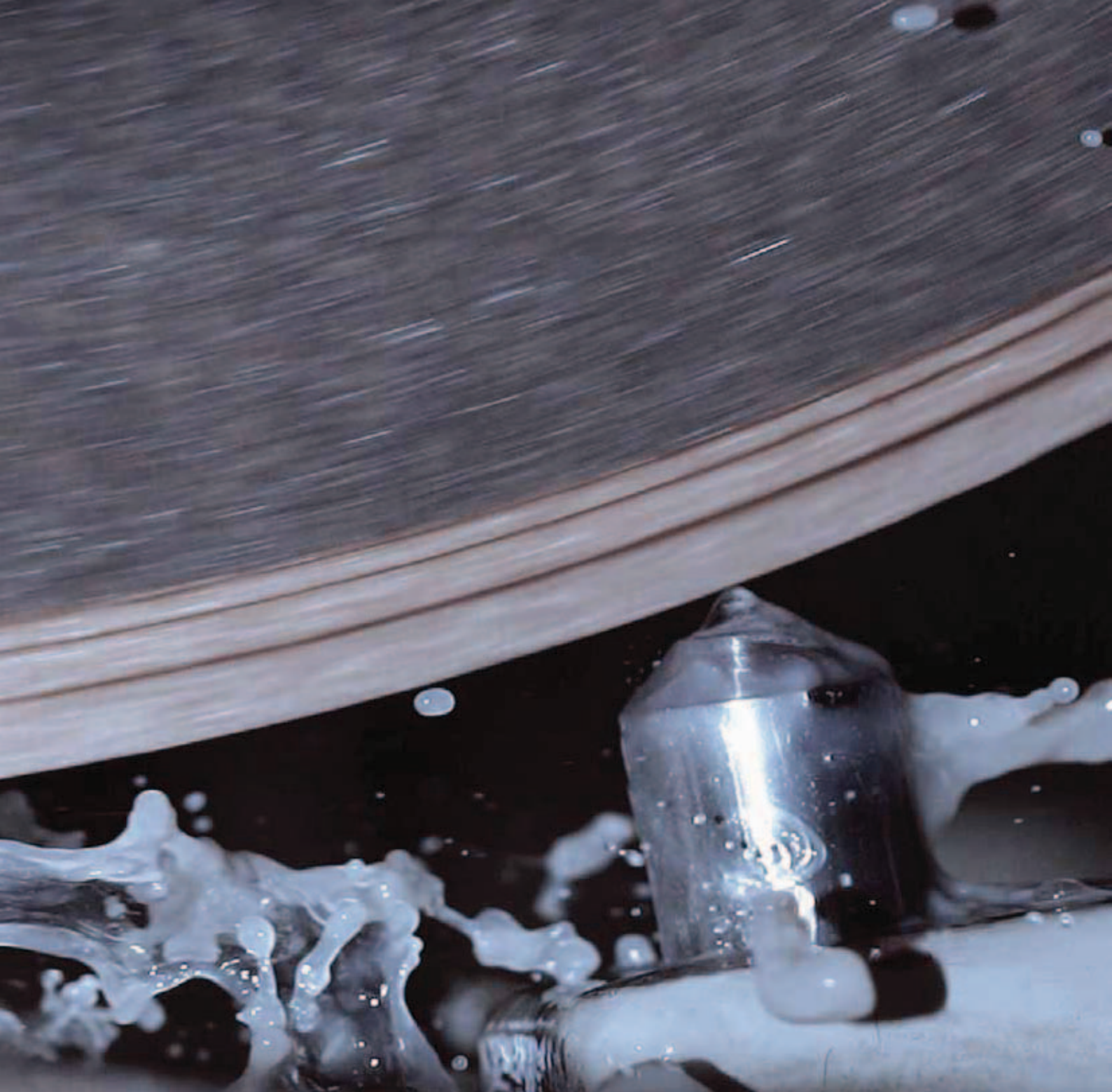


- **Turbine blade** : Aerospace turbine, power generator turbine & shipbuilding turbine

| Advantages |

- Custom roll design based on work piece
- Superior tool life and tool precision
- Stable dressing performance in creep feed grinding





Material for dresser

* SDD(Single-point Diamond Dresser), FDD(Forming Diamond Dresser),
MDD(Multi-point Diamond Dresser), IDD(Impregnated Diamond Dresser)



Natural diamond

· Application : SDD, FDD, MDD, IDD



Mono diamond

· Application : SDD, FDD, MDD
· Almost same properties as natural diamond



CVD (Chemical Vapor Deposition)

· Application : SDD, FDD, MDD
· Almost same properties as natural diamond

Stationary dresser

For conventional abrasive wheel

Type of dresser



SDD

Single-point Diamond Dresser



FDD

Forming Diamond Dresser



MDD

Multi-point Diamond Dresser



IDD

Impregnated Diamond Dresser

Conventional abrasive wheel

Stationary diamond dresser



Diamond Dresser
Natural, synthetic diamond

Dresser recommendations for abrasive wheel type

* SDD(Single-point Diamond Dresser), FDD(Forming Diamond Dresser), MDD(Multi-point Diamond Dresser), IDD(Impregnated Diamond Dresser)

Straight
SDD, MDD, IDD



Tapered
SDD, MDD, IDD



Convex
SDD, FDD, MDD



Concave
SDD, MDD, IDD



Angled
FDD, MDD



Multi-angled
FDD, MDD





Dresser recommendations for abrasive wheel

Type	Applications	Note
SDD	For conventional abrasive wheels with straight shape, simple profile, thread and gear grinding	Classified by carat (Size range : 1/30~1.5CT)
FDD	For conventional abrasive wheels with simple and complex profile, thread and gear grinding	Classified by shape of angle and radius (Roof, Chisel, Cone)
MDD	For conventional abrasive wheels with straight shape and precise, complex profile grinding Ideal for precise angular profile	Classified by the number of diamond rods and types (available rods : 2~10)
IDD	Ideal for dressing large and wide conventional abrasive wheels. For dressing conventional surface and center-less abrasive wheels.	Classified by grit size (available mesh : #18~#140)

Superabrasive grinding wheels

Bond Type

Products

62-63

Resin bonded wheel

64-65

Metal bonded wheel

66-67

Vitrified bonded wheel

68-69

Electroplated wheel

70-71

Rotary dresser

72-73

Stationary dresser

Resin bonded wheel

The Industrial Revolution was a catalyst in the rapid and gigantic growth of the automotive and heavy machinery industries. As more and more 'difficult-to-grind' materials and alloys were being used by these industries, the demand for higher quality, effective, and durable machine tools for cutting, grinding, and machining such materials continued to escalate. As a result, superabrasive diamond and cubic boron nitride (CBN) tools were invented to meet the needs of these industries and their heavy requirements. Today, the development and use of these specialized tools has expanded to various industries as demand never ceases and new applications are being discovered.

One of the most demanded tools is the 'resin-bonded wheel', which is manufactured through the curing process of bonding diamond or CBN abrasives, with inorganic fillers, and using resins as binders, such as phenol and polyimide. Resin bonded wheels are now effectively applicable to all sorts of grinding operations such as surface grinding, cylindrical and centerless grinding, grooving and internal grinding, and etc.. It is ideally used for grinding super alloys, cermet, ceramic, glass, ferrite, high-speed steel, tool alloys, and many other new ultra-hard materials.



Resin bonded wheel



Many types of resin-bonded diamond wheels are specially made for fast and cool cutting. These are particularly suited for the grinding of carbide tipped and inserted tooling, such as saws, cutters, reamers, and etc.. In addition, they are utilized in precision grinding operations on carbide dies, rolls and carbide wear parts. Resin bonds are the best choice for the precision finishing of ceramics as well as grinding tungsten carbide and ceramic thermal spray coatings. When combined with CBN, resin bonds can be used for grinding high-speed steels, tools and die steels, and superalloys with above HRC 50.

EHWA offers our customers the latest and highest quality resin-bonded wheels available today. Our extensive R&D and expertise in manufacturing diamond tools since 1975 are evident in all our products. EHWA provides complete line of resin-bonded wheels such as cylindrical grinding wheels, creep feed wheels, tip sawing grinding wheels, insert grinding wheels, and etc., and are reliable for mass-production of ground parts, wet or dry, with consistent high finish surface.

EHWA pledges to serve and satisfy the demands of our global customers with high quality and reliable products at the most competitive price, speedy delivery, and faithful warrant service.





Metal bonded wheel

The invention of glass is arguably one of the most important and useful discoveries in our history. Glass provides us with aesthetics and the ability to see beyond closed and limited space. Glass is used in every corner of the world for immeasurable applications. Life without glass would be unimaginable. The endless applications and shapes of glass products are possible by the use of special tools.

The manufacture of glass for any application is obviously a delicate process and not as easy as one may think. Special metal-bonded diamond wheels were invented to grind and shape various kinds of glass. These tools are designed to effectively and efficiently grind glass for uses such as auto-glass, architectural glass, glasses and etc.

Metal bonded wheel



Automotive glass grinding wheels

Lens grinding wheels

Honing stones

The applications of metal bonded wheels are unlimited. In addition to glass grinding, applications have extended to grinding and sharpening carbide tipped saws, ferrite, ceramic, tungsten carbide, auto-parts, quartz, stone, and etc.

In the late 1970's, EHWA started to design and manufacture edge wheels for grinding of auto-glass, and all sizes of broun tubes, from 14 inches to 33 inches. In the early 1990's, EHWA successfully began manufacturing high quality edge wheels for grinding liquid glass, which is mostly used in the semi-conductor industry. Thereafter, EHWA began producing electrolysis grinding wheels to meet the needs of the high-tech industries.

EHWA is committed to the continued development of high quality metal bonded wheels to meet the diverse needs of our valuable customers worldwide.





Vitrified bonded wheel

There is a great demand for special bonded wheels that are harder than both resin and metal bonded wheels, for the use in automated equipment and systems, which both resin and metal bonded wheels will not suffice. These highly demanded bonded wheels must be durable with extended life and be self-truing and self-dressing in order to sustain maximum performance over long periods of heavy use. Vitrified-bond technology is today's answer.

A vitrified bond is actually a ceramic bond. It is extremely hard, yet free cutting, and combines the better characteristics of both resin and metal bonds. It provides a longer tool life, effective grinding, and high productivity to provide maximum performance with minimum performance with minimum maintenance.

Vitrified bonded wheel



PCD / PCBN insert grinding wheels



Injection nozzle bore grinding wheels



Bearing grinding wheels and honing stones



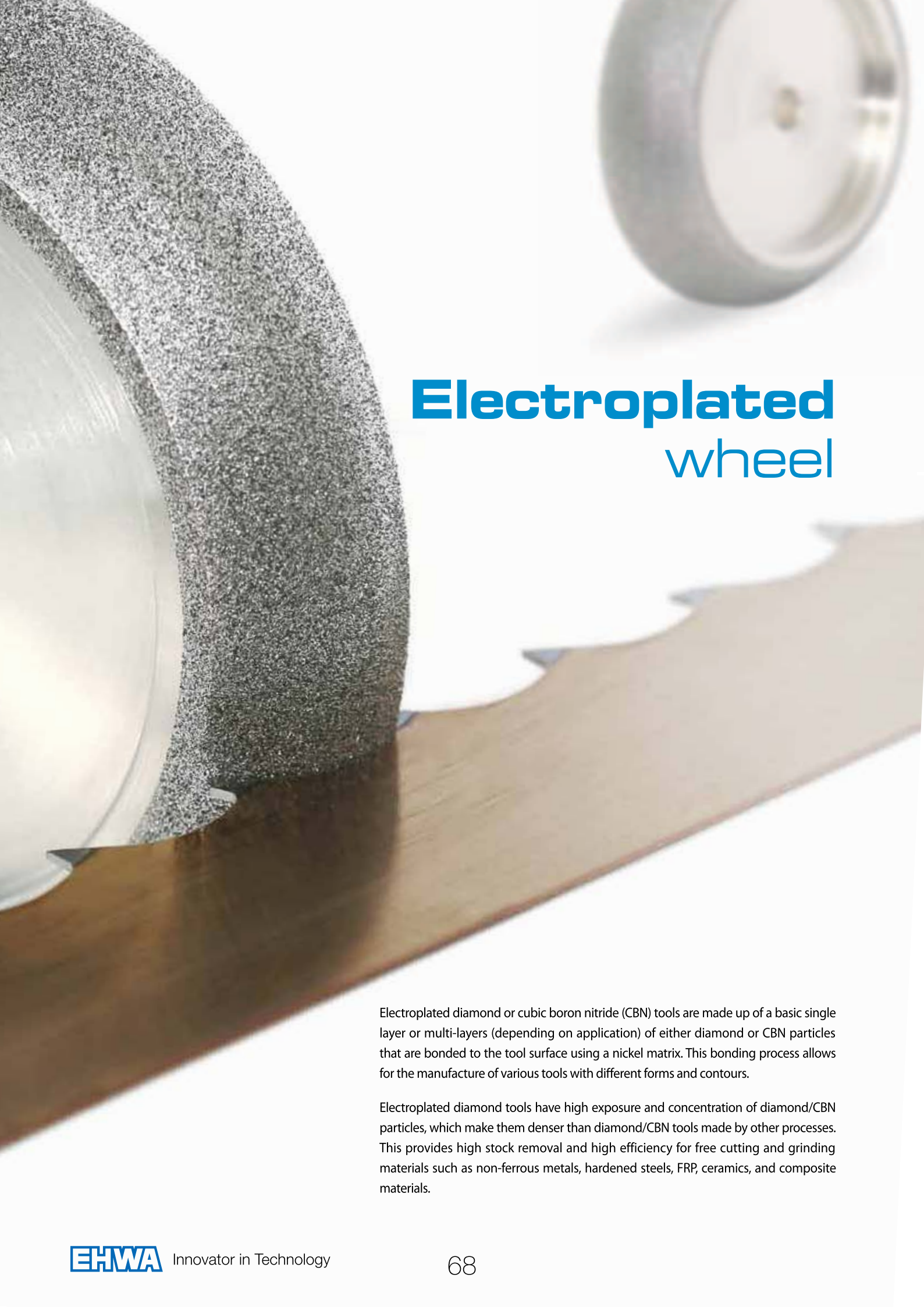
Crankshaft grinding CBN wheel

Since the late 1980's, EHWA has developed high quality vitrified-bonded CBN wheels for grinding auto-parts, such as constant velocity ball joints. Thereafter, EHWA expanded the development of vitrified-bonded wheels for many different applications such as for grinding high precision machine parts, bearings, gears, tools and dies, semi-conductors, ceramics, cermets, and in particular, cutting tools fabricated out of PCD or PCBN.

Today, the demand for vitrified-bonded wheels is sharply increasing in various high-tech industries. EHWA has put

forth its best efforts to develop better quality and high-performance vitrified-bonded products to meet all diversified industrial applications.





Electroplated wheel

Electroplated diamond or cubic boron nitride (CBN) tools are made up of a basic single layer or multi-layers (depending on application) of either diamond or CBN particles that are bonded to the tool surface using a nickel matrix. This bonding process allows for the manufacture of various tools with different forms and contours.

Electroplated diamond tools have high exposure and concentration of diamond/CBN particles, which make them denser than diamond/CBN tools made by other processes. This provides high stock removal and high efficiency for free cutting and grinding materials such as non-ferrous metals, hardened steels, FRP, ceramics, and composite materials.

Electroplated wheel



Electroplated reamer



Brake pad grinding wheel



Ferrite grinding wheels



SiC mould grinding wheels

Since 1992, EHWA has manufactured all kinds of high quality electroplated tools using the latest equipment and state of the art facilities, in order to meet the growing demand for these products from various industries worldwide.

In addition to conventional nickel-plated tools, EHWA also produces state-of-the-art reverse-nickel-plated diamond rotary dressers for the automotive and aerospace industries, and nickel-plated wafer dicing blades for the semi-conductor industry. EHWA will continue to engineer and develop electroplated diamond/CBN tools for our valuable customers worldwide.



Rotary dresser

High precision diamond tools are the most effective and practical means for most high-tech industries in the modern world to manufacture high precision machine parts, products, and other equipment. The automotive, aerospace, and turbine industries require extremely high precision machining and grinding tools, especially for application with new and advanced hard materials.



Rotary dresser



For water pump & ball bearings



For gear



For injection needle



For turbocharger

A diamond rotary dresser is a state-of-the-art diamond tool that enables mass production of extremely high precision products, such as engine and turbine parts for the automotive and aerospace industries, at very competitive production costs.

Since 1990, EHWA has been able to meet the demand of rotary dressers by aggressively investing millions of dollars and recruiting top engineers for the R&D and manufacturing rotary dressers. In 1992, EHWA successfully completed development and began supplying rotary dresser for the automotive and aerospace industries. EHWA Diamond Rotary Dressers are engineered to quickly and accurately, dress specific forms into aluminum oxide and silicon carbide grinding wheels for extremely high precision grinding. EHWA Diamond Rotary Dressers are also ideal for dressing conventional abrasive wheels of specific profiles for grinding bearings, screws, and gears.

EHWA assures our global customers that we manufacture only the highest quality rotary dressers that are able to meet the highest expectations and requirements of applicable use in any industry.





Stationary dresser

The importance of dressing and truing abrasive grinding wheels can never be over-emphasized. Dressing will restore the exposure and cutting ability of the abrasives on the wheel surface. Dressing must be performed after truing or whenever the wheel surface becomes loaded or glazed, or loses its cutting ability. Dressing removes the unwanted residue, such as braze and steel particles, from the wheel surface. Dressing also removes small portions of the bond material and exposes the abrasives, thus allowing for effective cutting action. Truing is the procedure for eliminating any unwanted 'run-out' once the wheel has been mounted. Truing is best done wet.

In general, there are four types of dressers 1) single point diamond dressers 2) multi-point diamond dressers 3) forming diamond dressers and 4) impregnated diamond dressers.

Stationary dresser

SDD

Single-point Diamond Dressers



MDD

Multi-point Diamond Dressers



FDD

Forming Diamond Dressers



IDD

Impregnated Diamond Dressers



1. SDD (Single-point Diamond Dressers)

This type of dresser is made by sintering a selected diamond crystal with a metal matrix in a steel shank. The point of the set diamond is concentric with the shank.

2. MDD (Multi-point Diamond Dressers)

This type of dresser is made by sintering two or more diamonds with a metal matrix to provide multi-diamond points for dressing larger and wider abrasive wheels. There are many advantages for multi-point diamond dressers. The multi-points allow the spreading of resistance, thus reducing frictional heat, extending tool life, reducing likelihood of early failure, and allowing for faster dressing.

3. FDD (Forming Diamond Dressers)

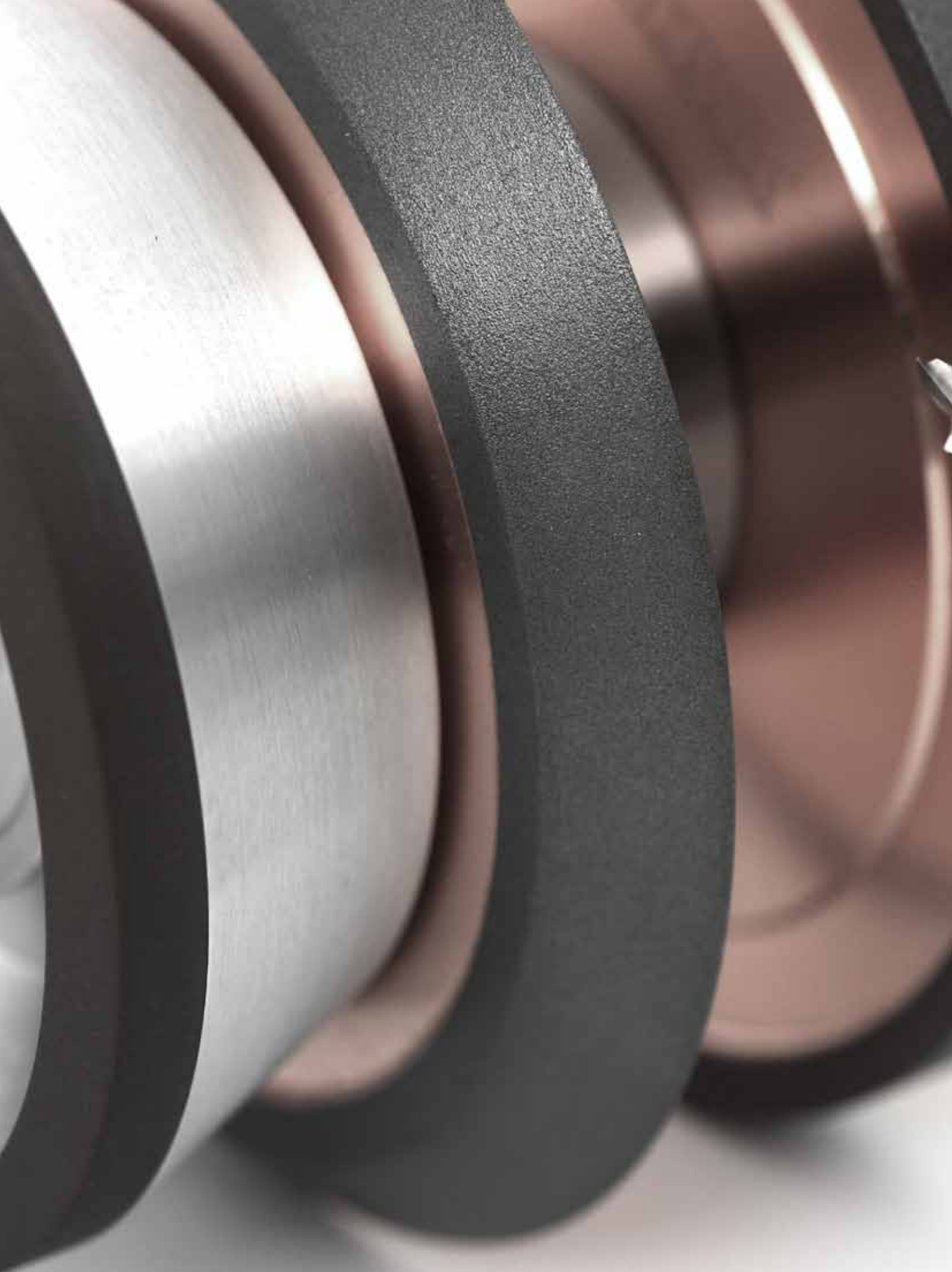
This type of dresser is made by sintering a high quality mono-diamond crystal with a metal matrix in a steel shank, and then grinding into various shapes such as a conical point with radius, facet, or profile.

4. IDD (Impregnated Diamond Dressers)

This type of dresser is made by sintering a mixture of selected diamond particles with a metal matrix. This provides a longer tool life, is very economical, and is ideal for use with larger and wider abrasive wheels.

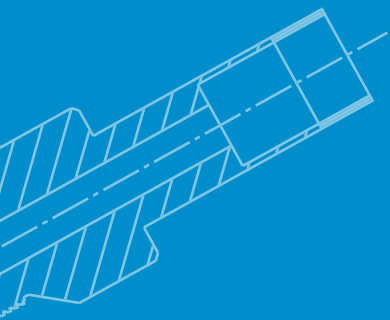
EHWA is committed to developing all kinds of diamond dressers by applying up-to-date technology for supporting our customers around the world.







Superabrasive grinding wheels



Contents

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EHWA standard markings for diamond and CBN wheels

78 - Resinoid and vitrified

79 - Metal

Diamond and CBN types

80 - Resinoid and vitrified

81 - Metal

Bond modifications

82 - Resinoid

83 - Vitrified

84 - Metal

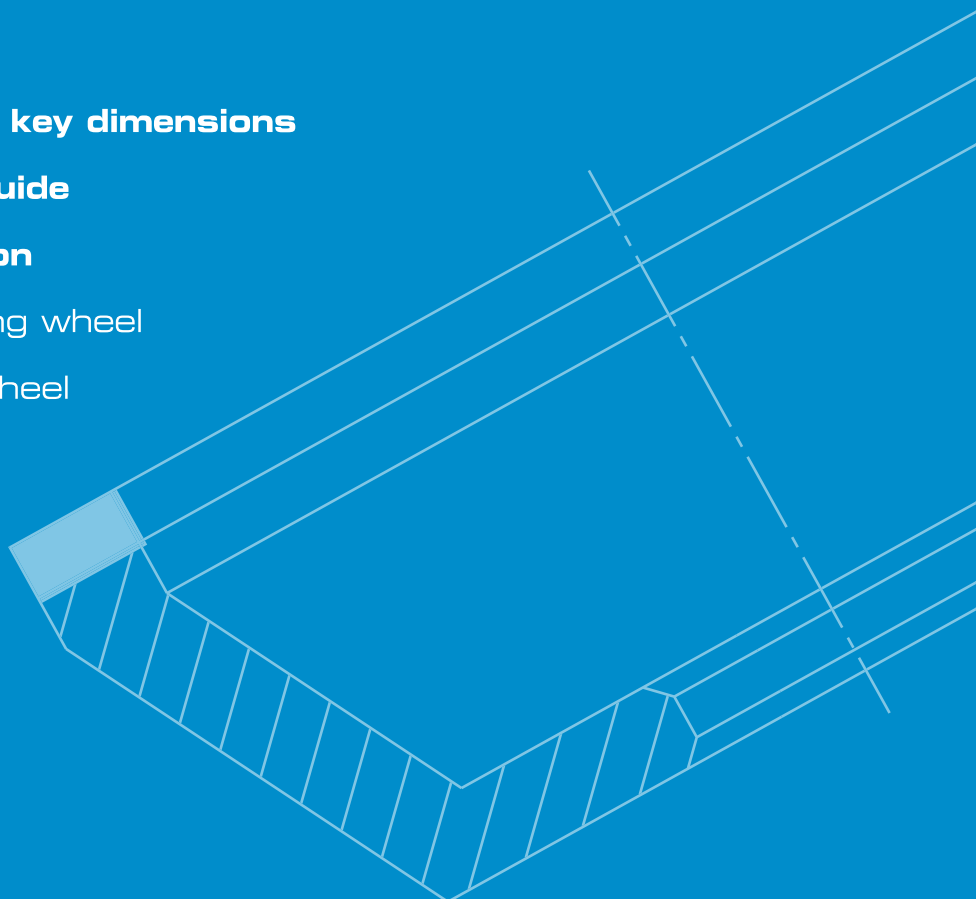
85 **Wheel shapes and key dimensions**

95 **Quick reference guide**

General information

98 - Diamond grinding wheel

103 - CBN grinding wheel



How to order diamond and CBN wheels

When placing your orders, please provide us with the following information.

1. **Shape**
2. **Dimension**
Provide the shape and dimensions in detail. If possible, include a drawing.
3. **Abrasive**
4. **Grit size**
5. **Grade**
6. **Concentration**
5. **Bond**
8. **Quantity**

In order to handle your order properly, we also like to be informed of the following

9. **Work**
 - A) Material (type & quality)
 - B) Shape
 - C) Dimension and dimensional tolerance (precision)
 - D) Hardness
 - E) Grinding removal or depth of cut
 - F) Required surface roughness (Rmax, Ra, Rz)
10. **Machine used**
 - A) Type B) Horse power
11. **Grinding condition**
 - A) Wheel speed: r. p. m.
 - B) Infeed : u. mm
 - C) Table speed : m/min
 - D) Cross feed : mm
 - E) Coolant : (dry or wet, coolant type)

EHWA standard

Markings for diamond and CBN wheels

Resinoid & vitrified bond

D	200	N	100	B	A	1.5 w	P
Abrasive	Grit size (mesh)	Grade	Concentration	Bond	Bond modification	Filler	Porosity
Diamond	Normal				Resinoid		
D	60	J Soft	25 1.1ct/cc	B Resinoid	BA	1.5	
ND	80	N Medium	50 2.2ct/cc	V Vitrified	BB	2	
DM	100	R Hard	75 3.3ct/cc		BC	3	
CSD	120		100 4.4ct/cc		BCT	4	
	140		125 5.5ct/cc		BD	5	
	170		150 6.6ct/cc		BE	6	
	200		175 7.7ct/cc		BG	7	
	230		200 8.8ct/cc		BH	8	
	270				BP	10	
	325				BQ		
	400				BX		
					BXT		
					BXC		
					PAE		
					PA8		
					BMX		
CBN	Micron				Vitrified		
B	40/60				VB	W	B
NB	40/50				VBT	M	F
BM	30/40				VE	G	P
NBM	22/36				VA	A	U
	20/30				VD	N	Y
	15/25				VCL	V	I
	8/16				VH	Z	C
	6/12						
	4/8						
	3/6						
	2/4						
	0/2						

EHWA standard

Markings for diamond and CBN wheels Metal bond

SD	200	N	100	M	A
Abrasive	Grit size (mesh)	Grade	Concentration	Bond	Bond modification
Diamond	Normal				
SD	20	G, H, I	25	M	MB21
SDC	30	J, K, L, M	50	Metal	MC9
SDM	40	N	75		MA
	50	P, Q, R	100		MF
	60		125		MP1
	80		150		ME4
	100				MG7
	120				MG21N
	140				MX32
	170				MX4
	200				MFS
	230				MX56
	270				MX57
	325				
	400				
CBN	Micron				
CBN	40/60				
CBS	30/40				
CBM	22/36				
	15/25				
	10/20				
	8/16				

Diamond and CBN types

Resinoid & vitrified bond

Diamond

D	Non-coated type. Friable, irregular shape. General grinding of cemented carbide. Resinoid and Vitrified bond. Mainly used in wet grinding. Grit size: #60 - #3000
ND	Nickel-coated type. Good bondability. Used primarily for grinding of all kinds of workpieces (cemented carbide, ceramic, cermet, glass, ferrite, etc.). Resinoid bond. Wet and dry grinding. Grit size : #60 - #400
DM	Micron type. Friable, regular shape. Used in lapping and polishing (cemented carbide, ceramic, glass ,etc.). Resinoid and Vitrified bond. Only used in wet grinding. Grit size : micron D 40/60 - D 0/2
CSD	Nickel-coated type. High strength, excellent bondability. Used in cemented carbide and hardened steel combinations grinding. Grit size : #60 - #400 Grit size : micron D 40/60 - D 20/30

CBN

B	Non-coated type. Used in general grinding (bearing, cam shaft, roll, dies, etc.). Vitrified bond. Only used in wet grinding. Grit size : #60 - #325
NB	Nickel-coated type. Good bondability. Used primarily for grinding of hardened steel (HSS, SKD-11, SUS, etc.). Resinoid bond. Wet and dry grinding. Grit size : #60 - #400
BM	Non-coated micron type. Used in lapping and polishing. Vitrified bond. Only used in wet grinding. Grit size : Micron G45, G30, G15
NBM	Nickel-coated micron type. Used in lapping and polishing. Resinoid bond. Mainly used in wet grinding. Grit size : micron G45, G30, G15

Diamond and CBN types

Metal bond

Diamond

- | | |
|------------|--|
| SD | Synthetic Diamond Special
Blocky diamond with high toughness
Grit size : #60-#400 |
| SDC | Coated Synthetic Diamond
Blocky, Special diamond with high toughness
Grit size : #60-#400 |
| SDM | Micron Diamond
Blocky, regular shape
Used in precision grinding and polishing application
Grit size : D40/60-D1/2 |

CBN

- | | |
|------------|---|
| CBN | Used for ferrous alloy and cast steel
Grit size : #60-#400 |
| CBS | Special CBN for hardened steel (HSS, SKD-11, SCM, SUS etc)
Grit size : #60-#400 |
| CBM | Micron CBN
Used in precision grinding
Grit size : D40/60-D2/4 |

Bond modifications

Resinoid

BA	Good elasticity. Depth of grinding is about 10 µm. Mainly used in micron size abrasive and grinding of cemented carbide, hardened steel and PCD (Polycrystalline Diamond).
BB	Heat transfer is excellent for dry grinding. Especially effective with CBN for HSS regrinding. Mainly used for cup type wheels.
BC	Heat transfer and shape maintenance are very good. Applied for fluting of endmill, reamer and drill(HSS).
BCT	Used in CNC machines with cup type(11V9, 12V9).
BD	Very soft. Low noise and good finish shape. Used in general grinding of cemented carbide, ceramic and glass.
BE	Used in heavy duty grinding with CBN for HSS grinding. Can be applied under dry condition.
BG	Standard bond for all kinds of workpieces. Applied for profile, face, cylindrical and centerless grinding.
BH	Shape maintenance and heat transfer are very good. Applied for profile and face grinding.
BP	Lubricant bond. Same applications as BG but softer.
BQ	Used for finishing of glass and quartz.
BX	Good cutting ability. Applied for fluting of endmill, reamer and cemented carbide by down feed method.
BXT	Same application as BX bond but harder.
BXC	Used for cermet and ceramic insert grinding.
PAE	High temp polyimide bond for micron carbide tools.
PA8	High temp polyimide bond for small to middle size carbide tools.
BMX	Hybrid bond for heavy stock removal in carbide tool grinding. Heavy stock removal.

* Note: The bond application according to hardness is as follows.

Wheel type	Soft ----- Hard							
D11V9			BG -----	BE -----	BCT			
B11V9			BB -----	BE -----	BCT			
1A1	BA -----	BP -----	BG -----	BH -----	BX			
1A1R		BD -----	BG -----	BH				
4A2/6A2/2A2T	BA-----	BB-----	BG-----	BE-----	BH-----	BC-----	BX-----	BXT

Bond modifications

Vitrified

VB	General bond for CBN Wheel Available for bearing , cam shaft , roll, velocity ball joint and die grinding
VBT	Improved version of VB bond to minimize the machining load Used with VB bond together for better grinding performance
VE	Normally used for better grinding performance and surface roughness Good to reduce machining load but wheel life is less than VB bond
VA	Can be applied for both Diamond and CBN For CBN application, its grinding performance and wheel life is intermediate between VB and VE For Diamond application, it's harder than VD so suitable for longer wheel life
VD	General bond for Diamond wheel Used for grinding of cemented carbide, PCD and PCBN materials
VCL	Suitable bond for crushing wheel Its grinding performance is better than VD but life time is less than VD bond.
VH	Due to good grinding performance, it's a good solution for chipping issue Specialized bond for PCBN materials and honing stones Its wheel life is less than VD and VCL bonds

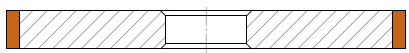
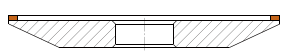
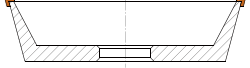
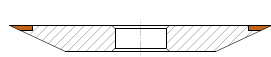
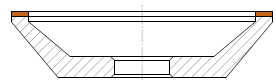
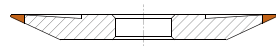
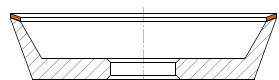
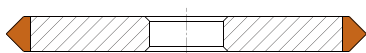
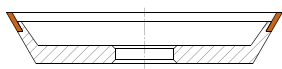
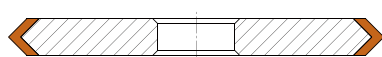
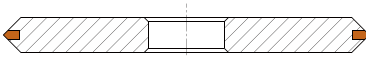
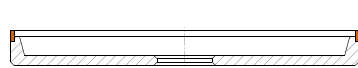
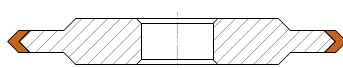
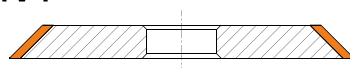
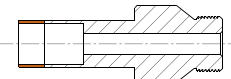
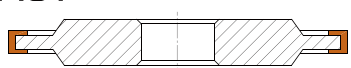
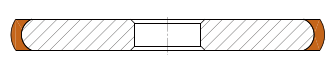
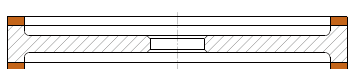
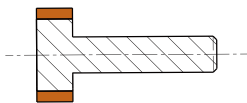
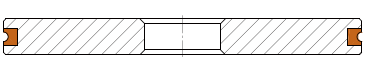
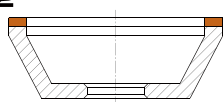
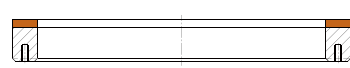
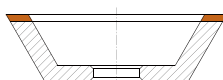
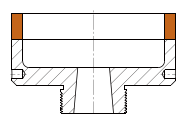
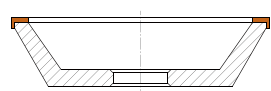
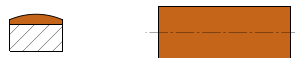
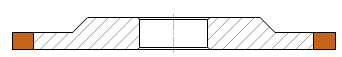
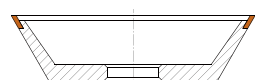


Bond modifications

Metal

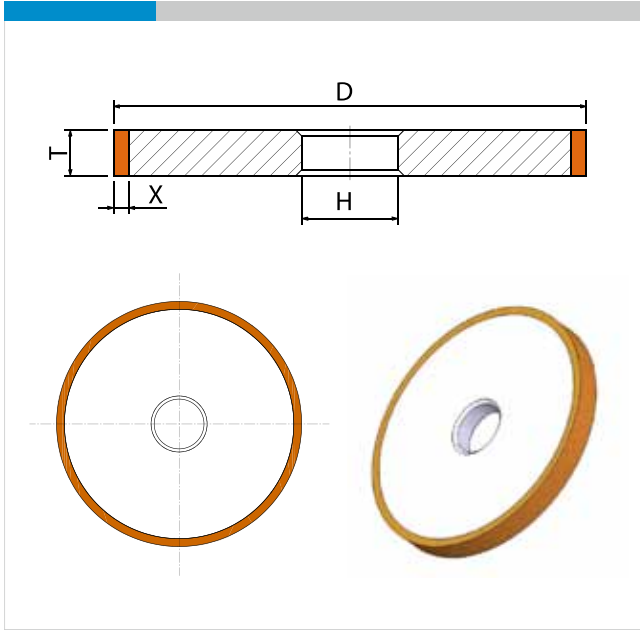
MB21	Bronze. Widely used for glass and lens application.
MC9	Bronze and Iron. Harder than MB21. Specialized bond for better wheel life of glass and lens application.
MA	Bronze. Widely used for ceramics, hardened steel and cemented carbide.
MF	Bronze. Used for profile wheels which need an edge for sharp grinding of hardened steel and cemented carbide.
MP1	Bronze and Cobalt. Used for profile wheels which need an edge for sharp grinding of cemented carbide.
ME4	Bronze and Cobalt. Used primarily for grinding of vehicle glass on an automatic operating machine.
MG7	Iron. Generally used for automotive glass and CNC machine.
MG21N	Iron. Primarily used for automotive glass on CNC machine for better wheel life. Harder than MG7.
MX32	Specialized bronze bond for better grinding performance. Specialized bond for general grinding of cemented carbide.
MX4	Specialized bronze bond. Softer than MX32. Proper for rough grinding of cemented carbide and cermet. Can be applied for Sapphire grinding.
MFS	Specialized bronze bond Softer than MX4. Proper for finish grinding of cemented carbide and cermet. Can be applied for Sapphire grinding.
MX56	Specialized bronze bond. Generally used for diamond grinding. Suitable for polishing (Grit size : # 3000 - # 5000).
MX57	Specialized bronze bond. Suitable for electrolytic polishing and crushing grinding.

Wheel shapes and key dimensions

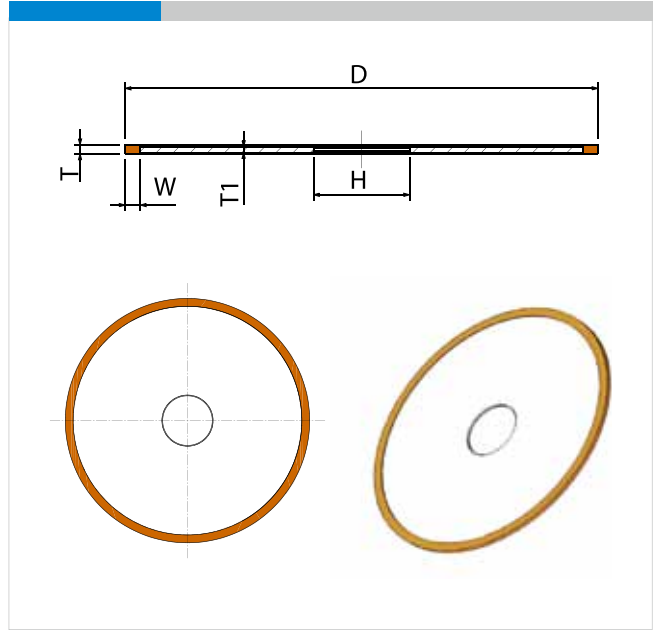
Type	Type	Type
1A1 	4A2 	11Y9 
1A8 	4B2 	12A2 
1A1R 	4M1 	12V4 
1E1 	6A2 	12V9 
1EE1 	6A2C 	14A1 
1E6Q 	6A9 	14EE1 
1V1 	6F2 	14U1 
1FF1 	9A3 	DW 
1FF6Y 	11A2 	BUL 
2A2T 	11B2 	HH1 
2FF2 	11C9 	HMF 
3A1 	11V9 	PEL 

Wheel shapes and key dimensions

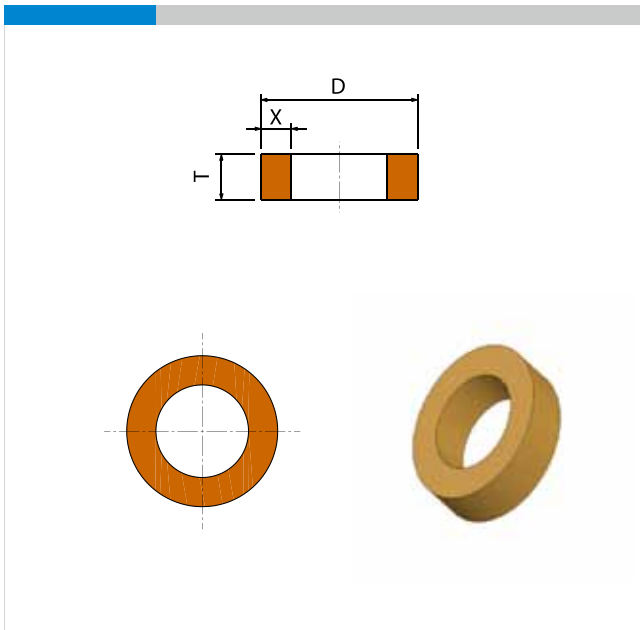
1A1



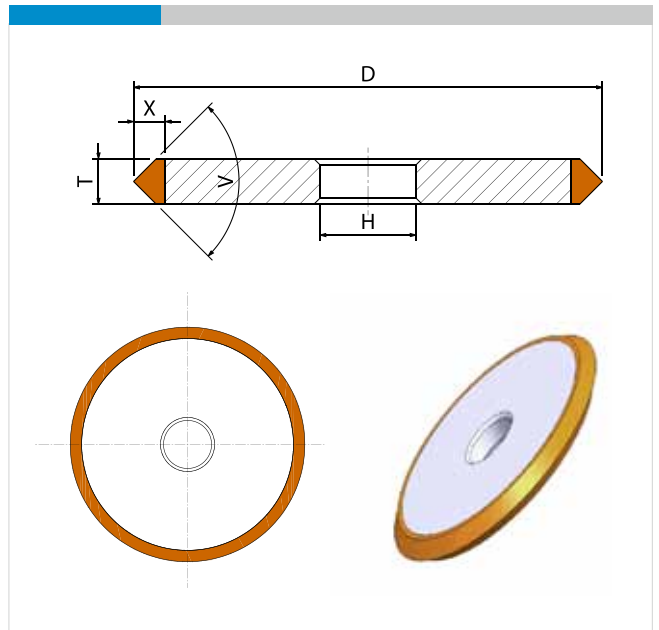
1A1R



1A8

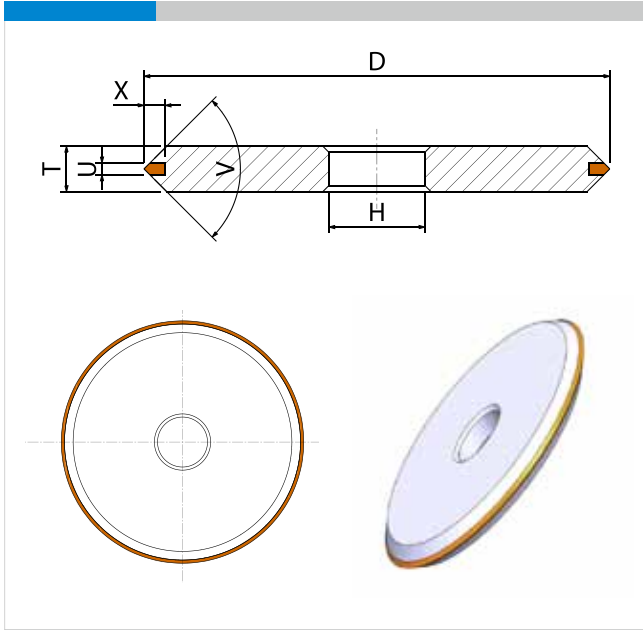


1E1

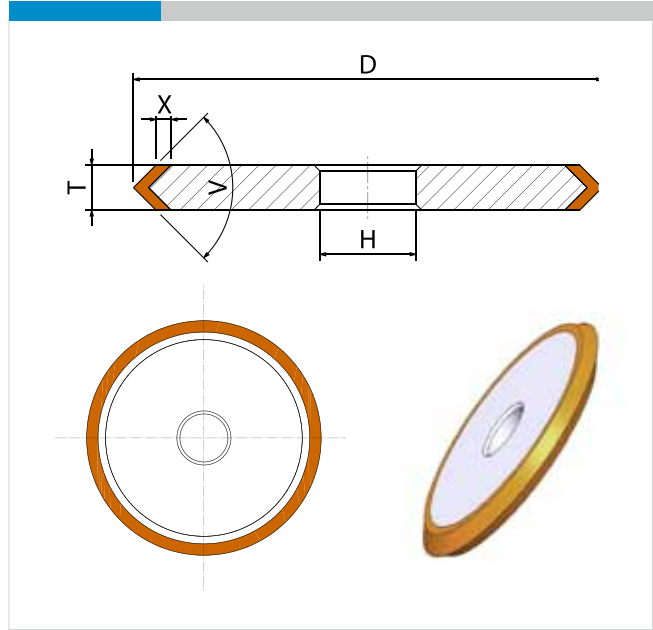




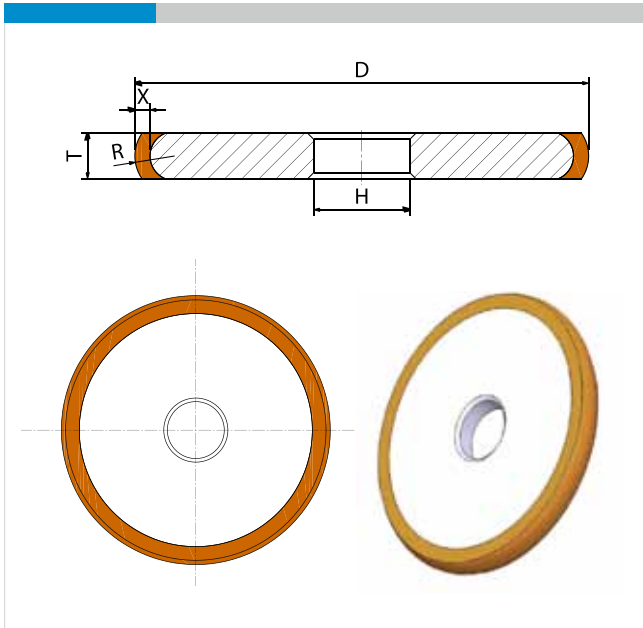
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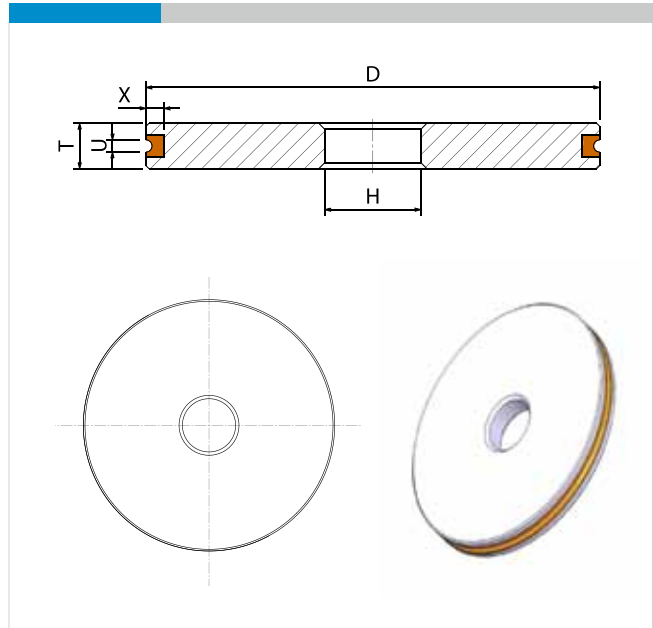
1EE1



1FF1

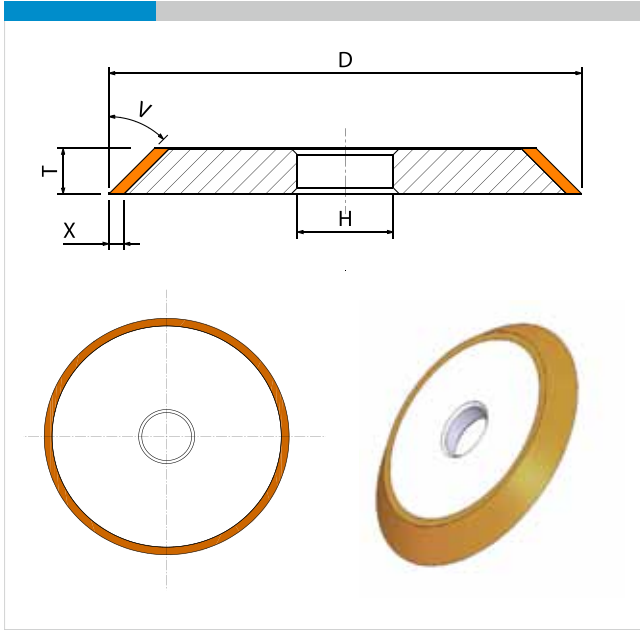


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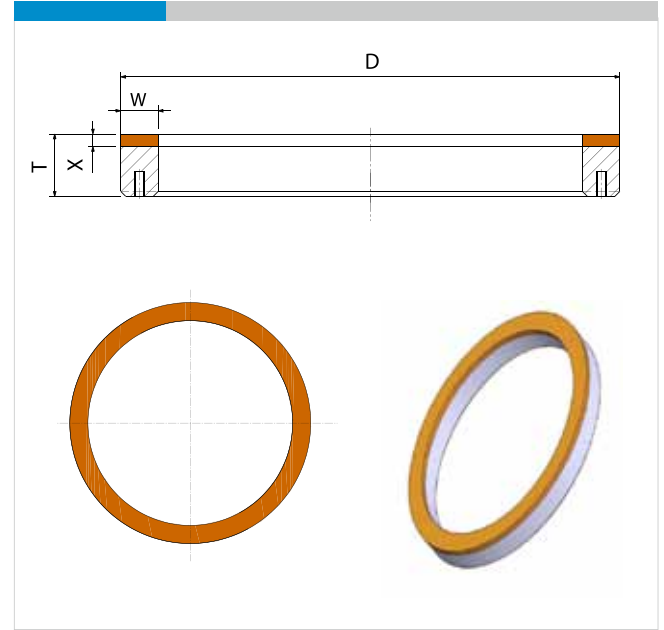


Wheel shapes and key dimensions

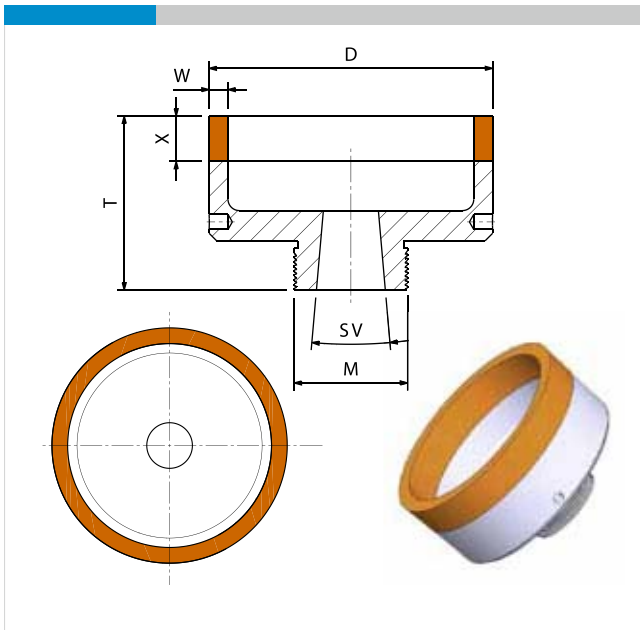
1V1



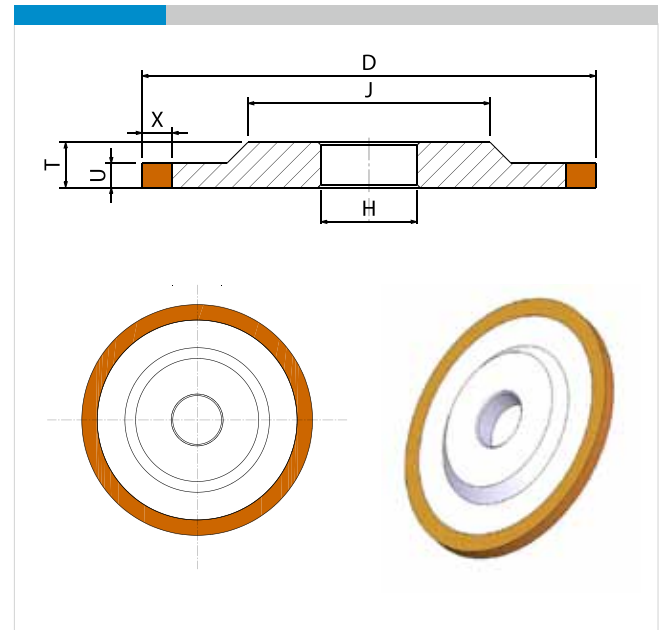
2A2T



2FF2

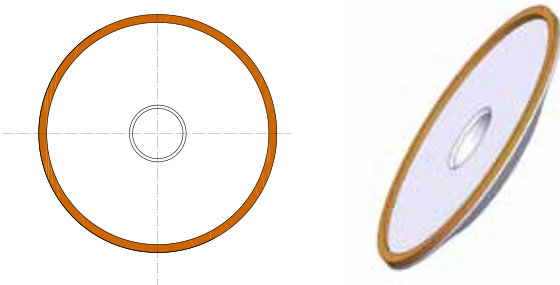
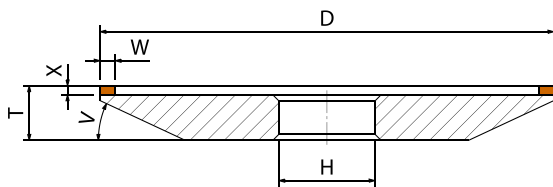


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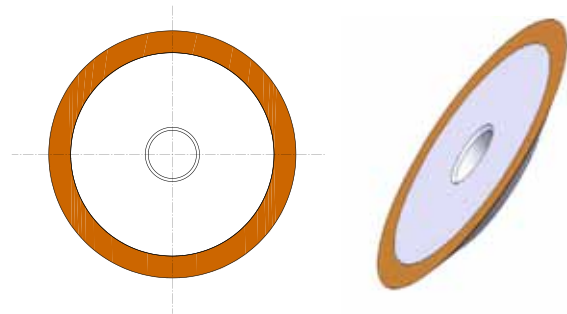
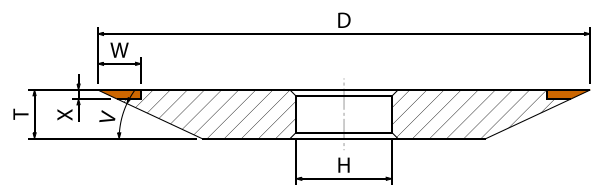




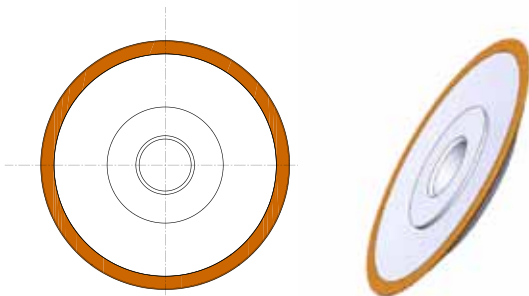
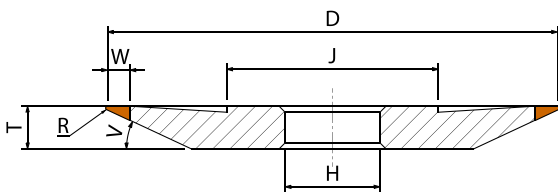
4A2



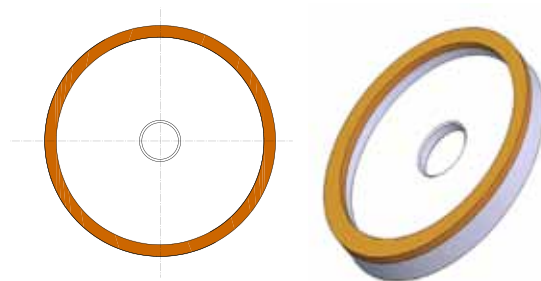
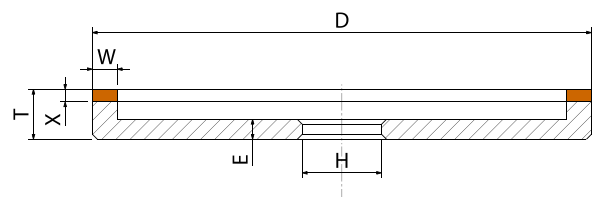
4B2



4M1

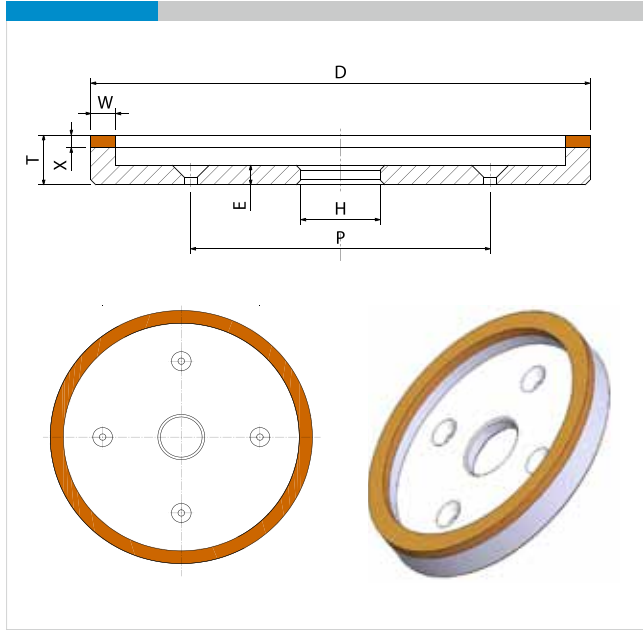


6A2

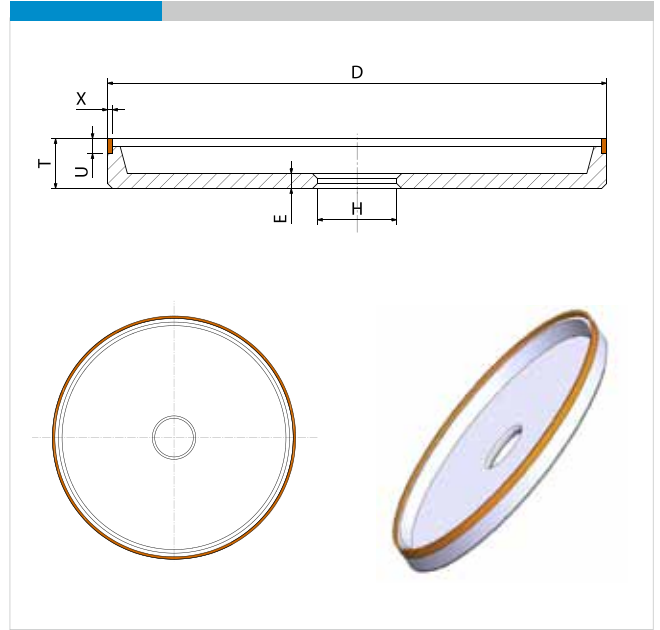


Wheel shapes and key dimensions

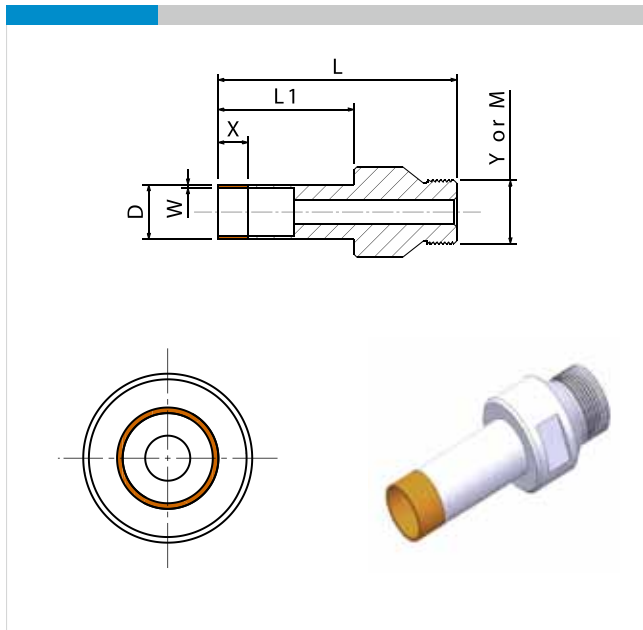
6A2C



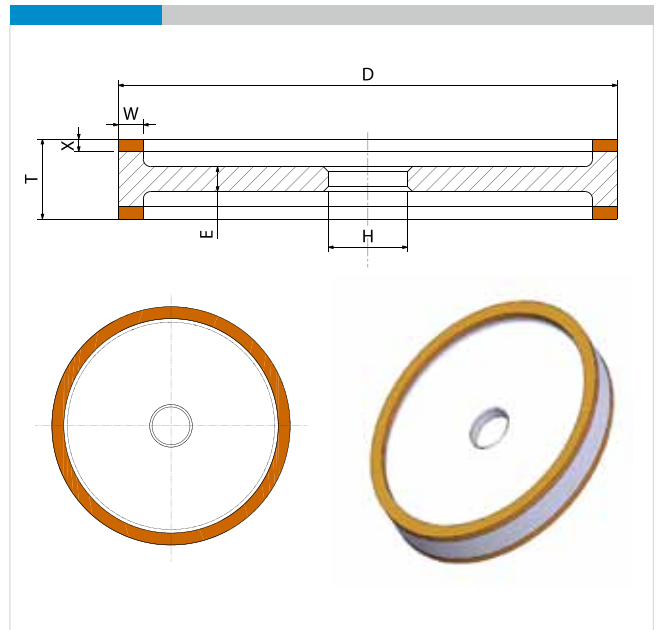
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6F2

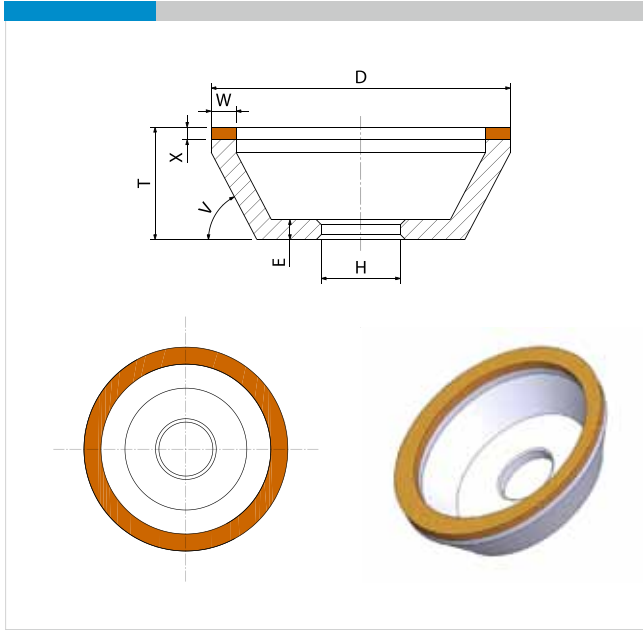


9A3

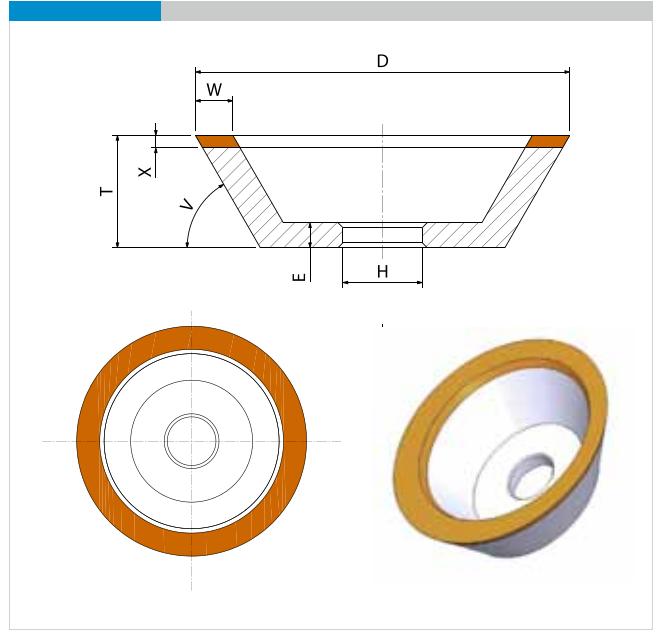




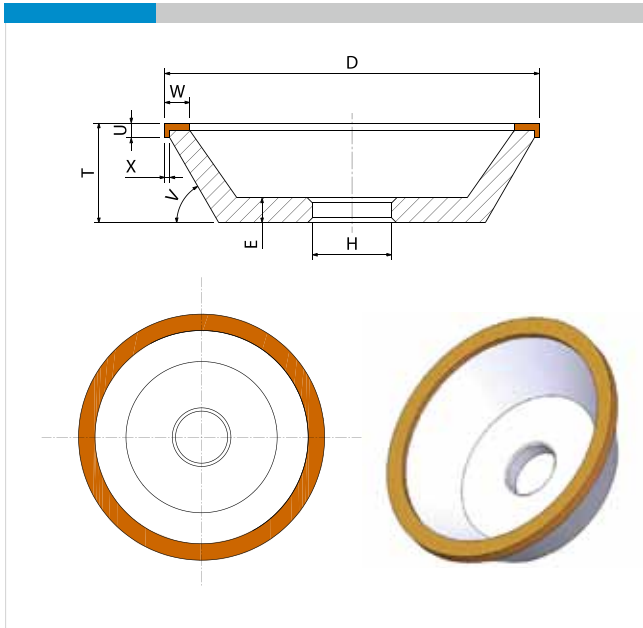
11A2



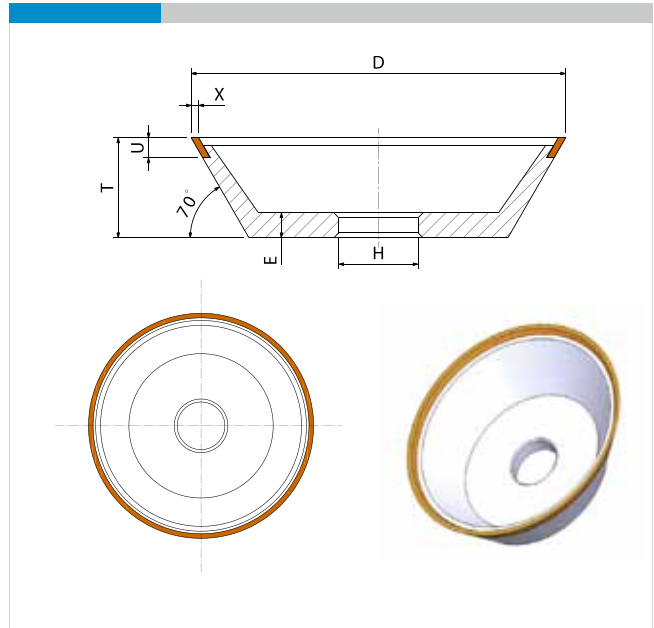
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11C9

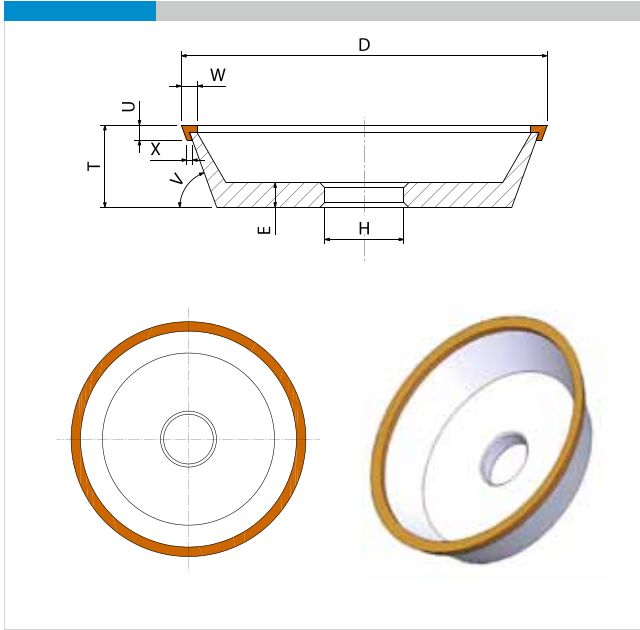


11V9

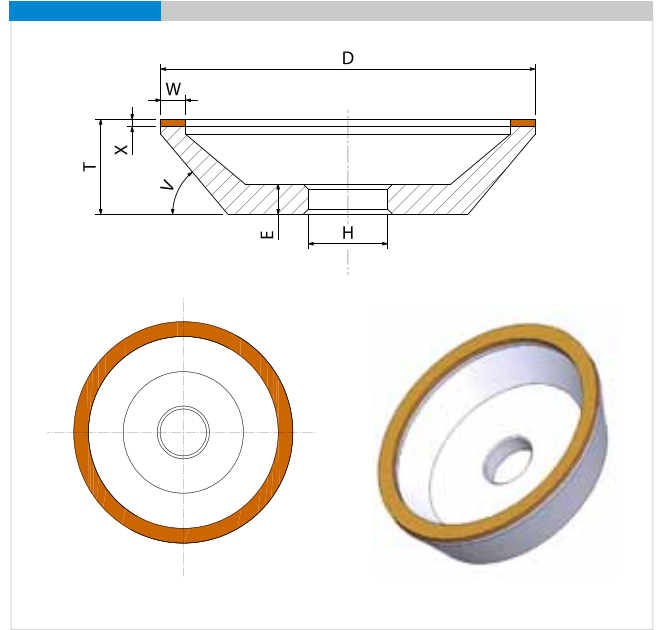


Wheel shapes and key dimensions

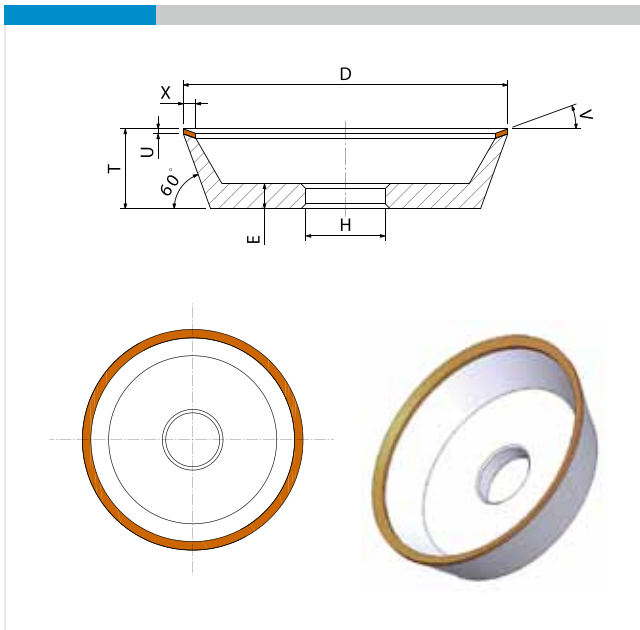
11Y9



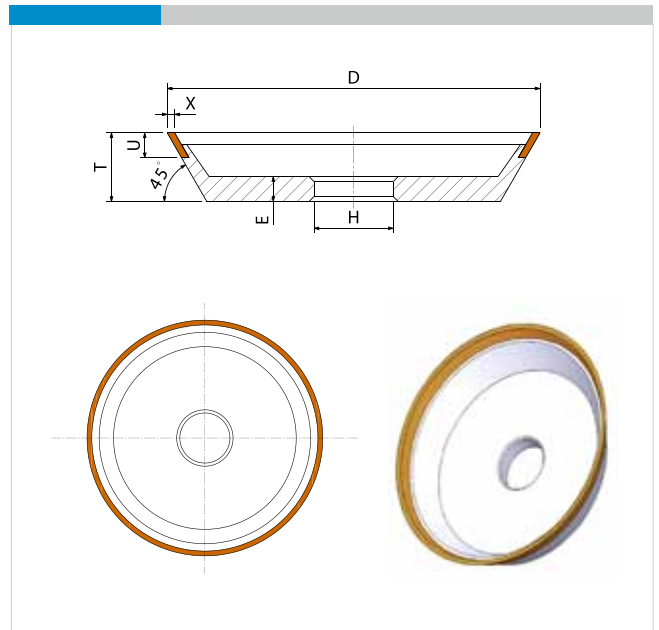
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12V4

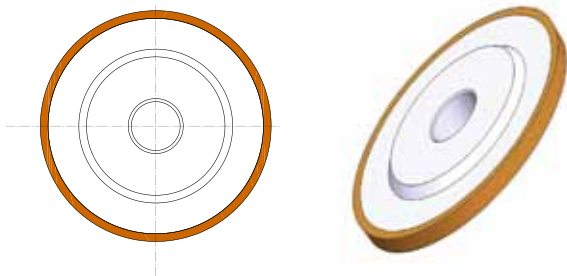
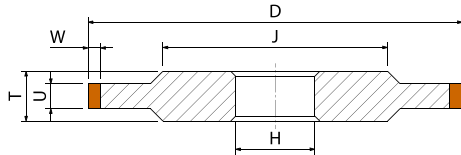


12V9

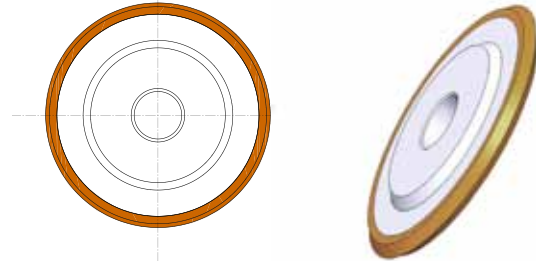
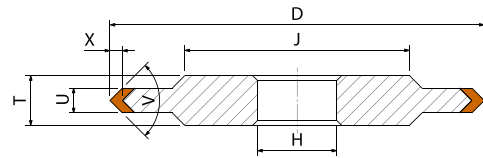




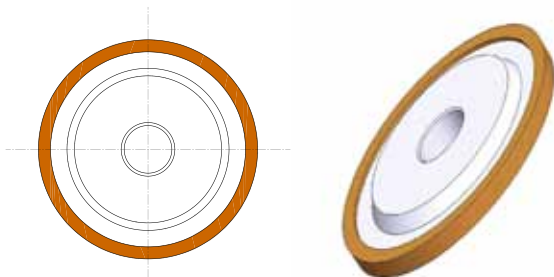
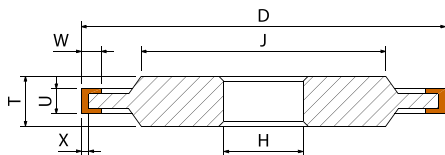
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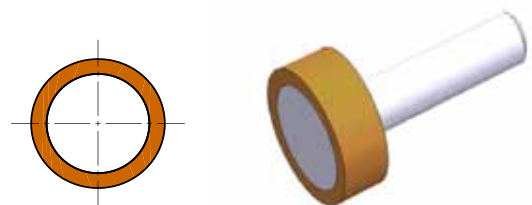
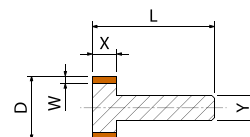
14EE1



14U1



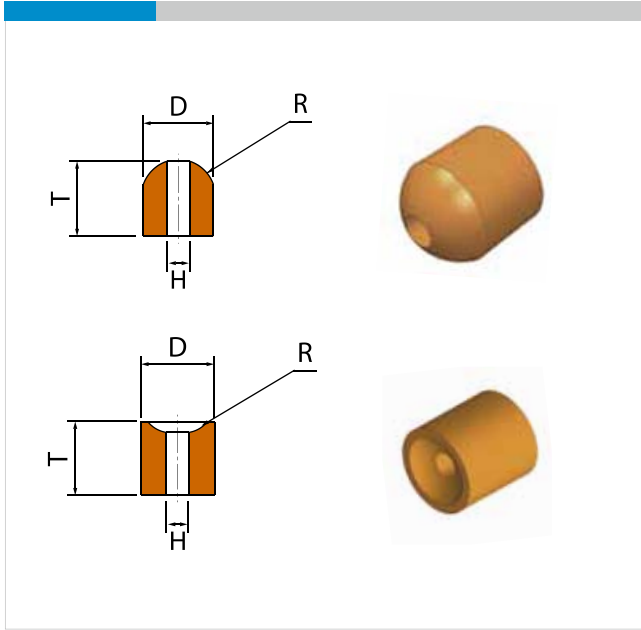
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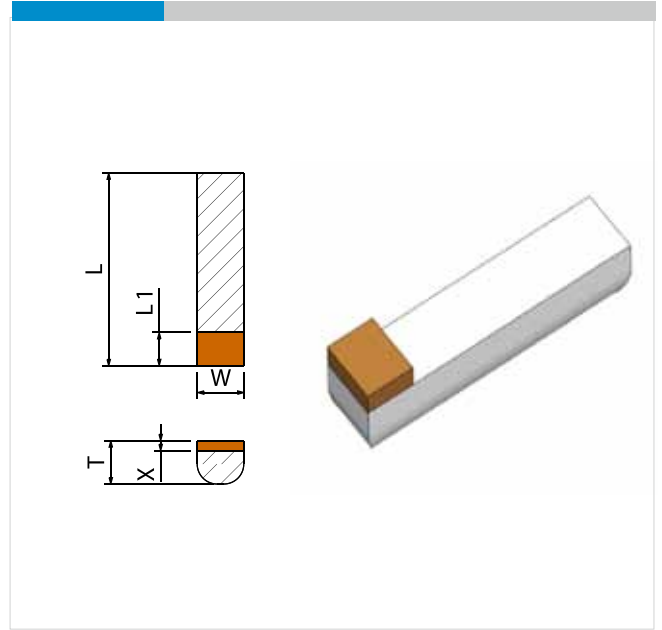


Wheel shapes and key dimensions

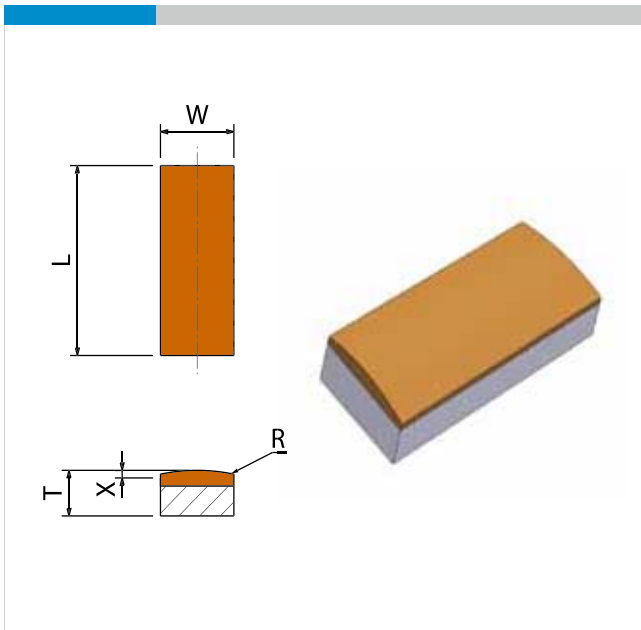
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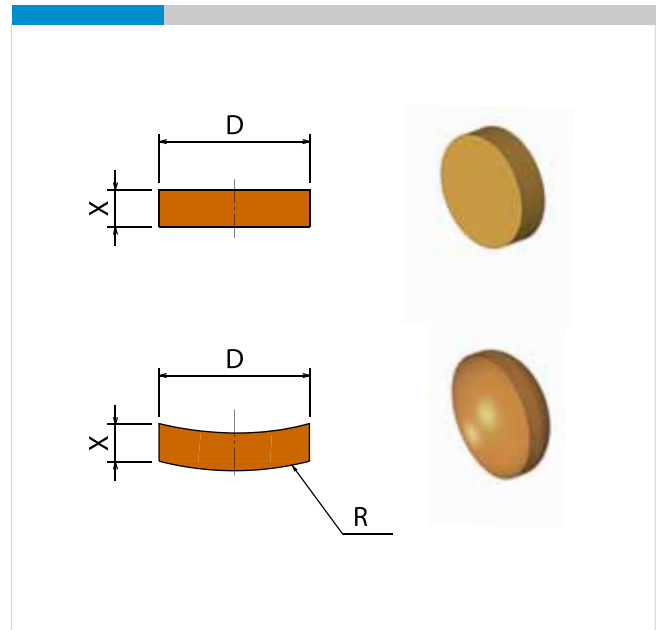
HH1



HMF



PEL



Quick reference guide

The first section of the wheel shapes and key dimensions is designed to provide you with a quick reference guide in determining the appropriate wheel shape & type.

A drawing of each shape is presented along with letter codes used to indicate the various dimensional characteristics. The key to letter dimensions listed below applies to wheels.

Key to letter dimensions for diamond and CBN wheels

B.C. : Bolt circle

D : Wheel diameter

d : Description of mounting hole

E : Back thickness

H : Hole size

J : Hub diameter

R : Radius

T : Wheel thickness

S : Back angle

L : Length of types DW, HH1, HMF, 2FF2, 6F2

n : Number of mounting holes

U : Diamond face for types 3A1, 14A1, 14EE1.

14U1 and pencil edgers insert length for
types 1E6Q, 6A9, 11C9, 11V9, 11Y9, 12V9

V : Face angle for types 1V1, 4B2, 11B2, 12V4

included angle for types 1E1, 1EE1, 1E6Q, 14EE1

W : Rim width

X : Diamond and CBN depth

K : Inside flat diameter

Y : Shank diameter for type DW, 6F2

* Please specify the dimensions if not filled in our tables.





General information

General information

Diamond grinding wheels

Diamond

The diamonds used in the manufacturing of EHWA diamond grinding wheels can be classified into two categories: natural diamonds and synthetic diamonds. Ever since synthetic diamonds were first introduced in 1957, their applications have been steadily increasing. Now they are accepted as the principal material for diamond grinding wheels.

Two important achievements in the history of synthetic diamonds are the development of strong, tough diamond grits used for saw blades and the improvement of grits for resinoid bonds. Some grits for resinoid bonds are coated with metal which enables the resinoid bond grinding wheels to achieve better performance.

Diamond powder is commercially available in 50 grades, and each grade has its own unique features. Diamonds may be classified into the following three categories in terms of bonding method:

- Resinoid bond
- Metal bond
- Vitrified bond

The grit types and grit sizes of grinding wheels can be selected depending on workpieces, bonds, and grinding conditions. To help us design the grinding wheels best suited to your purpose, please refer to "How to order diamond and CBN wheels" on page 5 and provide us with the necessary information.

Concentration

Concentration is the content of diamonds in a unit volume of a grinding wheel.

When content is 25 volume %, concentration is 100, which is equivalent to 4.4cts/cc of diamond in the grinding wheel. The relationship among grit content (in volume %), concentration, and diamond content (in cts/cc) is as follows:

Grit content (volume%)	Concentration	Diamond content (CT/CC)
25	100	4.4
18.75	75	3.3
12.5	50	2.2
6.25	25	1.1

As illustrated above, the price of a grinding wheel largely depends on its concentration. Since the appropriate concentration of a wheel depends on work materials, grinding conditions, etc., please refer to "How to order diamond and CBN wheels" on page 5 and supply us with the necessary details.

Grit size

Diamond grit sizes are classified into 22 grades as shown in the following table. The nominal grit size of a grinding wheel indicates the coarsest size grits which are present in the wheel. For instance, the grits in the #140/170 range pass through a #140 sieve and are trapped by a #170 sieve. The grit size in this range is noted as #140.

Grit size classification by sieves is only feasible up to #325 mesh. After this, the grit size is still indicated by number (#...), but the method of classification is different. Grit sizes can be more accurately understood by correlating them to their respective mesh sizes and grit size scatter in diameter (see chart below).

Normal grit size (mesh)	Grit size range (mesh of grit use)	Fepa	Normal grit size (mesh)	Grit size range (mesh of grit use)	Fepa
16	16/20		200	200/230	D 76
20	20/30	B 852	230	230/270	D 64
30	30/40	B 602	270	270/325	D 54
40	40/50	B 426	325	325/400	D 46
50	50/60	B 301	400		
60	60/80	B 252	600		
80	80/100	B 181	800		
100	100/120	B 151	1000		
120	120/140	B 126	1500		
140	140/170	D 107	2000		
170	170/200	D 91	3000		



Bond

There are three alternative bonding methods: resinoid bond, metal bond, and vitrified bond.

• Resinoid bond

Resinoid bond grinding wheels are manufactured by using resinoid bonds to bond diamond grits.

There are two types of resinoid bonds: the phenol resin type and the polyimide resin type. The phenol resin type is currently in more common usage.

Resinoid bond grinding wheels have good elasticity, fine surface finish, and high grinding performance. They are effective for:

- (1) grinding of cemented carbide
- (2) combination grinding of cemented carbide and hardened steel
- (3) grinding of cermet
- (4) precision grinding of magnetic materials, glass, ceramics, etc. Polyimide wheels are recommended for heavy grinding and creep-feed grinding.

• Metal bond

Metal bond grinding wheels are manufactured by sintering metal powder to bond diamond grits. These wheels are superior in grit retention, and therefore preferred:

- (1) when a long service life is required
- (2) when wear of the grinding wheel needs to be minimized (such as in form grinding)
- (3) in hand grinding of cemented carbide
- (4) in profile grinding
- (5) in the cutting and grinding of hard, and brittle materials such as ceramics, glass, and quartz
- (6) in the cutting and grinding of magnetic materials such as ferrite
- (7) in the cutting and grinding of stone
- (8) in the cutting and grinding of graphite, etc.

The high grit retention quality of metal bond can also cause glazing or loading. The increase of grinding pressure and of heating due to loading may cause thermal damage to the workpiece. In order to prevent thermal damage, please choose the grinding process, conditions, coolant, dressing intervals, etc. carefully.

• Vitrified bond

Vitrified bond grinding wheels are manufactured by using vitrified bonds to bond diamond grits. As vitrified bonds are porous, vitrified bond wheels can overcome the forming and dressing difficulties encountered with resinoid bond and metal bond grinding wheels. Vitrified bond wheels are used to grind cemented carbide, sintered diamond tools, etc.

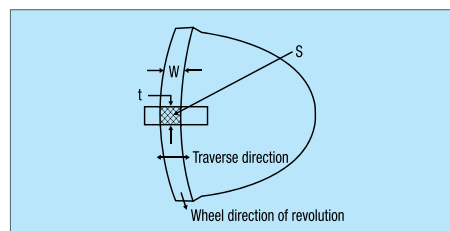
Wheel diameter

The heat produced by grinding with diamond wheels is cooled by the grinding fluid and by air. If the diameter of the wheel is small, the grits heated in the grinding process may not have sufficient time to be cooled before they come into contact with the workpiece in the next rotation. This results in progressive heat accumulation as grinding continues. And this in turn accelerates the wear of the diamond grits themselves as well as the deterioration of the resinoid bond in the vicinity of each grit, resulting in the early pull-out of the diamond grits.

It is always recommended that the diameter of the grinding wheel be made as large as possible. In high removal grinding, the heating is increased and the wheel life is shortened ; thus, the costs of grinding are also increased. For this reason, too, it would be advantageous to make the diamond wheel diameter as large as possible.

Wheel rim width

When the workpiece and the diamond wheel come into surface contact, stock removal is performed on the contact surface (s). The size of the contact surface is determined by the wheel rim width(w) and the contact length (t).



Stock removal is the cutting of the workpiece by the diamonds at the contact surface.

The force between the diamond wheel and the workpiece depends on the machine rigidity, the work supporting system, and the work type.

When the pressing force is constant, the surface pressure on the diamond wheel(kg/mm²) increases as the wheel width decreases.

The diamond grits then give a higher cutting performance, and the stock removal rate increases. This is of great practical significance in plunge grinding with a cup wheel or a straight wheel.

For greater efficiency, the wheel- workpiece contact area should be made as small as possible. On the other hand, the life of the diamond wheel increases as the wheel width increases. The width of the wheel should be determined after taking into consideration the required working efficiency, the machine rigidity, and other pertinent factors.

Machine

The grinding machine should have sufficient rigidity. Vibration of the table or the spindle will most likely cause the forming of an oscillation mark" or severe wheel wear. In order to achieve the optimum grinding efficiency, enough machine power is required to ensure stabilized peripheral speed of the wheel and stabilized infeed. A machine without sufficient power will result in insufficient wheel speed, abnormal wear, and decreased grinding efficiency. It is always best to use a vibration-free, highly rigid grinding machine with sufficient horse power.

Mounting of grinding wheel

If the wheel is not properly set and if the periphery and the sides of the grinding wheel attached to the machine spindle are subject to vibration, problems arise during grinding, including:

- (1) Oscillation marks on the workpiece.
- (2) Machine begins to vibrate; grinding noise increases
- (3) Wheel life is notably shortened.

To avoid these problems, the grinding wheel must be mounted properly.

When a cup wheel or dish wheel is mounted on the machine, side runout should be less than 0.02mm. Likewise, peripheral runout should be less than 0.02mm when a straight wheel is mounted. If the wheel runout is over 0.02mm, reduce runout by following the procedures below:

- (1) Fasten the grinding wheel gently on the flange fixed to the machine.
- (2) Check the periphery runout using a dial indicator.
- (3) Reduce the periphery runout by gently hammering the periphery of the grinding wheel.
- (4) After adjusting as instructed above and tightly fastening the grinding wheel, recheck the periphery runout with the dial indicator.

The above procedures are valid only if there is a space between the internal diameter of the grinding wheel and the flange.

If there is no space, the runout of the grinding wheel itself must be adjusted.

Truing and dressing

If the periphery runout is severe when the grinding wheel is mounted, or if profile wear of the straight wheel or cup wheel is found, the runout and profile of the wheel must be adjusted. Truing is the procedure of adjusting the runout and profile of the wheel. It involves shaving off the diamond grits and the bond to correct the runout and the profile of the wheel. The diamond grinding wheel cannot be used immediately after the truing procedure as the diamond grits are not properly exposed ; therefore, the wheel is not in prime condition to be used. To improve free-cutting ability, the bond must be dug out and the diamond grits exposed onto the surface of the wheel. This process is called dressing. Diamond grinding wheels cannot satisfactorily perform unless the above procedures are followed correctly.

• Selection of dressing stick

In order for the truing of the diamond grinding wheel to be effectively performed in a timely manner, the grit size of the silicon carbide truing wheel must be 2 grades coarser than that of the diamond grinding wheel. As shown below, the grade of the silicon carbide wheel must be relatively hard.

Grit size of diamond wheel	Silicon carbide wheel for truing
#80 or coarser	C46 - M
#100 - #200	C60 - M
#230 - #325	C80 - M
#400 or finer	WA200 - G

• Truing methods

There are four truing methods:

- (1) Brake dresser
- (2) Abrasive stick
- (3) Mild steel
- (4) Tool post grinder

General information

Diamond grinding wheels

1. Brake dresser

For truing with the wheel still mounted on the machine, the brake dresser is the best option of the above four methods by providing fast, simple, and stable truing.

2. Abrasive stick

Truing of the diamond grinding wheel can also be performed by grinding the abrasive stick fixed on the chuck with the grinding wheel. Please pay careful attention during truing, as this method tends to make the wheel edge round.

3. Mild steel

This method does not require any special devices and is easy to accomplish by grinding the mild steel with the diamond wheel. The diamond wheel could be damaged, however, if it is not sufficiently flooded with grinding fluid while grinding.

4. Tool post grinder

This truing method involves removing the diamond grinding wheel from the machine and grinding it with a silicon carbide wheel on another machine. Vibration of the diamond grinding wheel could possibly occur during the resetting of the trued on the first machine.

• Selection of dressing stick

Since the purpose of dressing the diamond grinding wheel is to expose the diamond grit by removing the bond only, the grit size of the stick should be 2 grades finer than that of the diamond grinding wheel.

Below is a guide to selecting a dressing stick:

GRIT SIZE OF DIAMOND GRINDING WHEEL	STICK FOR DRESSING
#80 or coarser	WA120 - G
#100 - #200	WA200 - G
#230 - #325	lapping stick
#400 or finer	lapping stick

• Dressing with stick

A diamond wheel is dressed by pushing the stick on the surface of the diamond grinding wheel by hand. Coolant must be used. In case of dry dressing, a wet stick should be used. When using a lapping stick, dry dressing is recommended.

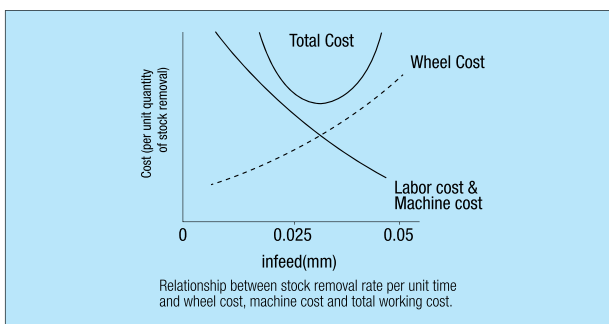
Analysis of work conditions

In the past, when diamond wheels were "expensive and precious tools", the life of the wheel was considered the most important factor. Today, however, diamond grinding wheels are often evaluated based on total working costs. Total working costs are:

(Wheel cost) + (Other expenses, including cost of labor).

Recently, as labor costs have been soaring, the component of "other expenses" has been increasing steadily. Consequently, grinding efficiency has become more important.

Making a graph such as the one shown below can help in finding optimum working conditions which minimize the total working costs.



• Peripheral speed

Wheel life, stock removal rate, and surface finish all depend largely on the peripheral speed of the wheel.

It is therefore very important to find the optimum peripheral speed for the diamond wheel. The table below shows recommended peripheral speeds:

Resinoid bond	Metal bond
Wet 1400 - 1600 m/min	Wet 1000 - 1800 m/min
Dry 900 - 1200 m/min	Dry 600 - 900 m/min

Peripheral speed is a function of wheel diameter and spindle speed(rpm).

• Grinding fluid

Since regrinding is performed by physically watching the point of contact between the wheel and the workpiece, dry grinding is usually employed.

When the wheel- workpiece contact area is relatively large, the heat from grinding increases. For this reason, dry grinding may result in workpiece burning, wheel loading, bond wear, and other conditions which lead to a shortened wheel life. Consequently, the proportion of wheel cost to total costs increase. In such a situation, then, wet grinding is recommended. In wet grinding, the grinding fluid should be applied directly to the point of contact between the wheel and the workpiece. In heavy grinding or in creep-feed grinding, when heat increases, use a grinding fluid with a high lubricating performance and apply the fluid to the grinding point under high pressure.

• Infeed

Infeed is an important factor in determining grinding efficiency. However, a too-high increase in infeed in an attempt to improve the grinding efficiency can shorten the wheel life.

To determine the proper infeed, follow the guide given below. In form grinding, however, increase the depth of the cut and decrease the feeding speed to prevent deviation from the shape.

Grit size of diamond grinding wheel	Depth of cut
#100 - #120	0.02 - 0.03 mm
#140 - #200	0.01 - 0.02 mm
#230 or finer	0.01 mm or less

• Surface finish

Because the surface finish of the workpiece depends on many factors--the grinding method and the workpiece material as well as the grit size of the diamond--it is difficult to make specific recommendations for surface finishing. In order to achieve a high rate of material removal and a good surface finish, grinding should be accomplished in two separate processes. The diamond grit sizes should be as follows:

Rough	Finish
#100	#270
#120	#325
#140	#400
	#600

In any case, surface finish can be improved by spark-out.

General information

Diamond grinding wheels

CBN

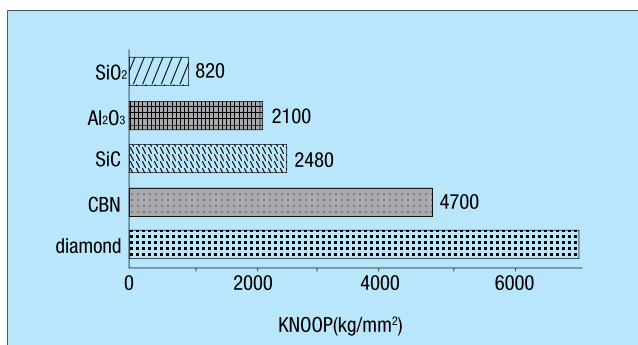
CBN (Cubic Boron Nitride) is the super abrasive used for steel grinding. CBN is crystallized from the nitric material in boron using a high pressure, high temperature method similar to the one used in diamond synthesis.

• Characteristics of CBN

Next to diamond, CBN is the second hardest material known on the earth. As shown by the figures below, it is harder than both Al_2O_3 (abrasive for WA and A grinding wheels) and SiC (abrasive for GC and C grinding wheels).

When considering the hardness only, diamonds would seem to grind steel easily, being the hardest materials. But at temperatures of 600-700°C, diamonds in contact with air begin to wear due to oxidation.

Also, since diamonds are basically composed of carbon, they react to the iron in steel, resulting in diamond wear. In contrast, CBN does not wear in these conditions, as it is stable up to 1370°C and does not react to iron.



Availability of CBN abrasives

CBN abrasives are classified into two types: metal-coated and uncoated. Metal-coated CBN is used mainly in resinoid bond grinding wheels, and uncoated CBN is used in electroplated metal bond and vitrified bond grinding wheel.

Concentration (see page 40)

Grit size

Normal grit size (mesh)	Grit size range (mesh of grit use)	Fepa	Normal grit size (mesh)	Grit size range (mesh of grit use)	Fepa
60	60/80	B 252	325	325/400	B 46
80	80/100	B 181	400	G 45	
100	100/120	B 151	800	G 30	
120	120/140	B 126	1000	G 15	
140	140/170	B 107	1500	G 9	
170	170/200	B 91	2000	G 6	
200	200/230	B 76	3000	G 3	
230	230/270	B 64	5000	G 1	
270	270/325	B 54			

General information

Diamond grinding wheels

Bond

There are three alternative bonding methods: resinoid bond, metal bond, and vitrified bond.

• Resinoid bond

Resinoid bond grinding wheels are manufactured by using resinoid bonds to bond CBN grits. The resinoid bond CBN grinding wheel has a wider range of uses than other bond wheels. It is mainly used for surface grinding, cylindrical grinding, creep-feed grinding, centerless grinding, double-disc grinding, and internal grinding.

CBN grinding wheel is economical in cases where the workpiece is an iron material with hardness of over HRC50. EHWA has succeeded in developing a resinoid bond which enables the full performance of the CBN grit.

• Metal bond

Metal bond grinding wheels are manufactured by sintering metal powder to bond CBN grits. They are used for the honing and cutting of hardened steel and for accomplishing a high removal rate in the grinding of mid-range hard steel.

• Vitrified bond

Vitrified bond grinding wheels are manufactured by using vitrified bonds to bond diamond grits. As vitrified bonds are porous, vitrified bond wheels can overcome the truing and dressing difficulties encountered with resinoid bond and metal bond grinding wheels.

Vitrified bond wheels are used for high precision grinding with various shapes.

(1) CBN wheels

- ① Automotive parts : CV Joint, Gear, Cam & Crank shaft
- ② Tool parts : End-mill, Thread die
- ③ Bearing
- ④ Electronic parts : Motor, Sleeve
- ⑤ Hydraulic and Air pressure machines : Compressor
- ⑥ Fuel pump : Injection nozzle

(2) Diamond wheels

- ① Cutting tools : Ceramic, PCD/PCBN inserts
- ② Surface Grinding : Silicon and Cemented carbide wafer
- ③ Double Disc : Rotor gear
- ④ Honing stones

• Peripheral speed

Wheel life, stock removal rate, and surface finish depend largely on the peripheral speed of the wheel. Finding the optimum peripheral speed for the CBN wheel is therefore very important. The table below shows recommended peripheral speeds.

Resinoid bond
Wet 1750 - 1850 m/min Dry 900 - 1200 m/min

Peripheral speed is a function of wheel diameter and spindle speed (rpm).

However, if the coolant pressure for grinding is kept high enough to keep the wheel from heating, the peripheral speed of the grinding wheel can be raised up to 13000ft/min. If the wheel speed (rpm) increases, the material removal speed can also be increased while maintaining a long wheel life.

• Grinding fluid

There are two types of grinding fluids. One is straight oil (water immiscible) and the other is water soluble. Straight oil is a coolant with an oily ingredient immiscible in water. It lubricates well, but it is an ineffective coolant with poor usability. However, straight oil enable CBN grinding to achieve maximum performance when grinding tough but soft workpieces such as stainless steel, inconel, and waspaloy. Straight oil also enables superior performance in heavy duty grinding.

Water soluble coolants are subdivided into three types: emulsion, soluble, and chemical.

The emulsion type becomes milky and opaque in water. Compared with straight oil, it has the next best lubricating effect, and emulsion type is better than straight oil for cooling. If the working place is not suited to straight oil, the emulsion type is recommended, but the concentration of coolant must be high - - above 5%.

The soluble type becomes translucent in water. Compared with emulsion type, it has the next best lubricating effect, and soluble type is better than emulsion type for cooling. In general grinding, soluble type is sufficient.

The chemical type becomes transparent in water. It is the best fluid for cooling, but the least effective for lubrication. If the chemical type is being used for general grinding, there is no need to change to the soluble type.



Conversion table of surface finish

Rmax(μm)	Ra(μm)	Rms(μm)	Rz(μm)	Rms(μin)	Rmax(μm)	Ra(μm)	Rms(μm)	Rz(μm)	Rms(μin)
0.1	0.02	0.02	0.1	1	2.4	0.41	0.46	2.2	24
0.2	0.03	0.04	0.2	2	2.8	0.48	0.53	2.5	28
0.3	0.05	0.06	0.3	3	3.2	0.54	0.61	2.9	32
0.4	0.07	0.08	0.4	4	3.6	0.61	0.68	3.2	36
0.5	0.09	0.10	0.5	5	4.0	0.68	0.76	3.6	40
0.6	0.10	0.11	0.5	6	4.5	0.77	0.86	4.1	45
0.7	0.12	0.13	0.6	7	5.0	0.85	0.96	4.5	50
0.8	0.14	0.15	0.7	8	5.5	0.94	1.05	5.0	55
0.9	0.15	0.17	0.8	9	6.0	1.02	1.14	5.4	60
1.0	0.17	0.19	0.9	10	7.0	1.19	1.33	6.3	70
1.2	0.20	0.23	1.1	12	8.0	1.36	1.52	7.2	80
1.4	0.24	0.27	1.3	14	9.0	1.53	1.71	8.1	90
1.6	0.27	0.30	1.4	16	10.0	1.70	1.90	9.0	100
1.8	0.31	0.34	1.6	18					
2.0	0.34	0.38	1.8	20					



EHWA diamond tools serve as a promoter of globalization

Since 1975, EHWA DIAMOND has been growing by developing long-term partnerships with customers worldwide and across the industries. EHWA is tirelessly striving to provide the very best customer satisfaction through continuous product innovation and world class service.

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Osan



Osan 2



Dongtan



Pyeongtaek



Seochon



Cheongju

Overseas



Fujian, China



Weihai, China



Shanghai, China



Bac Ninh, Vietnam



Hai duong, Vietnam



Indonesia



Germany



Japan



CA, USA



AL, USA



Italy



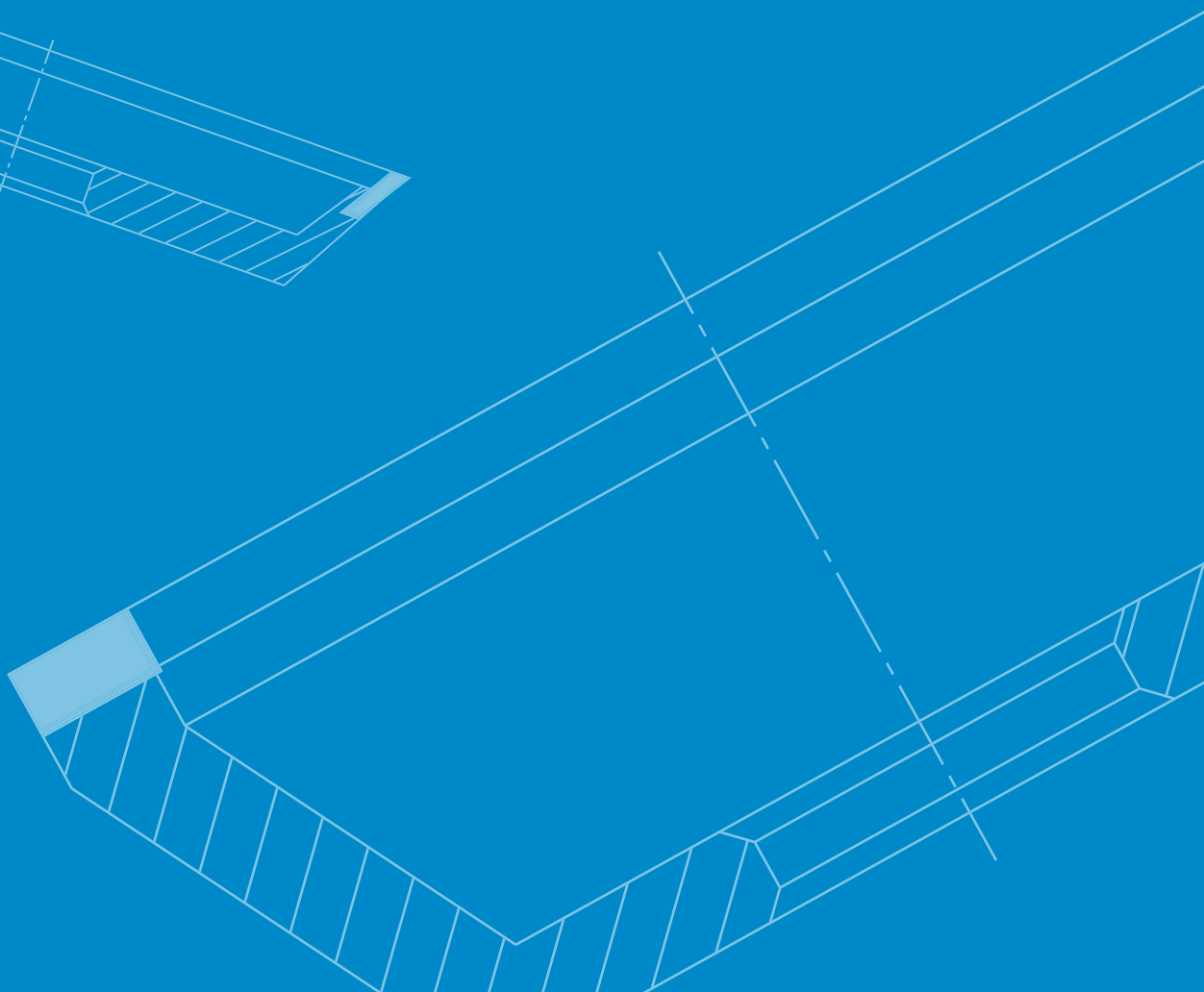
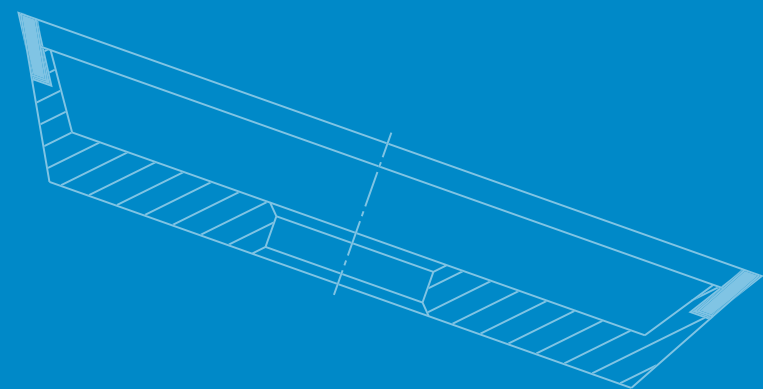
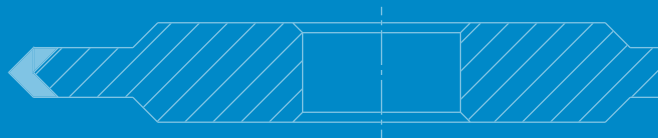
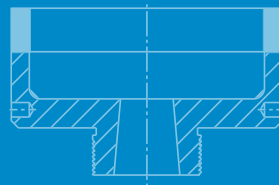
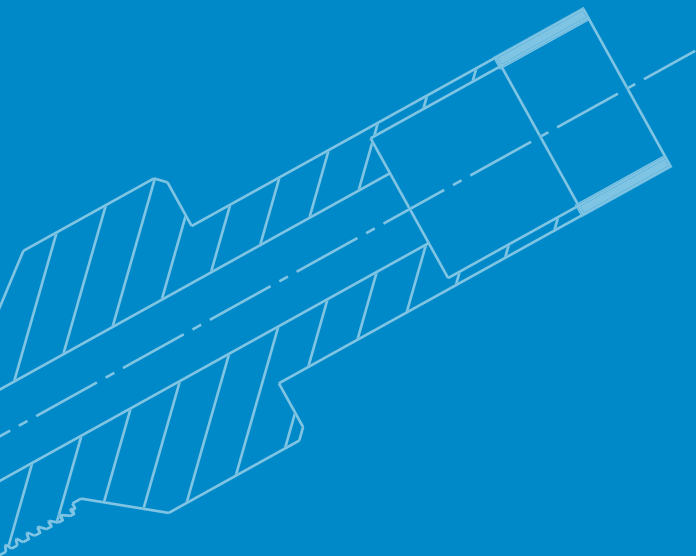
Thailand

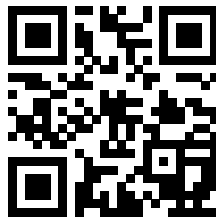


India



Mexico





EHWA DIAMOND INDUSTRIAL CO. LTD.

374 , Nambudae-ro, Osan-city, Gyeonggi-Do, 18145, Korea.

<http://www.ehwadia.com> / e-mail: bkkim@ehwadia.co.kr

Tel : +82-(31) 370 -9220 / Fax : +82-(31) 370-9840