Bonded precision grinding tools in
Diamond and CBN

Welcome to DIAMETAL AG

"Success with precision" – our family company has been operating under this motto since 1936. Our precision not only secures us success, it also opens up glittering prospects for our customers.

The headquarters of DIAMETAL AG are located in the Swiss watch metropolis of Biel/Bienne. This is no accident – no other Swiss city can point to such a rich tradition of sophisticated craftsmanship and manufacturing skills in the field of precision engineering. The Swiss headquarters and our subsidiaries in France, Italy and China are the base for our worldwide activities. Locally rooted and globally active – our commitment to Switzerland as a production location is at once a statement of what we understand by quality.

Precision tools – our strength.

Our core business embraces the development, production and marketing of two groups of products: precision grinding tools and hard material tools and their applications. By combining our know-how from both product groups, synergies are constantly being created that allow exceptional innovations. It is these in-house developments that consolidate our quality leadership on the market – along with the dedication and commitment of our highly qualified personnel.

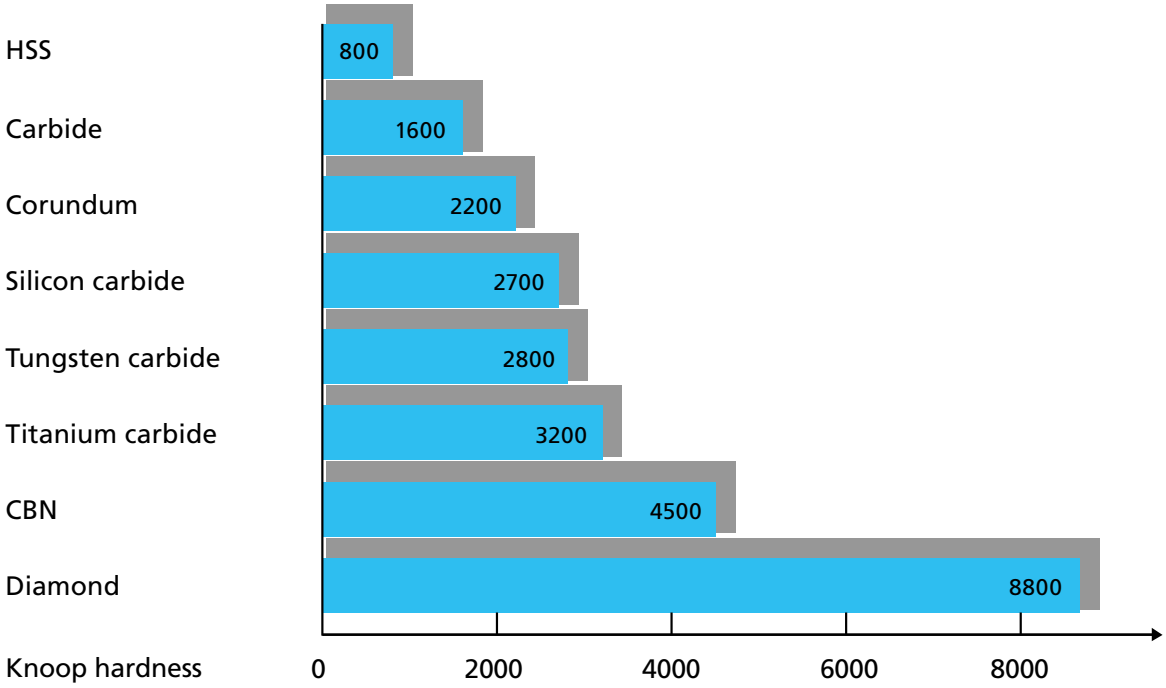
Precision for the customers – our mission.

The precise understanding of what the customer wants and needs is the first step towards elaborating optimal solutions. For that reason we want to be as close as possible to our customers: every product group has a competent consulting team with a direct person to contact. Thanks to this close partnership and our comprehensive application know-how, we are in a position to provide customised solutions at any time. That trust and reliability take centre stage in this work is a matter of course for us. Both today and tomorrow.

Diamond and CBN

Diamond and cubic boron nitride (CBN) are considered to be the hardest known grinding materials and are therefore often referred to as “super-abrasives”. For this reason they are suitable for machining materials which are difficult or even impossible to grind with conventional abrasives such as silicon carbide or corundum.
Diamond and CBN have the same crystal structure, with diamond consisting of pure carbon, whilst CBN is made up of the elements boron and nitrogen.

Comparison of hardness of different materials



Diamond

Due to its extreme hardness, Diamond is particularly suitable for machining the following materials:

– All carbide metal grades
– Cermet
– Oxide and non-oxide ceramics
– PCD / PCB
– Hard facing alloys
– Sapphire, glass
– Ferrite
– Graphite
– Fiber reinforced synthetics
– Precious and semi-precious stones

Steel has a high affinity to carbon. Since Diamond consists of pure carbon, it is not suitable for machining steel. The high temperatures produced in the grinding process cause the steel to extract carbon atoms from the Diamond, eroding the Diamond grinding grit.

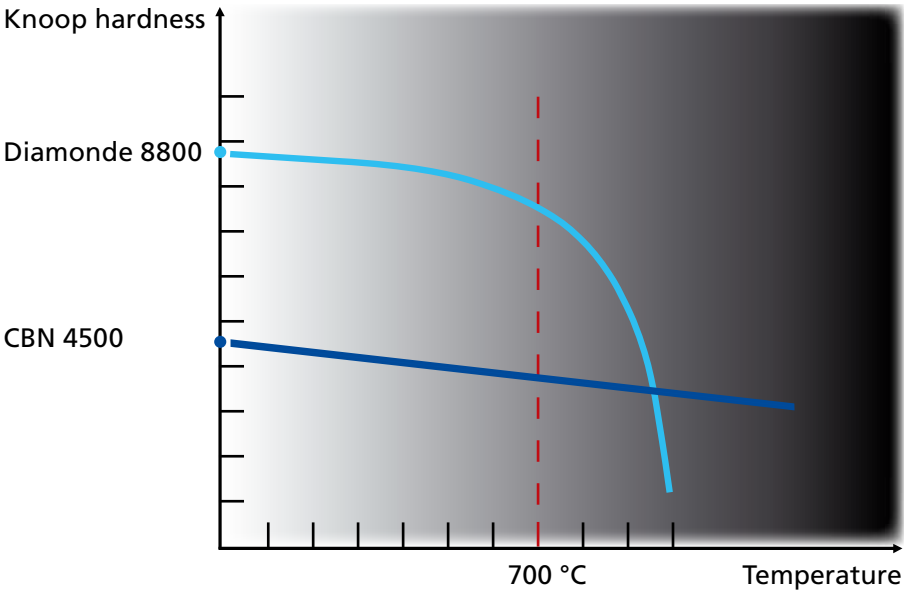
CBN (cubic boron nitride)

CBN consists of the elements boron and nitrogen. In contrast to Diamond, CBN has no carbon atoms, making it suitable for machining steel. CBN is better suited for machining the following materials:

– Hardened steel over approx. 54 HRc hardness
– High-speed steel (HSS)
– Stellite
– Nickel-based special alloys

As the following graph shows, another significant advantage of CBN over Diamond is its thermal stability.
Whereas Diamond suffers a massive loss of hardness at about 700 °C, the hardness of CBN remains virtually unchanged at over 1000 °C.

Thermal performance of Diamond and CBN



Abrasive qualities

Whilst Diamond is available both as a natural or man-made grit, CBN is a purely synthetic product.
In the synthetic production of abrasive grit, characteristics such as grit size, grit shape and structure can be controlled and influenced. This means that the specific demands of different grinding processes can be taken into consideration.
With the aid of “coating“ (grit refinement), other grit characteristics can be created in addition to size, form and structure. As a result, the abrasive grit can be even more precisely designed to match the task.

Grit size / surface grades

Next to the abrasive grade, it is the grit size which largely determines the performance of the grinding wheel, the material removal rate, the efficiency of the grinding process and the ultimate quality of the surface. Guaranteeing perfect cutting capacity with predefined roughness ratio requires grit sizes with close calibration. This is achieved by screening or precision elutriation. The table below shows the FEPA standard grit sizes and other common grit designations and rated mesh widths.

Grit sizes - Diamond and CBN

FEPA standard Screen grit sizes		US standard ASTM-E-11-70 mesh number per inch	ISO R 565 / 1972 rated mesh widths (µm)
D	CBN		
D 301	B 301	50– 60 mesh	300–250
D 251	B 251	60– 70 mesh	250–212
D 213	B 213	70– 80 mesh	212–180
D 181	B 181	80–100 mesh	180–150
D 151	B 151	100–120 mesh	150–125
D 126	B 126	120–140 mesh	125–106
D 107	B 107	140–170 mesh	106– 90
D 91	B 91	170–200 mesh	90– 75
D 76	B 76	200–230 mesh	75– 63
D 64	B 64	230–270 mesh	63– 53
D 54	B 54	270–325 mesh	53– 45
D 46	B 46	325–400 mesh	45– 38

FEPA standard / fine grit sizes		Microns (µm)
D	CBN	
MD 40	MB 40	30–45
MD 25	MB 25	20–40
MD 20		20–30
MD 18		15–25
MD 16	MB 16	12–22
MD 14		10–16
MD 10		6–12
MD 6.3		4– 8
MD 4		3– 6
MD 2.5		2– 4
MD 1.8		2– 3
MD 1		1– 2

Grinding tools made by DIAMETAL are all marked in compliance with FEPA* standards, with the grit size prefixed with a D (for Diamond) and with B (for CBN), (D 126 / B 151).

*FEPA = Fédération Européenne des fabricants de Produits Abrasifs
(Federation of European Producers of Abrasives)

For safety guidelines in the grinding process and other information on FEPA, take a look at the internet homepage at **www.fepa-abrasives.org**

It is the grit size which largely determines the material removal rate of grinding tools and, in particular, the surface quality of the workpiece. Normally, coarser grit sizes will achieve a higher removal rate, but usually at the expense of the surface quality. Conversely, finer grit sizes achieve better surface qualities, at the expense of abrasive performance. This contrast between performance on the one hand and surface quality on the other means that many grinding operations still need rough grinding followed by finish grinding.

The following table shows standard values in connection with grit size and surface quality. The values shown have been determined after cross-grinding (resulting in the best quality) which means that they indicate the best possible results.

Obtainable surface quality according to grinding grit size

Diamond and CBN wheel, resin bond, cup wheel, cross grinding on carbide metal K20/HSS 64 HRc

FEPA grit size		Mean roughness Ra		Surface quality	Grinding operation
D	CBN	D	CBN	N	
	B 301		2.100	N8	Roughing
	B 251		1.770	N8	Roughing
	B 213		1.410	N7	Roughing
	B 181		1.120	N7	Roughing
	B 151		0.750	N6	Roughing
	B 126		0.660	N6	Roughing
D 181	B 107	0.530	0.530	N6	Coarse grinding
D 151	B 91	0.500	0.500	N6	Coarse grinding
D 126	B 76	0.450	0.450	N6	Coarse grinding
D 107	B 64	0.400	0.400	N5	Pregrinding
D 91	B 54	0.330	0.330	N5	Pregrinding
D 76	B 46	0.250	0.250	N5	Pregrinding
D 64		0.180		N4	Fine grinding
D 54		0.160		N4	Fine grinding
D 46		0.150		N4	Fine grinding
MD 25		0.120		N3	Ultrafine grinding
MD 20		0.050		N2	Ultrafine grinding
MD 10		0.025		N1	Ultrafine grinding

	N1	N2	N3	N4	N5	N6	N7	N8
Ra (µm)	0.025	0.05	0.10	0.2	0.4	0.8	1.60	3.20
Rt (µm)	0.500	0.80	1.25	2.5	5.0	8.0	16.0	32.0
Rz (µm)	0.400	0.63	1.00	2.0	4.0	6.3	10.0	16.0

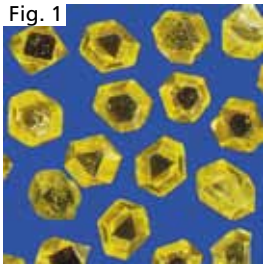
Note:
When using periphery wheels (flat, external, internal, creep feed grinding, etc.), the grit size selected should be 2 to 3 increments finer to achieve the surface values shown in the table.

Grit shape / structure / finishing (coating)

The quality of the grit has a decisive impact on the properties of the grinding tools. The grit shape, for instance, offers a wide spectrum of options, ranging from rather round and block-like grits (Fig. 1) to oblong, splinter-shaped grits (Fig. 2).

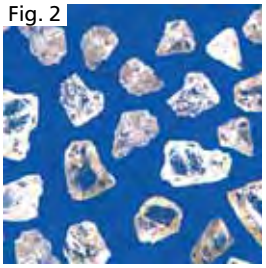
Within the various grit shapes, one also distinguishes between monocrystalline and polycrystalline grits. Whereas monocrystals (Fig. 1) are very tough and impact-resistant, polycrystals (Fig. 3) tend to split up.
During grinding, this splitting tendency keeps on generating new tips and cutting edges which can help to improve the life and the cutting performance of the grinding tool. This is usually referred to as “self-sharpening”.

Fig. 1



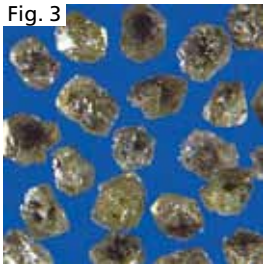
Round, block-shaped monocrystals

Fig. 2



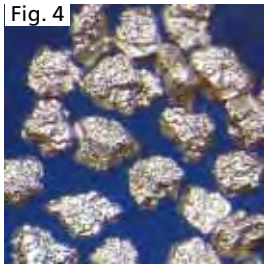
Oblong, splinter-shaped grit, monocrystals

Fig. 3



Polycrystalline grit

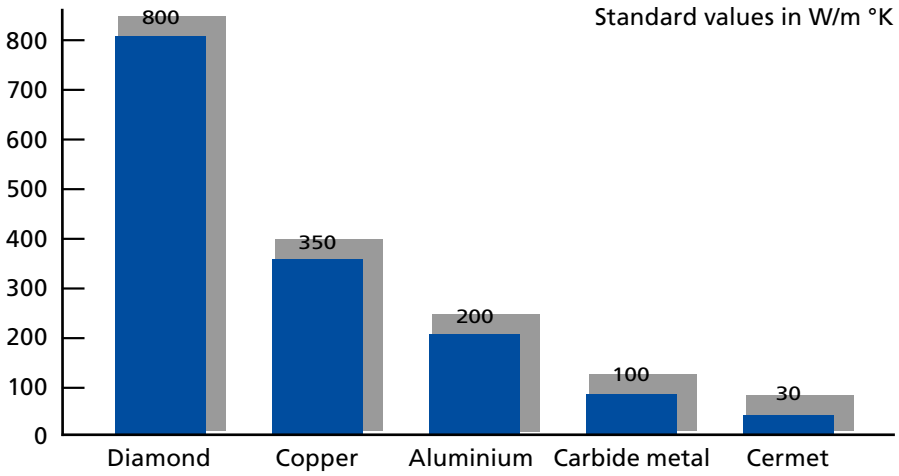
Fig. 4



Finished grit / coating

Finishing the grinding grits, also known as coating (Fig. 4), can enhance the anchoring power of the grits in the bond. Also, coated grits generate a thermal barrier between the bond and the grinding grit, which is advisable in some applications. These options gain in importance by the fact that diamond has an excellent thermal conductivity.

Thermal conductivity of diamond versus other materials



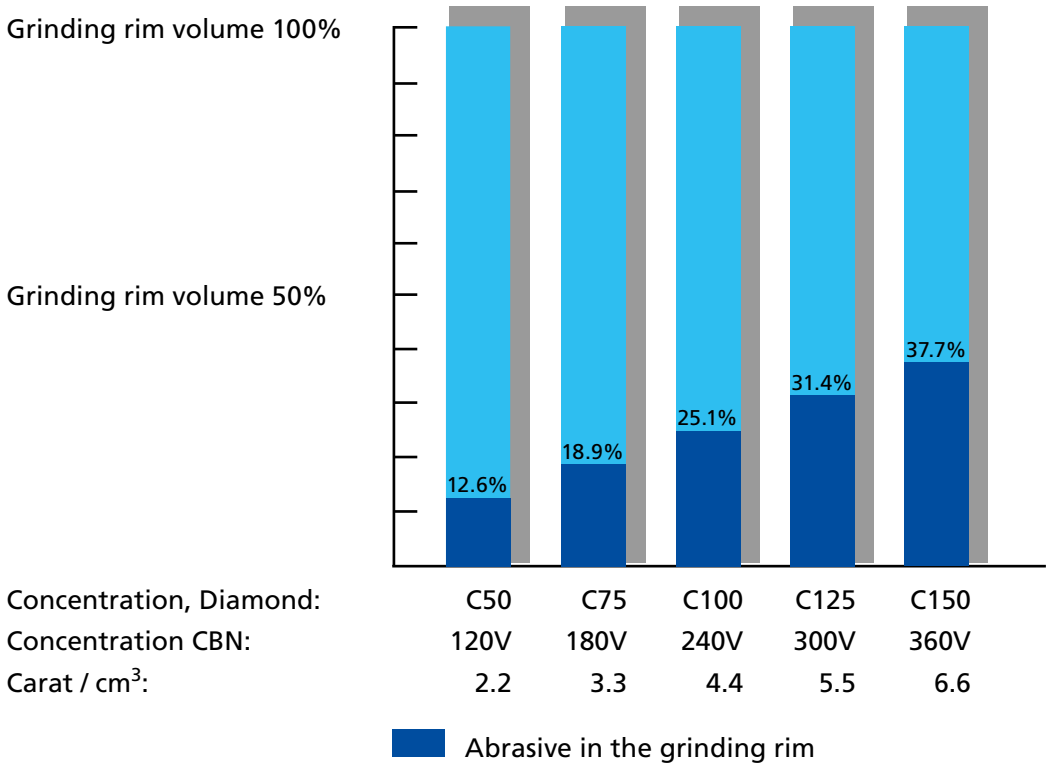
Ever since the company was founded, DIAMETAL has always used grit grades of the highest qualities available by suppliers. Thanks to many years of development and trials involving the performance in use of a wide range of grit grades, we now have unmatched experience with innumerable grit types in the grinding process.
Solving specific customer problems is always a challenge for us which we are always ready to tackle.

Concentration

Concentration is the ratio of the weight of the Diamond or of the CBN in carat (1 carat = 0.2 g) to a cubic centimeter of grinding rim volume. According to FEPA standards concentration "100 for Diamond" resp. "240V for CBN" corresponds to an abrasive content of 4.4 carat per cubic centimeter of grinding rim volume. All other concentrations are proportional. Concentration has a considerable impact on the cutting performance and the life of a grinding wheel, to some extent also on the price.

The diagram below shows the different concentrations

Concentrations



Bonds

Wheel performance and the efficiency of the grinding operation are determined to a large extent by the correct choice and the careful manufacture of the bond, as well as by the quality of the abrasive and the grit size. To account for the virtually infinite variety of different grinding processes and their ever-increasing demands, we continuously optimize and supplement our range of bonds. Depending on the conditions of use, DIAMETAL grinding tools are used with the following bond types:

– Resin bonds	B
– Metal bonds	M
– Metal-vitrified bonds	MV (VC / V2)
– Vitrified bonds	V
– Electroplated bonds	G

The bond properties are essentially characterized by the bond agent used, as shown by the table below:

Basic properties of the bond systems

	Cutting capacity	Stability of shape	Temperature resistance	Thermal conductivity	Dressing capability
Resin	↑	→	→	→	↑
Metal	→	↑	↑	↑	→
Vitrified	↑	→	↑	↓	↑
Metal-vitrified	→	↑	↑	↓	↓

↑ = excellent → = good ↓ = inadequate

The bond characteristics can also be varied by adding different fillers, grinding grit and bond agents. Essentially, their purpose is:

Supporting fillers:	Supporting the grinding grits and anti-wear protection
Metallic fillers:	Thermal leak-off and better grit retention
Lubricating fillers:	Reducing the friction heat and better chip removal
Pore-forming fillers:	Coolant transport and reducing the contact surface

Today, with the wide variety of combination options involving grinding grit, fillers, concentration and substrate material, there is always the right kind of grinding tool to meet the requirements of any modern grinding process.

Thanks to our wealth of experience combined with ongoing developments, our product offering provides an unmatched variety of different bonds.
Spread over the various bond systems, DIAMETAL today offers more than 80 standard bonds, with new ones being added almost daily. This unique choice allows us to offer solutions for virtually any grinding task. And if things get really tight, we even go as far as modifying a standard bond specially for a customer.

Resin bonds - “B”

The usual bond agents in resin bonds include phenol and imide resins. The short-term thermal load capacity of these bonds is between 250°C and a maximum of 350°C. Resin-bonded grinding tools have an excellent cutting capacity and a cool cut, designed for use in a wide variety of applications both with Diamond and in CBN. Certain bonds can also be used for dry grinding.
Due to economies of scale and the low press temperature, grinding tools with resin bond are usually the best bargain among the various systems. As a result of their limited mechanical strength, resin-bonded grinding tools tend to reach the end of their stability of shape somewhat quicker than, for instance, metal or metal-vitrified bonds.
But, if the grinding process demands very fine surfaces, resin-bonded grinding tools are perfectly efficient and adequate for the job.

Metal bonds - “M”

The bond agents used in metal bonds include various different bronze alloys. The thermal load capacity of these bond systems can be as high as 600°C. Due to their superb grit retention power, metal-bonded grinding tools have an excellent stability of shape - a decisive point when grinding profiles, for instance.
The ability of leaking off grinding heat much better makes these bond systems the ideal choice for flute grinding (mills, drills, etc.), with enhanced productivity.

Metal-vitrified bonds “MV” (VC for Diamond / V2 for CBN)

As in classic vitrified bonds, the bond agents used in metal-vitrified bonds includes various glass grades. They differ from classic vitrified bonds only in their manufacturing process. Classic vitrified bonds are “pressure-free sintered“, i.e. stoved in the furnace without pressing. Similar to metal bonds, metal-vitrified bonds are pressed under high temperatures. The thermal load capacity of these bond systems is similar to that of metal bonds (approx. 600°C).
Typical applications for metal-vitrified bonds are internal grinding, cutting sapphire and oxide ceramic, honing tools and - for CBN - purling and flute grinding.

Vitrified bonds “V”

We are now talking of the classic ceramic or vitrified bond, made with glass and without pressing. The thermal load capacity of this bond system is between 600°C and 700°C. Vitrified bonds have an excellent dressing capacity, allowing these grinding tools to return to their original shape easily once they lose their grinding rim geometry. This also allows for a reproducible dressing process capable of being automated, as a rule on the machine.
Another advantage of vitrified bonds is the controllable porousness of the grinding rim during production, ranging from a closed to a very open rim structure. No other bond system allows a similar range.

High porousness enhances the coolant transport, improves chip removal and reduces the contact surface / the grinding force and therefore the process heat. These benefits are particularly pronounced in high material removal grinding operations. The main applications for vitrified bonds are found in steel machining (CNB wheels), particularly in flat, external, internal and tool grinding.

Dressing is an element deserving special attention in vitrified bonds. A few notes on this subject may therefore be of interest:

– use rotating dressing tools whenever possible
– always make small feeds (0.002 to max. 0.01 per overrun)
– never run over the grinding wheel without feed control
– dress with cooling, whenever possible

Depending on machine options, the following dressing tools are commonly used today:

– Diamond dressing (form) roller
– PCD wheels
– vane-type dressers with Diamond cup wheel
– Crushier wheels
– Silicon carbide wheels
– MKD tiles
– multigrit Diamonds

Electroplated bonds - "G"

For these bond systems, please refer to our special catalog "Electroplated precision grinding tools in Diamond and CBN".

Cutting speeds (Vs)

Cutting speed is defined as the speed at the perimeter of the grinding wheel, measured in meters per second. The dynamic grinding hardness of a grinding tool can be influenced by changing the cutting speed. The higher the cutting speed, the higher the dynamic grinding hardness, which has a positive effect both on the life and the stability of shape of the grinding wheel. But the negative effect of this scenario is the deterioration of the "self-sharpening effect", with the wheel tending to clog up more readily.
Grinding wheels clogging up (an effect often found in practice) can therefore be counteracted by reducing the cutting speed, with the outcome that "self-sharpening" is enhanced and the grinding wheel becoming more cut-efficient.

The table below shows our recommended cutting speeds. As there are many different grinding processes and machines, the values shown should be regarded only as reference values:

Recommended cutting speeds

Grinding agent	Type of bond	Wet grinding m/s	Dry grinding m/s
Diamond	B: resin	20– 30	10–20
Diamond	M: metal	15– 25	10–15
Diamond	V: vitrified	10– 20	
Diamond	G: electroplated	10– 20	10–15
CBN	B: resin	40– 80	15–30
CBN	M: metal	40– 80	10–20
CBN	V: vitrified	40– 60	
CBN	G: electroplated	40–125	10–30

Notes:

For cutting speeds in excess of 30 m/s, particular attention must be paid to cooling (see the chapter on "Cooling" on page 34).

For internal grinding (with grinding pins), the above values should be reduced by 30% to 50%.

Equation for determining the cutting speed
Vs = cutting speed in m/s
D = grinding wheel diameter in mm
Ns = rotary speed of the grinding wheel in rpm.

$$Vs = \frac{D \times \pi \times Ns}{60 \times 1000} = m/s$$

All of the DIAMETAL grinding wheels show the maximum permissible cutting speed:

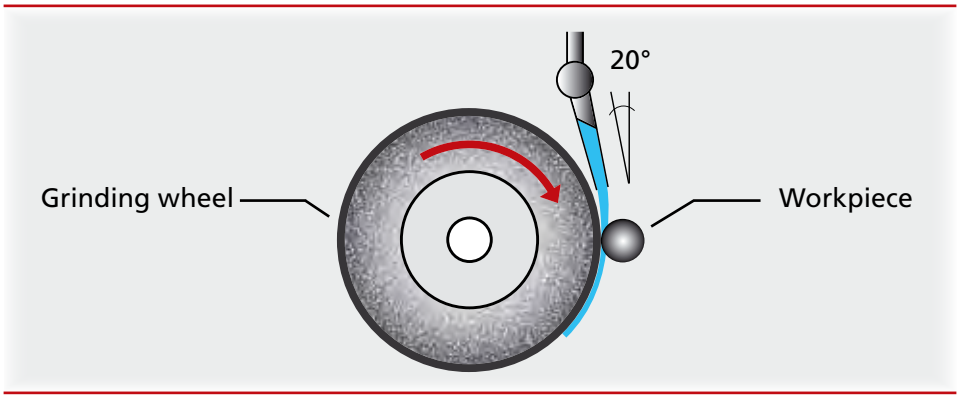
Diamond: Vmax. 63 m/s
CBN: Vmax. 80 m/s

Cooling

Whenever possible, grinding processes should always be made with some mode of cooling. Compared with dry grinding, wet grinding substantially improves the life of the grinding wheel and the risk of causing thermal damage to the workpiece drops dramatically. Also, cooled grinding allows a much higher removal volume which, ultimately, is a measure of the efficiency of a grinding operation.
Using pure grinding oil as coolant has provided by far the best results, especially when using CBN grinding tools. Compared with other cooling media, the life of the grinding wheel rises by a factor of 3.

Highly important criteria for successful cooling during the grinding process are the positioning and the configuration of the nozzle and the coolant pressure.
The coolant jet should always hit the grinding wheel at an angle of 20°, as close as possible to the grinding contact zone.

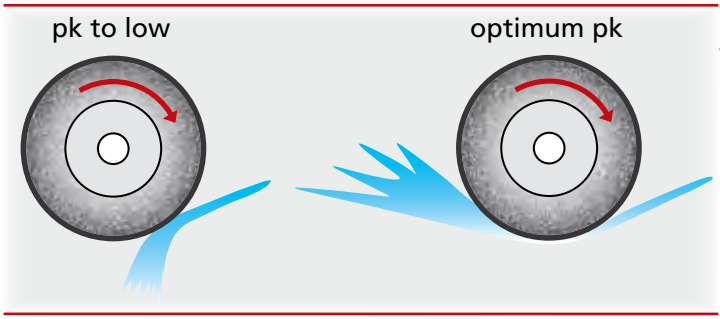
Nozzle position



The exit opening of the nozzle should be sharp-edged, undamaged, and only marginally wider than the grinding rim (e.g. grinding wheel 10 mm in width / nozzle 11 mm in width).

To safeguard the efficiency of the cooling, the exit speed at the mouth of the coolant nozzle should correspond to the perimeter speed of the grinding wheel (Vs). The required coolant pressure (pk) is shown in the table below.

Wheel speed (Vs) and required coolant pressure (pk) at the nozzle



Vs in m/s	pk in bar	
	optimum	minimum
10	1	0.6
20	2	1.2
30	5	3.0
40	8	4.8
50	13	7.8
60	19	11.4

Wheel body - the base material of a grinding wheel

Depending on manufacturing method and use of a grinding wheel, a variety of different wheel bodies are used. The choice of the body material follows the standard of DIAMETAL, although exceptions may be made for optimizing certain grinding tools.
The following diagram shows the basic properties of various materials used by DIAMETAL for wheel bodies:

Wheel body materials and their properties

	Vibration damping	Thermal conductivity	Mechanical strength	Specific weight	Cost
Pressed aluminium	↑	→	↗	↓	↑
Synthetic	↑	↓	↘	↓	↑
Cast aluminium	↓	↑	↑	↘	↓
Bronze	↓	↑	↑	↑	↗
Steel	↓	↗	↑	↗	↓

↑ = very high ↗ = high → = medium ↘ = low ↓ = very low

Particularly when grinding with fine grit sizes, the use of a material very low in vibration is highly recommended. This is the only way of accomplishing what a fine-grit grinding wheel has been designed for, namely a perfect surface quality.

As a result of their low mechanical strength, synthetic wheel bodies are used only in Diamond grinding wheels. Diamonds allow lower cutting speeds (compared with CBN) which, in turn, reduces the mechanical stress acting on the grinding tool.

Conditioning of Diamond and CBN grinding wheels

Conditioning means both the dressing and the sharpening of grinding wheels. In many cases, only a combination of both methods will provide satisfactory results in terms of grinding wheels.
The following details relate mainly to the conditioning of the bond variants resin B, metal M and metal-vitrified MV. The requirements for dressing vitrified bonds are different from those described in the chapter “Vitrified Bonds“ on page 31/32.

Dressing

Dressing in this context means the recovery of the grinding rim geometry and the correction of plane and radial runouts (eccentricity).
Conventional silicon carbide wheels are used for dressing B, M and MV bonds. The choice of the proper dressing wheel with respect to grit size and degree of hardness depends on the grit size of the Diamond or CBN grinding wheel to be dressed. The overview below shows the appropriate details.

Selecting the right silicon carbide wheel

Diamant / CBN grit size				Silicon carbide wheel	
D		CBN		Grain size	Hardness
D	301	B	301	36	M
D	251	B	251	36	M
D	213	B	213	60	K
D	181	B	181	60	K
D	151	B	151	60	K
D	126	B	126	60	K
D	107	B	107	120	H
D	91	B	91	120	H
D	76	B	76	220	H
D	64	B	64	220	H
D	54	B	54	220	H
D	46	B	46	320	G
MD	40	MB	40	320	G
MD	25	MB	25	320	G
MD	20			500	E
MD	16	MB	16	500	E
MD	10			500	E
MD	6.3			600	E
MD	4			600	E
MD	2.5			800	E

The figures refer to silicon carbide wheels supplied by WST Winterthur Schleiftechnik

Dressing should always be made in the wet mode. If this cannot be done, select the grit size of the dressing wheel one increment finer than shown in the table. The same applies to the dressing of grinding wheels with small rim angle, e.g. pointed profile grinding wheels.

The true running (or concentricity) of the dressing wheel should be checked before every use. The runout of a dressing wheel should never be more than 0.01 mm. Particularly for fine-grained dressing wheels (grit size 320 and finer), the true running should be as perfect as possible to guarantee the best results for the Diamond or CBN grinding wheel to be dressed.

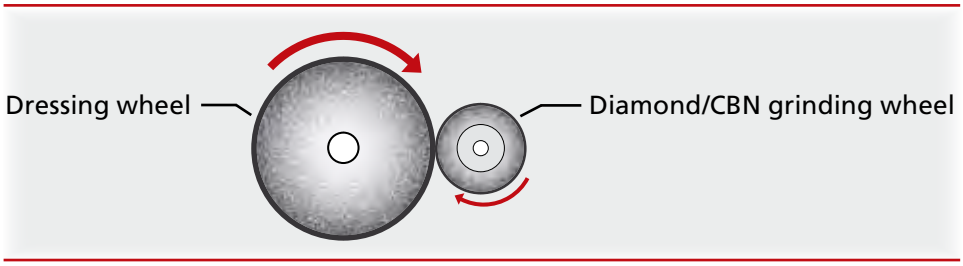
Similar to the actual grinding process, the successful dressing of a grinding wheel depends to a large extent on the parameters selected. Here are our recommendations:

Recommended parameters:

Speed of the dressing wheel:	30 m/s
Speed of the DIA/CBN wheel to be dressed:	1 m/s
Feed per stroke during predressing (roughing):	0.02–0.05 mm
Feed per stroke during finish dressing (finishing):	0.01–0.02 mm

Always use the counterrotation principle when dressing. This will increase the life of the dressing wheel, and the dressed grinding tool will be more cut-efficient.

The counterrotation principle during dressing



Always select the dressing wheel with the widest possible diameter. This will make it easier to achieve straight rims on the grinding wheel.

During dressing, the SiC dressing wheel should always remain in contact with the grinding wheel to be dressed. We recommend using only about half the dressing wheel width to run over the grinding wheel rim to be dressed.

When dressing very wide Diamond or CBN wheels, make sure that the feed is not only made at the end or outer points. The occasional feed in the center of the rim prevents convex rim topographies on the grinding wheel to be dressed.

To be noted specially for pointed profile wheels:
Feed should be made in these wheels only on the inside rim. Also, the rim of the steel body which is "ground along" should not be wider than 1 mm.

Note:
The "G" value for dressing Diamond and CBN wheels is roughly between 0.025 and 0.03. This means that 30 to 40 cubic centimeters of SiC dressing wheel are needed for removing one cubic centimeter of Diamond or CBN rim. In other words: the wear at the dressing wheel is enormous, but perfectly normal.

Sharpening

For grinding tools to have the best possible cutting efficiency, they need a certain amount of free-standing grinding grits. If a grinding wheel has been dressed as described in the preceding “Dressing“ chapter, the amount of free-standing grits is usually insufficient. To obtain the necessary grit free-stand, the bond must be set back after dressing. This process is known as “sharpening“.

Unlike the dressing with silicon carbide wheels, corundum wheels are used for sharpening. The universal grit size which can be used for this process is 320 with a hardness J (specifications by WST Winterthur Schleiftechnik).

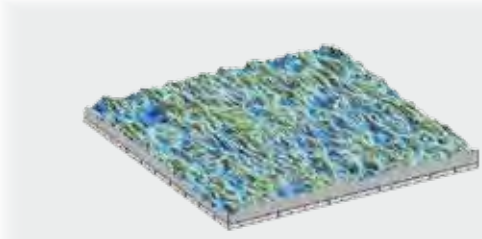
The parameters to be selected for sharpening are similar to those for finish dressing.

When sharpening by hand, we recommend using our sharpening stones:
No. 1: red = for grit size grinding wheel D/B 301 - D/B 46
No. 2: white = for grit size grinding wheel MD/MB 40 - MD/MB 1

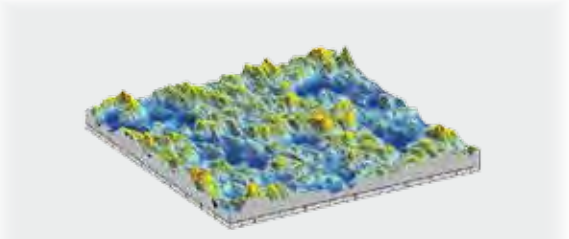
The sharpening stone should always be wet before use. Grinding oil is not suitable for wetting the stone. Use only water or emulsion.

Important:
When grinding by hand or by machine, the direction of rotation of the grinding wheel must be the same as that used during the actual grinding process.

Grinding rim surface after dressing (hardly any grit free-stand, blunt)



Grinding rim surface after dressing and sharpening (good grit free-stand, aggressive)



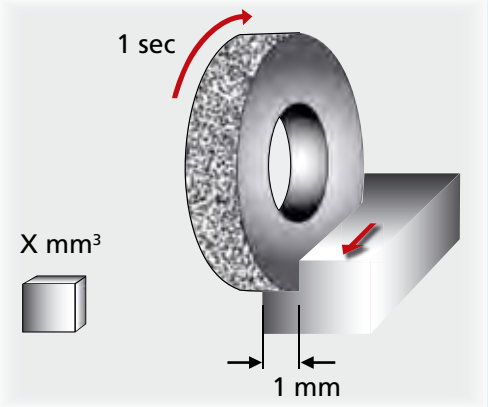
Grinding characteristics

There are many characteristic variables in the grinding process. At this point we focus on just two of the most important in practice: the specific time-machining volume and the "G" value.

Specific time-machining volume Qw'

The specific time-machining volume, also known as Qw', describes the removal capacity of a grinding wheel in cubic millimeters per millimeter of grinding rim width per second. This allows a direct comparison of various grinding processes and to evaluate the actual removal capacity. Also, Qw' is often used to calculate the feed control.

Qw' = mm³ / mm / s



Educations for calculating Qw':

Flat or deep grinding

$$Qw' = \frac{ae \times Vt}{60}$$

External – longitudinal grinding

$$Qw' = \frac{ae \times Nw \times Dw \times \pi}{60}$$

External – plunge-cut grinding

$$Qw' = \frac{Vf \times Dw \times \pi}{60}$$

With:
ae = feed in mm
Vt = advance speed in mm/min
Dw = workpiece diameter mm
Nw = rotary speed of workpiece in rpm
Vf = radial feeding speed (advance) in mm/min

G value

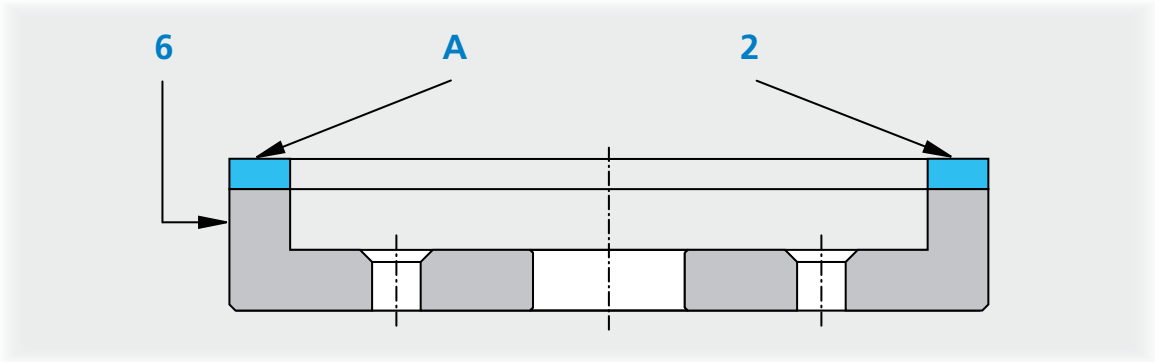
The G value is a ratio number. It corresponds to the ratio of material removed from the workpiece in cubic millimeters and the grinding rim volume required for this operation, also measured in cubic millimeters. Naturally, the G value makes sense only when directly comparing different grinding wheels used in identical grinding processes and with identical parameters.

$$\text{G value} = \frac{\text{removed workpiece volume in mm}^3}{\text{volume of wear of the wheel rim in mm}^3}$$

The general guide values for the G value when using Diamond and CBN wheels are:

Diamond on carbide metal:	50–300
CBN on HSS:	150–800

Wheel description / FEPA shape description



6 = Position 1

Shape of the wheel body

A = Position 2

Shape of the Diamond rim

2 = Position 3

Configuration of the Diamond rim on the wheel body

Order details

The following details are required for processing your enquiries or orders:

– Spezifications according to data sheets
– Grit size / with identifier D for Diamond, B for CBN
– Concentration
– Bond

The engraved fabrication number is sufficient for follow-up orders.

Ordering example:

6A2	150	6	2	20	D	126	50	B5
Wheel shape	Diameter	Rim width	Rim depth	Bore	Abrasive agent	Grit size	Concen-tration	Bond

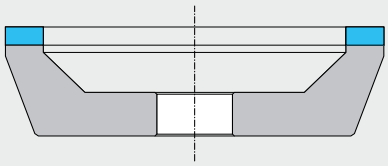
Werkzeuge / Tools

Formenübersicht / Overview of shapes

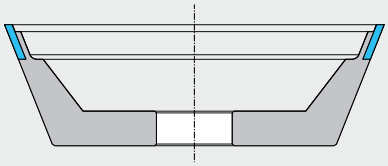
Formenübersicht / Overview of shapes

61 | 62

11 A 2

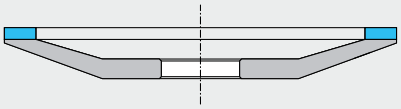


11 V 9

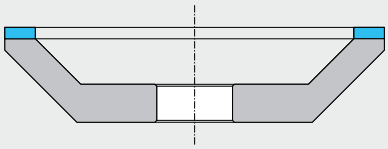


63 | 64

12 A 2 20°

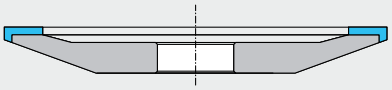


12 A 2 45°

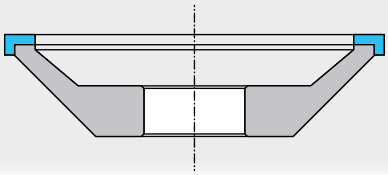


65 | 66

12 C 9 20°

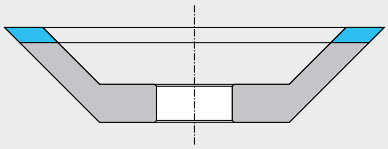


12 C 9 45°

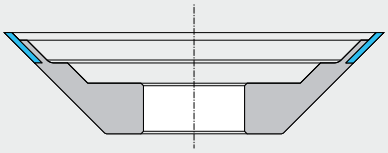


67 | 68

12 V 2 45°

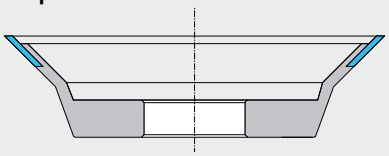


12 V 9 45°

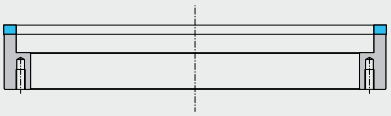


69 | 70

12 V 9 45°|70°

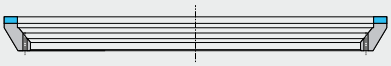


6 A 2 WSP

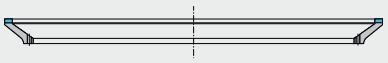


71 | 72

11 A 2 60°|70° WSP



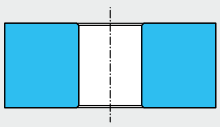
12 A 2 45° WSP



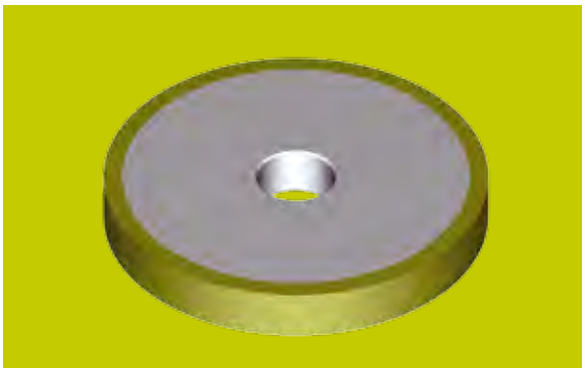
73 | 74

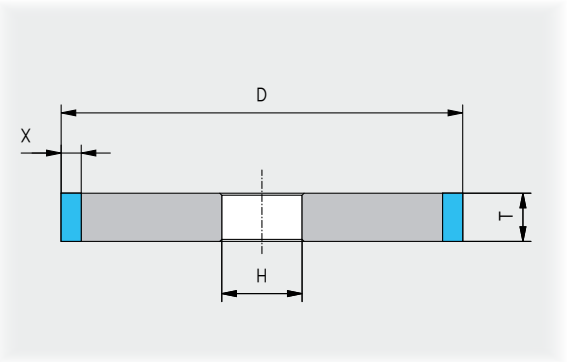
1 A 1 R

1 A 8



1 A 1





D	T	X	H*
25	6|8|10	3	
30	6|8|10	3	
40	6|8|10	3	
50	6|8|10	3	
75	6|8|10|12	3|5	
100	6|8|10|12	3|5	
125	8|10|12	3|5	
150	10|12|15|20	3|5	
175	12|15|20	3|5	
200	15|20	3|5	
250	20	3|5	
300	20	3|5	
350	20	3|5	
400	20	3|5	
450	20|25	3|5	
500	auf Anfrage / on request		
550	auf Anfrage / on request		
600	auf Anfrage / on request		

H* = Bei Bestellung angeben / specify when ordering

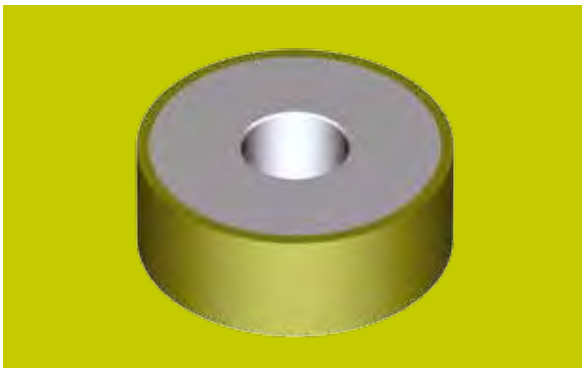
B Standard / standard

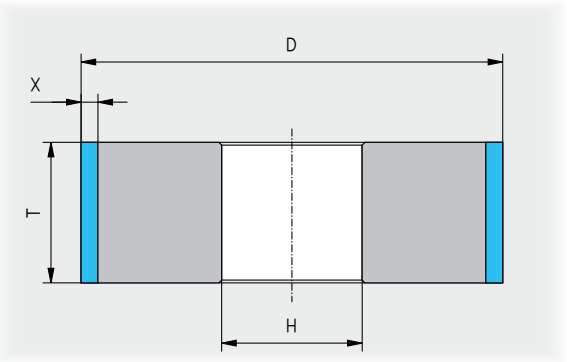
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

1 A 1 Centerless





D	T	X	H*
150	Nach Kundenwunsch	3|5	
200	acc. to customer specifications	3|5	
250		3|5	
300		3|5	
350		3|5	
400		3|5	
450		3|5	
T breiter als 50 mm = Mehrbelagsscheiben T wider than 50 mm = Multi-rim wheels			

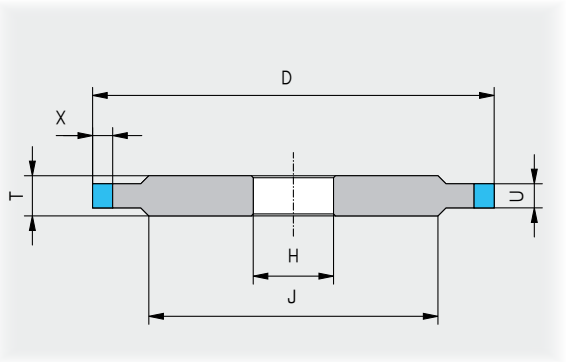
H* = Bei Bestellung angeben / specify when ordering

Wichtig:
Angabe, ob Durchlauf- oder Einstechschleifen

Important:
Specify if sweep grinding or plunge-cut grinding

B	Standard / standard
M	auf Anfrage / on request
MV	auf Anfrage / on request
V	auf Anfrage / on request

14 A 1



D	U	X	T	J	H*
75	2|3	3|5	6	55	
100	2|3	3|5	6	80	
125	2|3	3|5	8	105	
150	2|3	3|5	10	130	
175	2|3|4	3|5	12	155	
200	2|3|4	3|5	15	180	

H* = Bei Bestellung angeben / specify when ordering

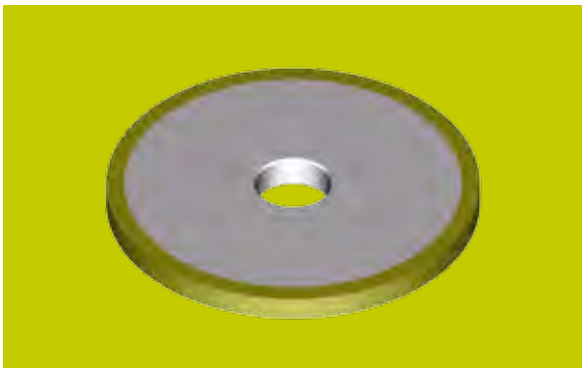
B Standard / standard

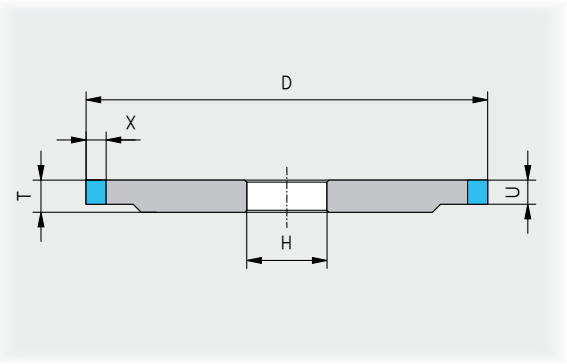
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

4 A 1





D	U	X	T	H*
25	4	3	6	
30	4	3	6	
40	4	3	6	
50	3|4	3|5	6	
75	2|4|5	3|5	6	
100	2|3|4|5	3|5	6	
125	2|3|4|5	3|5	8	
150	2|3|4|5|6|8	3|5	10	
175	2|3|4|5|6|8|10	3|5	12	
200	2|3|4|5|6|8|10	3|5	15	
250	8|10|12|15	3|5	20	
300	8|10|12|15	3|5	20	
350	10|12|15	3|5	20	
400	10|12|15	3|5	20	
450	12|15	3|5	20	
500	auf Anfrage / on request			
550	auf Anfrage / on request			
600	auf Anfrage / on request			

H* = Bei Bestellung angeben / specify when ordering

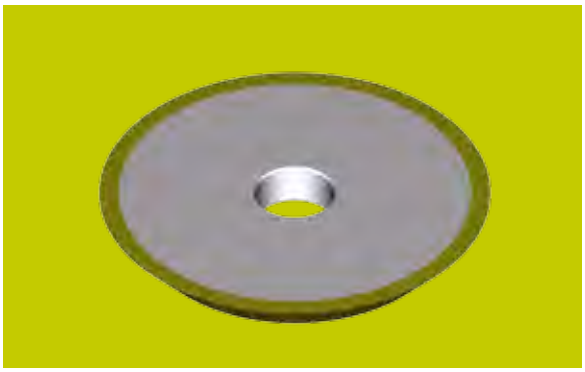
B Standard / standard

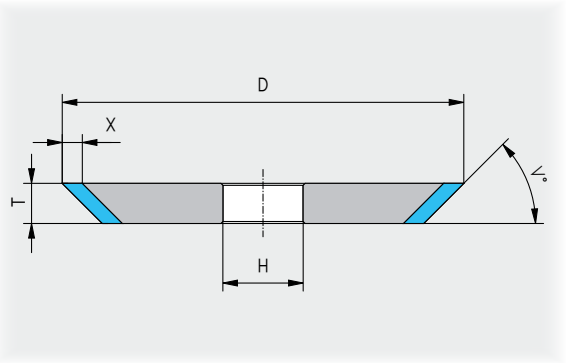
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

1 V 1





D	T	X	V°	H*
75	6|8|10|12|15|20	5	45°|60°|65°|70°|75°|80°	
100	6|8|10|12|15|20	5|8	45°|60°|65°|70°|75°|80°	
125	6|8|10|12|15|20	5|8	45°|60°|65°|70°|75°|80°	
150	6|8|10|12|15|20	5|8	45°|60°|65°|70°|75°|80°	

H* = Bei Bestellung angeben / specify when ordering

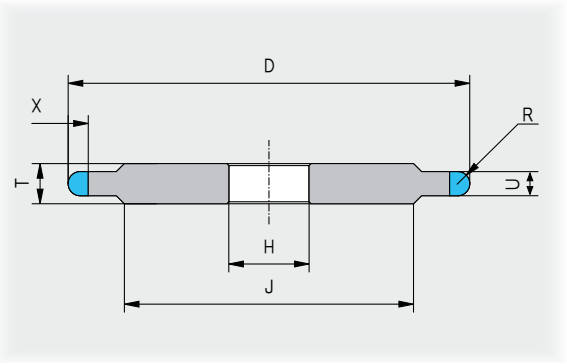
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

14 F 1



D	U	X	T	J	R	H*
50	2|3|4	3|5	6	30	1|1.5|2	
75	2|3|4	3|5	6	55	1|1.5|2	
100	2|3|4	3|5	6	80	1|1.5|2	
125	2|3|4	3|5	6	105	1|1.5|2	
150	2|3|4	3|5	6	130	1|1.5|2	

H* = Bei Bestellung angeben / specify when ordering

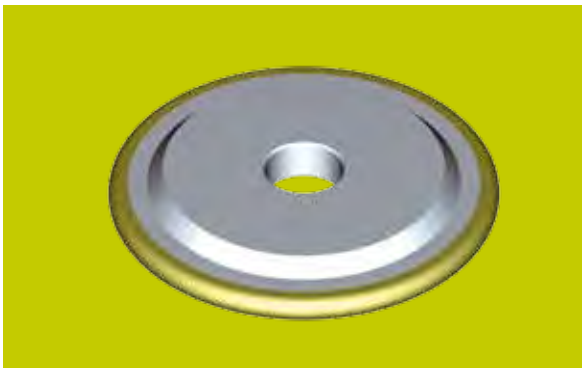
B Standard / standard

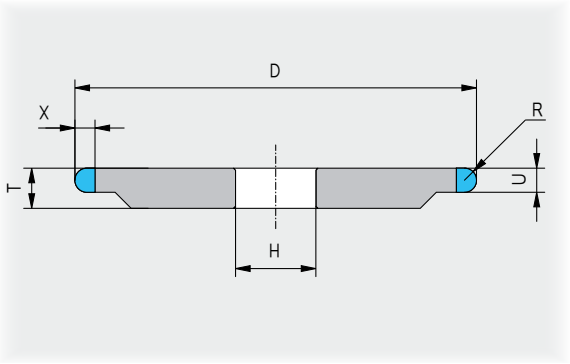
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

4 F 1





D	U	X	T	R	H*
50	1|1.5	5	6	0.5|0.75	
75	1|1.5	5	6	0.5|0.75	
100	1|1.5	5	6	0.5|0.75	
125	1|1.5	5	6	0.5|0.75	
150	1|1.5	5	6	0.5|0.75	

H* = Bei Bestellung angeben / specify when ordering

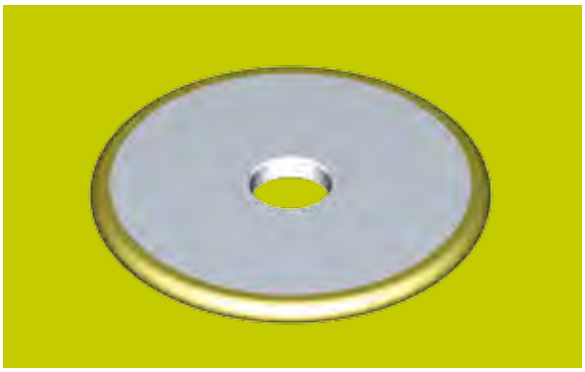
B Standard / standard

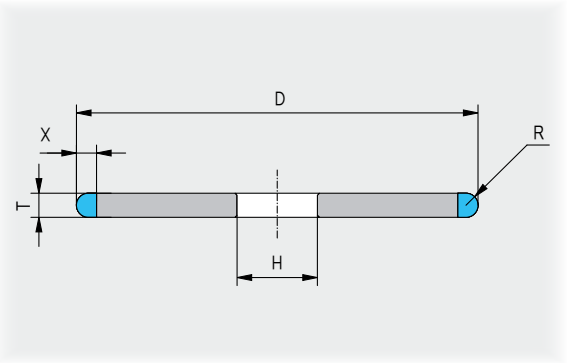
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

1 F 1



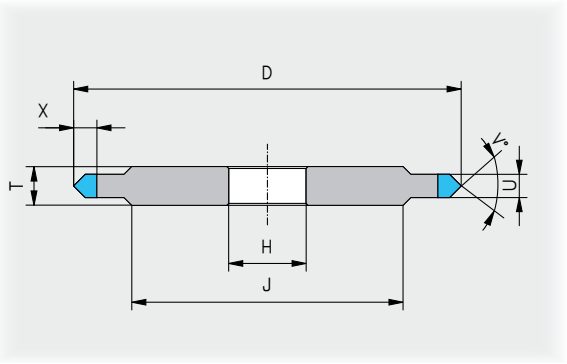


D	T	X	R	H*
50	6|8	5	3|4	
75	6|8	5	3|4	

H* = Bei Bestellung angeben / specify when ordering

B	Standard / standard
M	Standard / standard
MV	auf Anfrage / on request
V	auf Anfrage / on request

14 E 1



D	U	X	T	J	V°	H*
40	2|3|4	4|5	4|5	26	35°|45°|60°|90°	
50	2|3|4	4|5	4|5	36	35°|45°|60°|90°	
75	2|3|4	5	5	61	35°|45°|60°|90°	
100	2|3|4	5	5	86	35°|45°|60°|90°	
125	2|3|4	5	5	111	35°|45°|60°|90°	
150	2|3|4	5	5	136	35°|45°|60°|90°	
200	2|3|4	5	10	186	35°|45°|60°|90°	

H* = Bei Bestellung angeben / specify when ordering

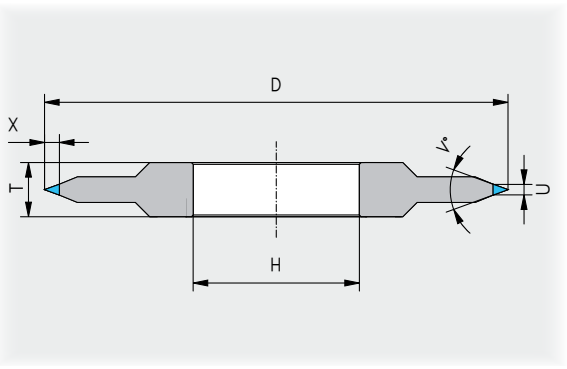
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

14 K 1



D	U	X	T	V°	H*
125	1.58	5	10	18°	
125	2.68	5	10	30°	
150	1.58	5	10	18°	
150	2.68	5	10	30°	
150	2.54	8	10	18°	
150	4.28	8	10	30°	
200	1.58	5	20	18°	
200	2.68	5	10	30°	
200	2.54	8	10	18°	
200	4.28	8	10	30°	

H* = Bei Bestellung angeben / specify when ordering

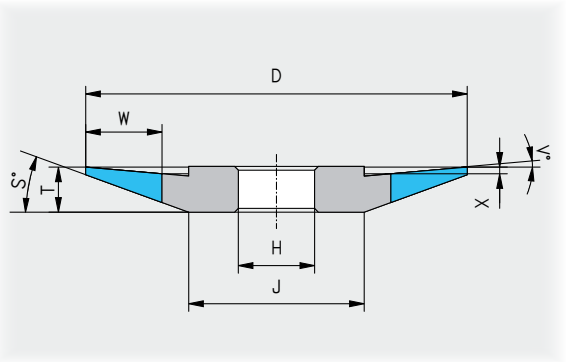
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

4 BT 9



D	W	X	T	J	V°	S°	H*
60	10	1	8	21	10°	20°	
75	6|10	1	8	34	5°	20°	
100	6|10	1	10	46	5°	20°	
125	6|10	1	12	62	5°	20°	
150	6|10	1	12	87	5°	20°	

H* = Bei Bestellung angeben / specify when ordering

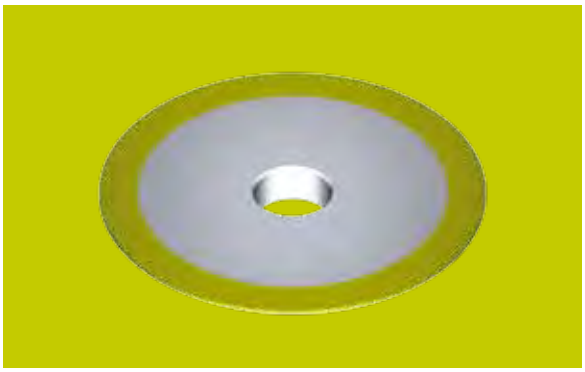
B Standard / standard

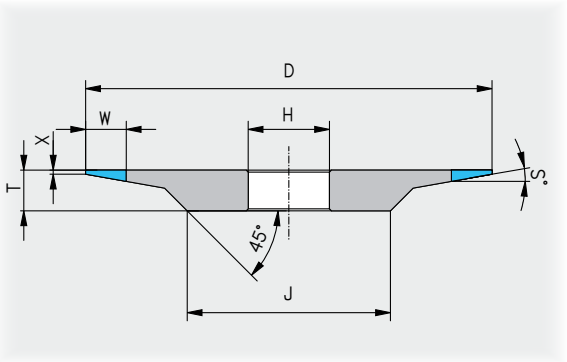
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

4 B 9





D	W	X	T	J	S°	H*
50	6|10	1	6	25	10°	
75	6|10	1	8	40	10°	
100	6|10	1	8	50	10°	
125	6|10	0.5|1	8	65	10°	
150	6|10	0.5|1	10	80	10°	

H* = Bei Bestellung angeben / specify when ordering

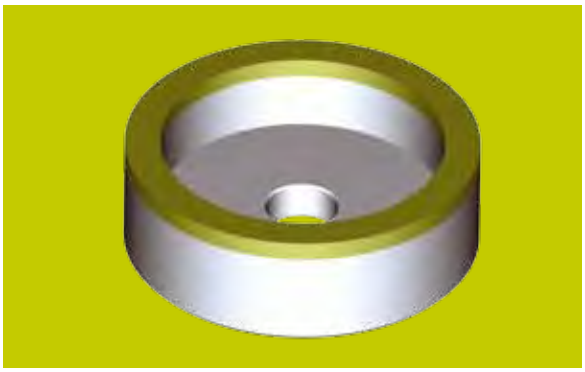
B Standard / standard

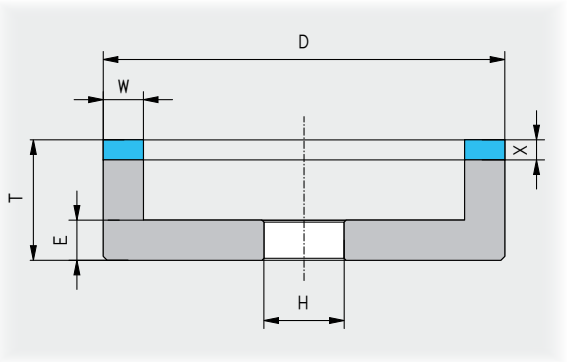
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

6 A 2





D	W	X	T	E	H*
30	3	4	25	10	
50	3|5	4	22	10	
75	3|5|6|10	3|4	22	10	
100	4|5|6|8|10|15	3|4	22	10	
125	5|6|8|10|15	3|4	25	10	
150	5|6|8|10|15|20|25	3|4	25	10	
175	6|8|10|15|20|25	3|4	25	13	
200	10|15|20|25	3|4	30	13	
250	8|10|12|16|20	3|4	30	13	

H* = Bei Bestellung angeben / specify when ordering

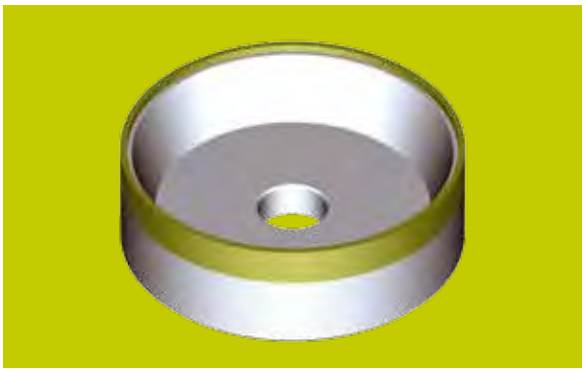
B Standard / standard

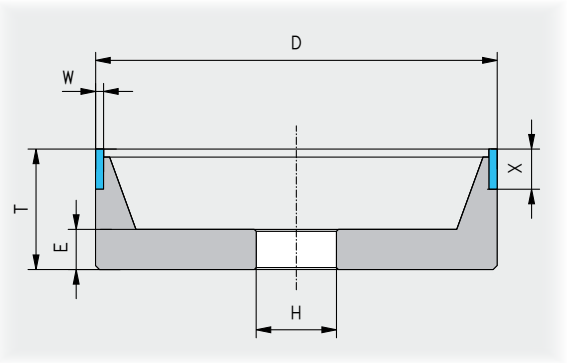
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

6 A 9





D	W	X	T	E	H*
75	2|3	6|10	25	10	
100	2|3	6|10	30	10	
125	2|3	6|10	30	10	
150	2|3	6|10	35	10	

H* = Bei Bestellung angeben / specify when ordering

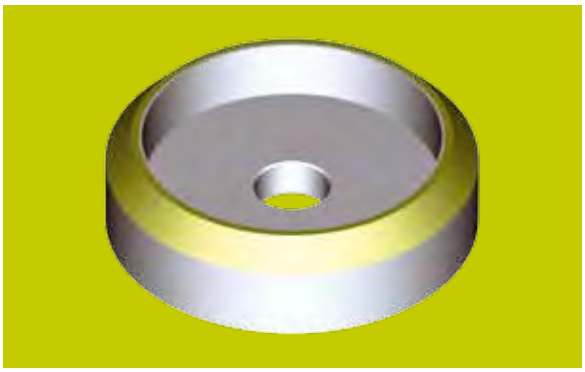
B Standard / standard

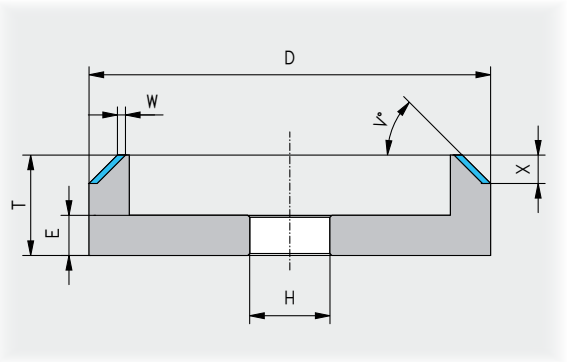
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

6 V 5





D	W	X	T	E	V°	H*
75	2	6	25	10	30°|45°	
100	2	6	30	10	30°|45°	
125	2	6	30	10	30°|45°	

H* = Bei Bestellung angeben / specify when ordering

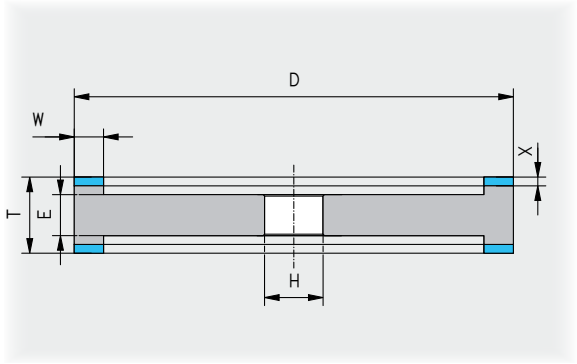
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

9 A 3



D	W	X	T	E	H*
100	5|6	2|3	22	10	
125	5|6	2|3	22	10	
150	4|6|8	2|3	25|35	14	
175	4|6|8	2|3	25|35	14	
200	6|8	2|3	30	20	

H* = Bei Bestellung angeben / specify when ordering

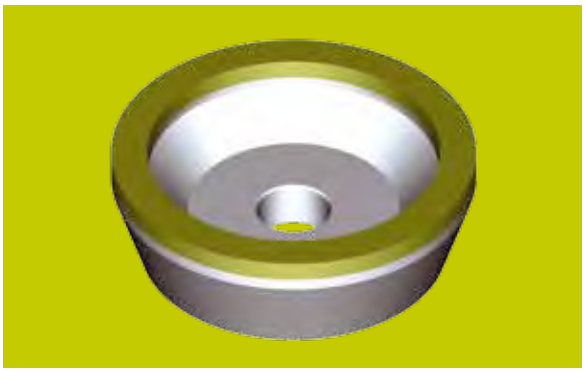
B Standard / standard

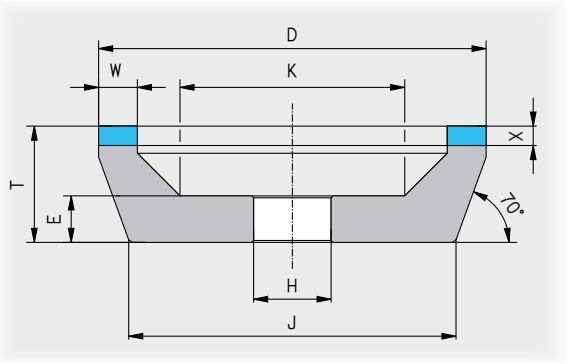
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

11 A 2



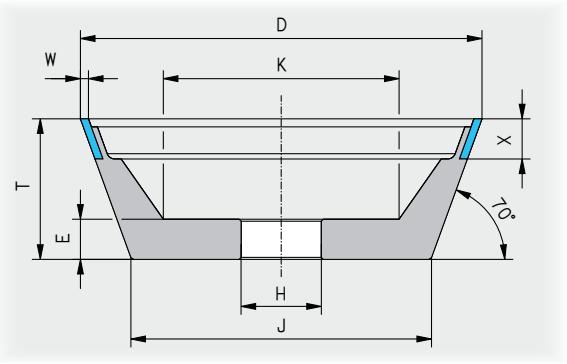


D	W	X	T	E	K	J	H*
50	3|5	3|4	22	10	30	38	
75	3|5|6|10	3|4	22	10	48	63	
100	6|8|10	3|4	22	10	70	88	
125	6|8|10	3|4	25	10	98	110	
150	6|8|10	3|4	25	10	123	135	

H* = Bei Bestellung angeben / specify when ordering

B	Standard / standard
M	Standard / standard
MV	auf Anfrage / on request
V	auf Anfrage / on request

11 V 9



D	W	X	T	E	K	J	H*
50	2	6	25	10	18	31	
75	2|3	6|10	30	10	42	53	
100	2|3	6|10	35	10	55	75	
125	2|3	6|10	40	10	75	96	
150	2|3	6|10	50	10	90	114	

H* = Bei Bestellung angeben / specify when ordering

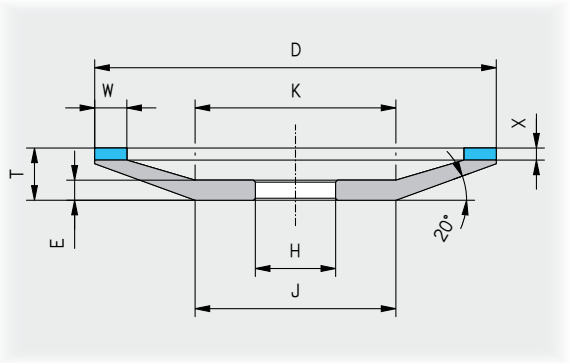
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

12 A 2 20°



D	W	X	T	E	K	J	H*
50	5	2	8	5	19	22	
75	3|4|5|6	2	10	5	33	36	
100	4|5|6|8	2	12	6	50	50	
125	4|5|6|8|10	2	16	8	53	53	
150	4|5|6|8|10	2	18	9	67	67	
175	5|6|8|10|15	2	20	10	81	81	
200	5|6|8|10|15	2	22	11	95	95	
250	6|8|10|15	2	25	13	129	129	

H* = Bei Bestellung angeben / specify when ordering

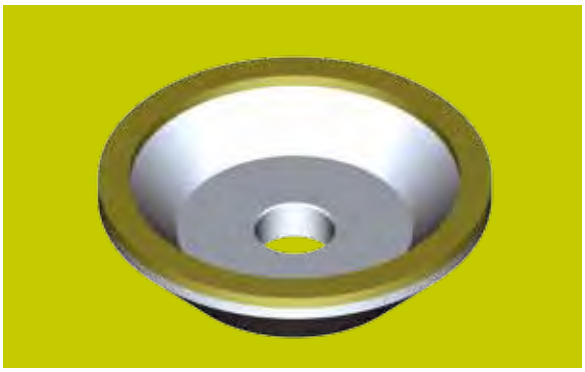
B Standard / standard

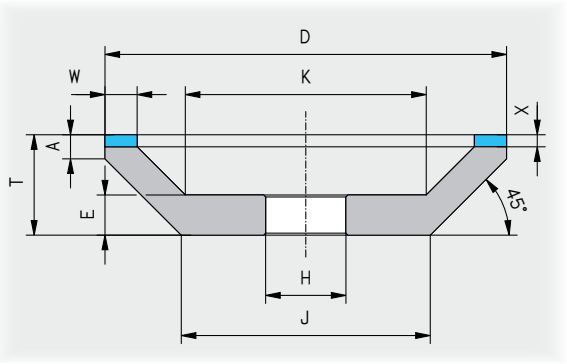
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

12 A 2 45°





D	W	X	T	E	K	J	A	H*
50	3|4	3|4	20	8	25	22	6	
75	3|5|6|10	3|4	25	10	37	37	6	
100	3|5|6|8|10	3|4	25	10	54	70	10	
125	4|5|6|8|10|15	3|4	25	10	79	95	10	
150	4|5|6|8|10|15|20	3|4	25	12	94	124	12	
175	6|8|10|15|20	3|4	25	12	123	149	12	
200	6|8|10|15|20	3|4	25	12	138	174	12	
250	8|10|15|20	3|4	25	12	188	224	12	

H* = Bei Bestellung angeben / specify when ordering

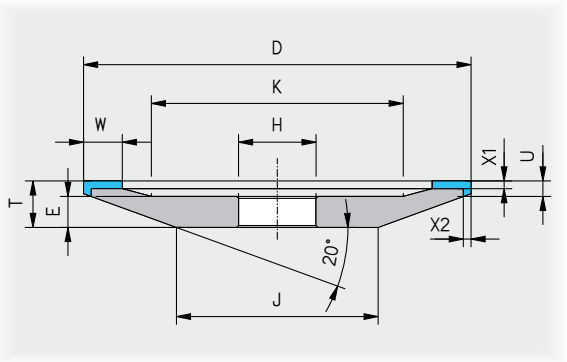
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

12 C 9 20°



D	W	U	X_1 / X_2	T	E	K	J	H*
50	4	4	2	6	4	34	22	
75	5	4	2	8	5	50	42	
100	6	4	2	12	8	65	45	
125	6	4	2	14	10	90	59	
150	6	4	2	15	10	108	78	
175	6	4	2	18	12	125	87	
200	6	4	2	20	12	135	101	

H* = Bei Bestellung angeben / specify when ordering

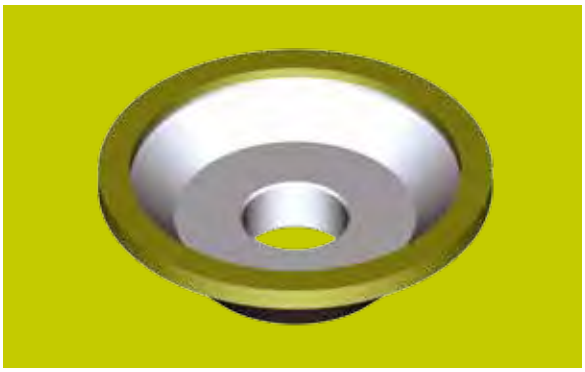
B Standard / standard

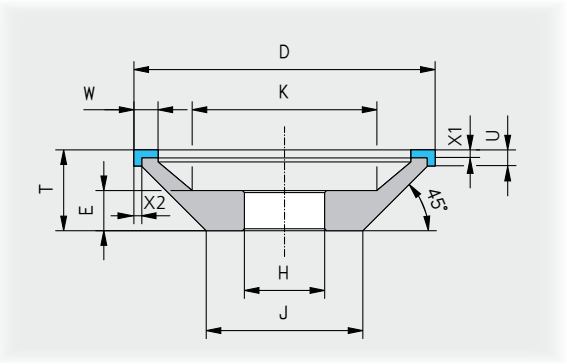
M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

12 C 9 45°



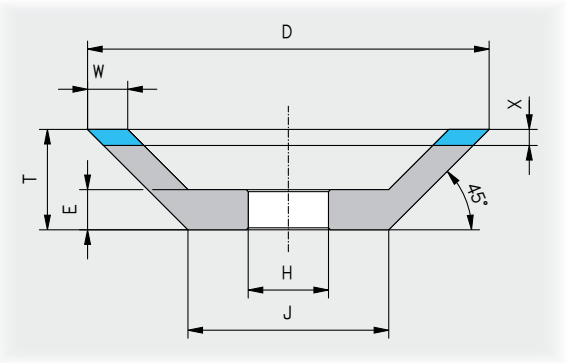


D	W	U	X_1/X_2	T	E	J	H*
75	6	4	2	20	10	39	
100	6|10	4	2	25	10	54	
125	6|10	4	2	25	10	79	

H* = Bei Bestellung angeben / quote with orde

B	Standard / standard
M	Standard / standard
MV	auf Anfrage / on request
V	auf Anfrage / on request

12 V 2 45°



D	W	X	T	E	J	H*
75	5	3|4	20	10	35	
100	6|10	3|4	25	10	50	
125	6|10	3|4	25	10	75	

H* = Bei Bestellung angeben / specify when ordering

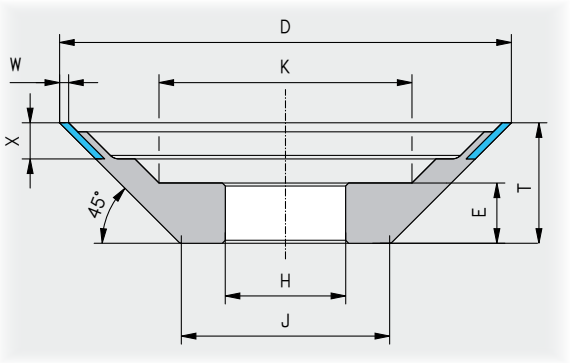
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V Standard / standard

12 V 9 45°



D	W	X	T	E	K	J	H*
50	2|3	6	15	6	20	20	
75	2|3	6	20	10	42	35	
100	2|3	6	20	10	60	60	
125	2|3	6	25	10	70	75	
150	2|3	6	30	10	70	90	

H* = Bei Bestellung angeben / specify when ordering

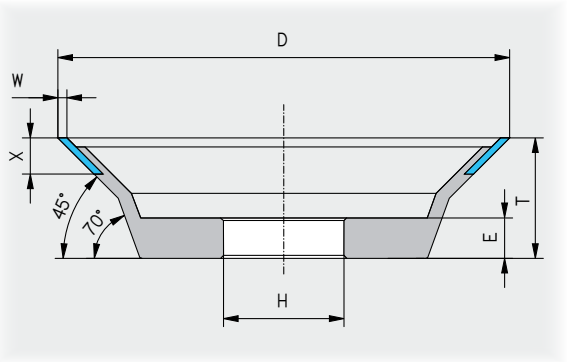
B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V Standard / standard

12 V 9 45° | 70°

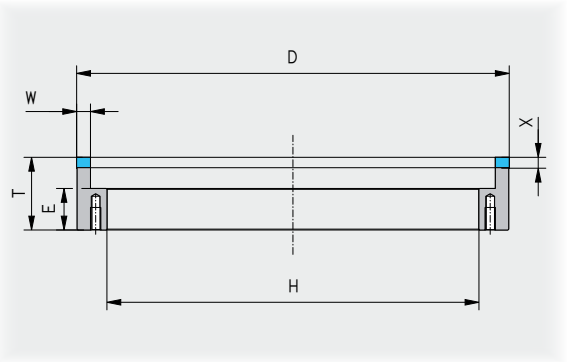


D	W	X	T	E	H*
75	2|3	6	25	7	

H* = Bei Bestellung angeben / specify when ordering

B	Standard / standard
M	auf Anfrage / on request
MV	auf Anfrage /on request
V	auf Anfrage / on request

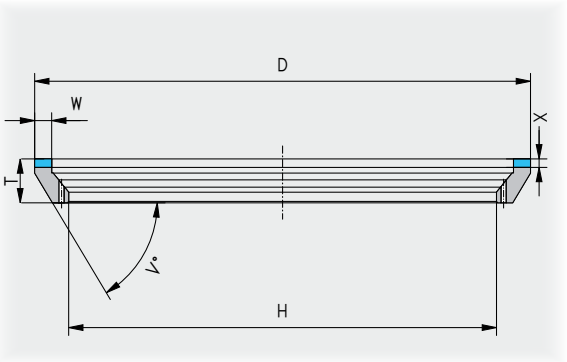
6 A 2 WSP



D	W	X	T	H
250	6|8|10|12|16|20	6	42	215

B	Standard / standard
M	auf Anfrage / on request
MV	auf Anfrage / on request
V	Standard / standard

11 A 2 60° | 70° WSP



D	W	X	V°
350	6|8|10|12|16|20	4|6	60|70
400	6|8|10|12|16|20	4|6	60|70

Körperkonstruktion nach Kundenzeichnung
Substrate design according to customer-supplied drawing

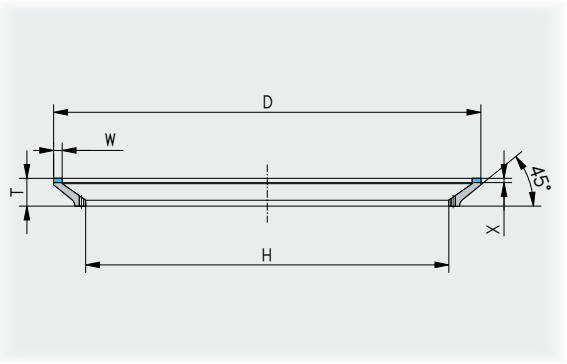
B Standard / standard

M auf Anfrage / on request

MV auf Anfrage / on request

V Standard / standard

12 A 2 45° WSP

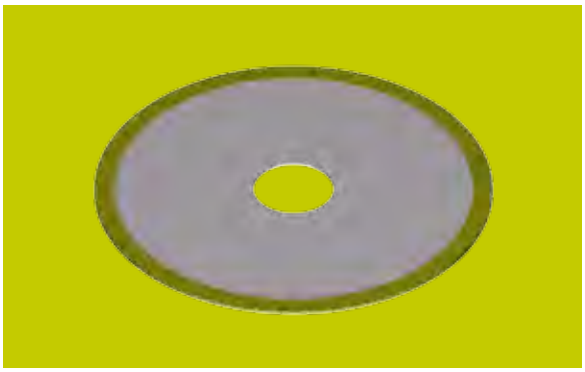


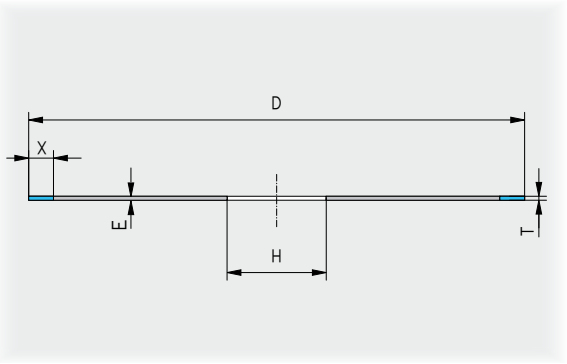
D	W	X
350	6|8|10|12|16|20	4|6
400	6|8|10|12|16|20	4|6

Körperkonstruktion nach Kundenzeichnung
Substrate design according to customer-supplied drawing

B	Standard / standard
M	auf Anfrage / on request
MV	auf Anfrage / on request
V	Standard / standard

1 A 1 R



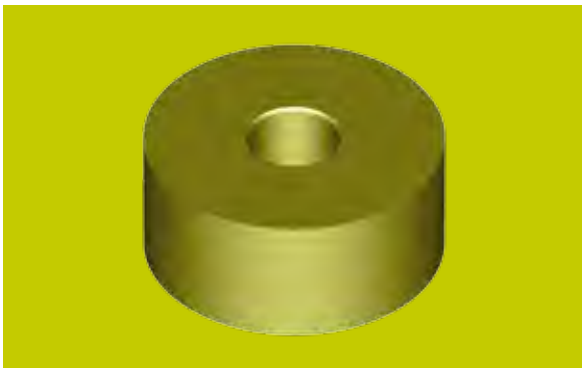


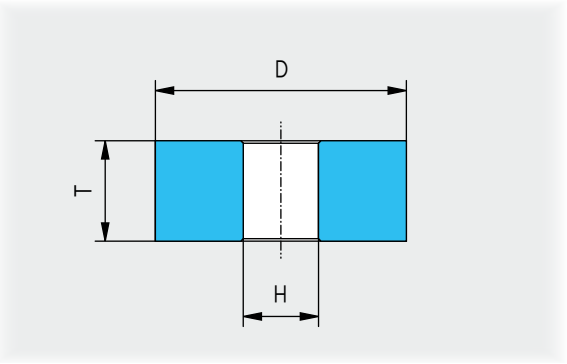
D	T	X	E	H*
30	0.4	5	0.3	
40	0.4	5	0.3	
50	0.4	5	0.3	
75	0.8	5	0.5	
100	0.8	5	0.5	
125	1.1	5	0.8	
150	1.2	5|7	0.9	
175	1.2	5|7	0.9	
200	1.2	5|7	0.9	
250	1.5	5|7	1.1	
300	1.8	5|7	1.4	

H* = Bei Bestellung angeben / specify when ordering

B	Standard / standard
M	auf Anfrage / on request
MV	auf Anfrage / on request
V	auf Anfrage / on request

1 A 8





D	T	H
10	4|6|8|10	3|4
11	4|6|8|10	3|4
12	4|6|8|10	6
13	4|6|8|10	6
14	4|6|8|10	6
15	4|6|8|10	6|8
16	4|6|8|10	6|8
18	4|6|8|10	6|8|10
20	4|6|8|10	6|8|10

B Standard / standard

M Standard / standard

MV auf Anfrage / on request

V auf Anfrage / on request

Sonder-Schleifwerkzeuge / Special grinding tools

Ein grosser Teil der von DIAMETAL produzierten Schleifscheiben werden nach Kundenwunsch hergestellt.
In unserer langjährigen Tätigkeit konnten wir schon unzählige Kundenwünsche realisieren. Dank unserer Flexibilität fertigen wir innert 3 bis 5 Wochen Schleifscheiben nach Ihren Zeichnungen und Wünschen. Unsere erfahrenen und kompetenten Techniker werden Sie bei der Auswahl und Konstruktion «Ihrer» Schleifscheibe beraten und unterstützen.

Hier eine kleine Auswahl von DIAMETAL hergestellter Sonder-Schleifwerkzeuge:

Many of the DIAMETAL grinding wheels are custom-made.
In our many years of experience, we have satisfied innumerable specific customer demands. Thanks to our flexibility, we respond within 3 to 5 weeks and make the grinding wheels to your drawings or specifications. Our experienced and competent technicians offer you their advice and support in choosing and designing “your“ grinding wheel.

A small selection of special grinding tools made by DIAMETAL is shown below.